LIVES IN THE 20TH CENTURY

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INTRODUCTION[1]

Human history as cultural history

We need to reform our teaching of history so that the emphasis will be placed on the gradual growth of human culture and knowledge, a growth to which all nations and ethnic groups have contributed.

This book is part of a series on cultural history. Here is a list of the other books in the series that have, until now, been completed:

- Lives in the Ancient World
- Lives in the 17th Century
- Lives in the 18th Century
- Lives in the 19th Century
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[1]This book makes heavy use of my previously-published book chapters, but some of the material is new.

Contents

Chapter 1

PAINTING IN THE 20TH CENTURY

1.1 Henri Matisse

Henri Matisse (1869-1954) together with Pablo Picasso, is generally regarded as on of the most important artists to revolutionize painting during the early years of the 20th century. He was the oldest son of a wealthy French grain merchant. Following his father's wishes, he studied law, and after qualifying, he worked as a court administrator in Le Chateau-Cambrésis. In 1889, when he was 20 years old, while Henri Matisse was recovering from an attack of appendicitis, his mother bought him some painting materials. He later described the experience of his first efforts in painting as the discovery of "a kind of paradise". To his father's deep disappointment, he soon decided to become an artist. In 1891 he enrolled the Académie Julian in Paris.

At first Matisse painted landscapes in a conventional style. However, in 1896 he visited the Australian painter John Russell on the island of Belle Ile off the coast of Brittany. Russell introduced Matisse to the bright colour spectrum of the Impressionists, and to the works of Vincent van Gogh, who had been a friend of Russell, even giving Matisse one of van Gogh's drawings. As a result of Russell's influence, Matisse changed his style of painting completely, abandoning the earth colours that he had previously used for a bright spectrum of bold primary colours. He later said, "Russell was my teacher, and Russell explained colour theory to me."

In 1905, Matisse exhibited with a group of artists who came to be known as the "Fauves" or "Wild Beasts" at the Salon d'Automne. The group used strong colours to express strong emotion, with little regard for realism. The name given to the group came from a newspaper reviewer who noticed a conventional stature among the paintings and commented "Donatello chez les fauves" (Donatello among the wild beasts). Another reviewer characterized the exhibition as "A pot of paint thrown in the face of the public". The painting, *Woman With a Hat* by Matisse, was singled out by the reviewers for special condemnation. However this painting was bought by Gertrude Stein and her brother Leo, wealthy Americans living in Paris, who had begun to collect the work of avant-guarde artists. Their purchases also included the works of Picasso.

Wikipedia states that

The decline of the Fauvist movement after 1906 did not affect the career of Matisse; many of his finest works were created between 1906 and 1917, when he was an active part of the great gathering of artistic talent in Montparnasse, even though he did not quite fit in, with his conservative appearance and strict bourgeois work habits. He continued to absorb new influences. He travelled to Algeria in 1906 studying African art and Primitivism. After viewing a large exhibition of Islamic art in Munich in 1910, he spent two months in Spain studying Moorish art. He visited Morocco in 1912 and again in 1913 and while painting in Tangier he made several changes to his work, including his use of black as a colour. The effect on Matisse's art was a new boldness in the use of intense, unmodulated colour, as in L'Atelier Rouge (1911).

Figure 1.1: ***Woman with a Hat*, 1905, by Henri Matisse, San Francisco Museum of Modern Art.**

Figure 1.2: ***The Joy of Life*, 1905-1906, by Henri Matisse, Barnes Foundation, Philadelphia, Pennsylvania.**

Figure 1.3: ***Harmony in Red*, 1908, by Henri Matisse. Commissioned by the Russian collector Sergei Shchukin, the painting is now at the Hermatage Museum in St. Petersburg.**

Figure 1.4: ***Dance*, 1910, by Henri Matisse, The Hermitage, St. Petersburg.**

Figure 1.5: ***Blue Nude*, 1952, collage by Henri Matisse. In his old age, Matisse was confined to a wheel-chair after a cancer operation; but with the help of assistants, he created an impressive body of work using the technique of collage.**

1.2 Pablo Picasso

Pablo Ruiz Picasso (1881-1973) was one of the most influential artists of the 20th century. He was enormously talented and prolific, and over his long career he explored and invented many different styles and techniques. Besides being a painter, Picasso was also a sculptor, ceramicist, print-maker, stage designer, poet and playwright.

Picasso's father was, for most of his life, professor of art at the School of Crafts and curator of a local museum in the city of Málaga in the Andalusian region of Spain. Picasso showed extraordinary artistic ability as a child. According to his mother, his first words were "piz, piz", a shortening of lápiz, the Spanish word for "pencil".

At the age of 16, after studying with his father, Picasso was sent to Madrid to enroll in the Real Academia de Belles Artes de San Fernando, the country's foremost art school. Although he disliked the formal instruction, and attended few classes, Picasso was inspired by the painters whose work he saw in Madrid's museums - Diego Veláozquez, Francisco Goya, and Francisco Zurbarán. Picasso especially admired the works of El Greco.

In 1900, Picasso moved to Paris, the art capital of Europe, where he shared an apartment with the journalist and poet Max Jakob. Max slept during the night, while Picasso worked by night and slept during the day. Jakob also helped Picasso to learn the French language. This was a time of poverty and desperation for Picasso. However, the situation soon changed. By 1905, Picasso had become the favorite of Gertrude Stein and her brother Leo, wealthy Americans living in Paris, who also purchased the paintings of Henri Matisse.

Regarding Picasso's legacy, Wikipedia says of him:

Picasso's influence was and remains immense and widely acknowledged by his admirers and detractors alike. On the occasion of his 1939 retrospective at MoMA, Life magazine wrote: "During the 25 years he has dominated modern European art, his enemies say he has been a corrupting influence. With equal violence, his friends say he is the greatest artist alive." In 1998, Robert Hughes wrote of him: "To say that Pablo Picasso dominated Western art in the 20th century is, by now, the merest commonplace. ... No painter or sculptor, not even Michelangelo, had been as famous as this in his own lifetime"...

Throughout his life Picasso maintained several mistresses in addition to his wife or primary partner. Picasso was married twice and had four children by three women:

- **Paulo (4 February 1921 - 5 June 1975, Paul Joseph Picasso) - with Olga Khokhlova**
- **Maya (born 5 September 1935, Maria de la Concepcion Picasso) - with Marie-Thérèse Walter**
- **Claude (born 15 May 1947, Claude Pierre Pablo Picasso) - with Francoise Gilot**
- **Paloma (born 19 April 1949, Anne Paloma Picasso) - with Francoise Gilot**

Figure 1.6: **Picasso's *Family of Saltimbanques*, 1905, National Gallery of Art, Washington, D.C..**

Figure 1.7: **Pablo Picasso's *Les Demoiselles d'Avignon*, 1907, Museum of Modern Art, New York City. The faces reflect Picasso's interest in African art. The painting is Proto-Cubist in style.**

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Figure 1.8: ***Portrait of Daniel-Henry Kahnweiler*, by Pablo Picasso, 1910, Art Institute of Chicago. This Cubist painting is almost completely non-representational, but Picasso challenges the viewer to find Kahnweiler. With a little effort, we can find his hair, two eyes, nose, mouth, and crossed hands.**

Figure 1.9: **Picasso's *Girl Before a Mirror*, 1932, Museum of Modern Art, New York City. In the girl's face, on the left-hand side of the painting, two perspectives appear simultaneously. The girl is seen both in profile, and from the front. The use of black lines, like lines of lead between coloured glass, gives the painting the luminous quality of a stained-glass window.**

Figure 1.10: **Picasso's *The Dream*, 1932, Private collection of Steven A. Cohen. Here again, two perspectives appear simultaneously. The girl is seen both in profile, and from the front.**

Figure 1.11: ***The Weeping Woman*, 1937, Tate Gallery, London. The woman is Picasso's mistress, Dora Marr. She is weeping because of his many infidelities. Dora Marr (1907-1997) was a very talented artist in her own right. A large retrospective exhibition of her work provoked a review with the title, *The Weeping Woman Gets The Last Laugh.***

Figure 1.12: ***Guernica*, 1937, Museo Reina Sofía, Madrid, Spain. This famous large painting represents Picasso's protest against the Fascist/Nazi terror-bombing of the civilian population of the Basque town of Guernica.**

1.3 Edvard Munch

Edvard Munch (1863-1844) was Norway's greatest painter. He was extremely prolific: The Munch Museum in Oslo contains approximately 1,100 of his paintings, 4,500 of his drawings, and 18,000 prints, so many that only a small fraction can be exhibited at one time.

Munch's childhood was overshadowed by the illness and death of family members, and by his dread of inheriting the mental illness that ran in the family. He began studying painting at the Royal School of Art and Design, and during this period he was influenced by the Norwegian writer and philosopher Hans Jæger, who urged him to express his own emotions in his painting.

Later, on study trips to Paris, Munch was influenced by the works of Gauguin, van Gogh and Toulouse-Lautrec, especially in their use of colour. However, he developed his own distinctive expressionist style, and was able to convey strong emotions through his paintings, drawings and prints.

Munch met the Swedish dramatist August Strindberg in Berlin and his conversations with Strindberg helped to inspire Munch's epic mural painting, *The Frieze of Life*, which expresses deeply-felt emotions, such as love, anxiety and jealousy.

Edvard Munch stated that the idea for his famous painting *The Scream* came to him as he was walking in Kristiania (today called Oslo). As he was walking at sunset he "heard the enormous, infinite scream of nature". Between 1893 and 1910 he produced two painted versions, two pastels and a number of prints expressing this idea.

Munch experienced periods of mental illness and heavy drinking which ended in stays in mental hospitals. Finally, towards the end of his life, increasing sale of his work gave him the financial means to purchase an estate in Ekely, at Skøyen, Oslo, and he retired there for two decades of solitary painting. Wikipedia states that:

Many of his late paintings celebrate farm life, including several in which he used his work horse "Rousseau" as a model. Without any effort, Munch attracted a steady stream of female models, whom he painted as the subjects of numerous nude paintings. He likely had sexual relationships with some of them. Munch occasionally left his home to paint murals on commission, including those done for the Freia chocolate factory.

To the end of his life, Munch continued to paint unsparing self-portraits, adding to his self-searching cycle of his life and his unflinching series of takes on his emotional and physical states...

In October 2006, the color woodcut Two people. The lonely (To mennesker. De ensomme) set a new record for his prints when it was sold at an auction in Oslo for 8.1 million kroner (US$1.27 million equivalent to $1,600,000 in 2019). It also set a record for the highest price paid in auction in Norway. On 3 November 2008, the painting Vampire set a new record for his paintings when it was sold for US$38,162,000 (equivalent to $45,300,000 in 2019) at Sotheby's New York.

Figure 1.13: ***The Scream*, 1893, by Edvard Munch, Munch Museum, Oslo, Norway.**

Figure 1.14: ***Madona*, 1894-1895, by Edvard Munch, National Gallery of Norway, Oslo.**

Figure 1.15: ***Love and Pain*, 1895, by Edvard Munch, Munch Museum, Oslo.**

Figure 1.16: ***The Dance of Life*, 1899-1900, by Edvard Munch, National Gallery of Norway, Oslo.**

Figure 1.17: ***Red and White*, 1899-1900, by Edvard Munch, Munch Museum, Oslo.**

Figure 1.18: ***The Sick Child*, 1907, by Edvard Munch, Munch Museum, Oslo. Norway.**

1.4 Vilhelm Hammershøi

Vilhelm Hammershøi (1864-1916) was the son of a wealthy Copenhagen merchant, and thus, from a financial standpoint, his life was a secure one.

He began private drawing lessons at the age of eight with Niels Christian Kierkegaard and Holger Grønvold, and also studied painting with Vilhelm Kuhn. He later entered the Royal Danish Academy of Fine Arts. During the years 1883-1885, he studied with Peder Severin Krøyer at the Independent Study Schools. In 1885, Hammershøi made his artistic debut with a portrait of his sister Anna, a painting which was admired by Pierre-August Renoir.

In 1891, Hammershøi married Ida Ilsted, and Ida appears in many of his later paintings. The couple moved into a 17th century apartment on Strandgade 25, in the Christiania district of Copenhagen. This apartment, and a nearby one into which Vilhelm and Ida later moved, form the backgrounds for most of Hammershøi's interior scenes.

The quietness and modesty of Vilhelm Hammershøi's life is reflected in his paintings. His range of colours is extremely subdued, and in fact it consists mostly of slightly modified shades of grey. This gives his paintings not only unity, but also a mysterious quality.

Michael Palin's BBC documentary

Besides painting interiors, Hammershøi also painted landscapes and architecture. In his paintings of buildings, there are no people, a feature that adds to the paintings' mysterious quality. Hammershøi traveled widely in Europe, and he found London, with its fogs, an especially fine subject for painting. His London studies of buildings were seen by the famous British comedian and travel show presenter, Sir Michael Palin, and excited Palin's admiration and curiosity. He traveled to Copenhagen to uncover the psychological background of Hammerhøi's unique and unusual artistic style. (Interestingly, my daughter Julie, who is in charge of public relations at the Royal Archives, met Sir Michael on this visit, and she helped him to try to find answers.) The result of this research was the BBC documentary, broadcast in 2005, entitled *Michael Palin and the Mystery of Hammershoi.*

Recent interest and exhibitions

- Vilhelm Hammershøi: The Poetry of Silence, Royal Academy, Sackler Wing of Galleries, London, UK, 28 June-7 September 2008
- Vilhelm Hammershøi: The Poetry of Silence, The National Museum of Western Art, Tokyo, Japan (- 7 November 2008)
- Vilhelm Hammershoi's Paintings at Scandinavia House, Scandinavia House, New York
- Painting Tranquility: Masterworks by Vilhelm Hammershøi, Art Gallery of Ontario, Toronto, Canada, 16 April-3 July 2016

Figure 1.19: ***Interior With Young Man Reading*, 1902, by Vilhelm Hammershøi.**

Figure 1.20: ***Interior With Young Woman Seen From The Back*, 1903-1904, by Vilhelm Hammershøi, Randers Museum of Art, Denmark.**

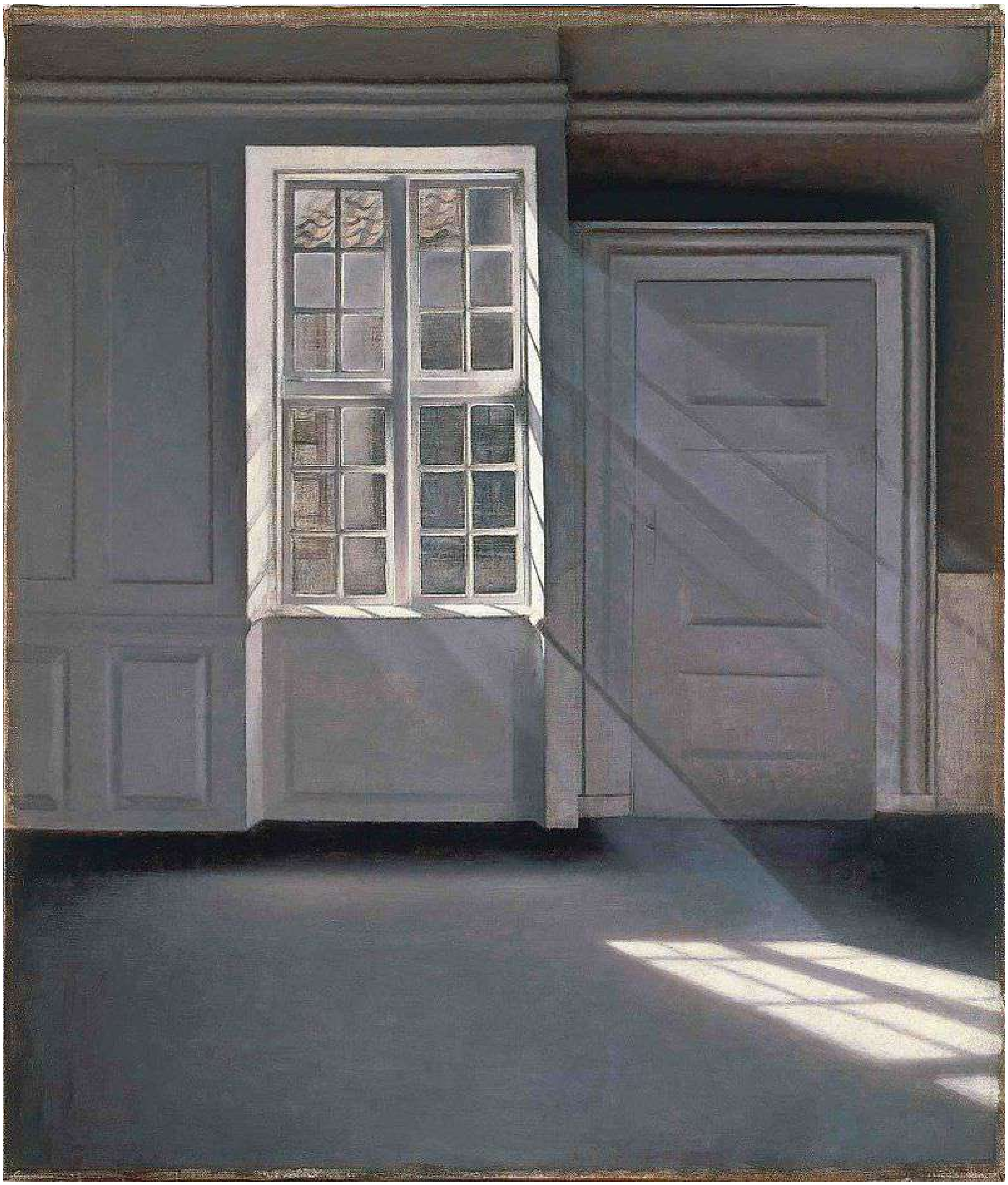

Figure 1.21: ***Dust Motes Dancing in a Sunbeam*, by Vilhelm Hammershøi.**

1.5 Grant Wood and Edward Hopper

Grant Wood

Grant Wood (1891-1942) was born in rural Iowa and studied at The Handicraft Guild, an art school run entirely by women. He later studied at the School of the Art Institute of Chicago. In 1932, Wood helped to found the Stone City Art Colony, to help his fellow artists to get through Great Depression. Grant was an advocate of regionalism in painting, a movement that emphasized the accurate portrayal of local rural themes. Wikipedia states that:

Wood's best known work is his 1930 painting American Gothic, which is also one of the most famous paintings in American art, and one of the few images to reach the status of widely recognized cultural icon, comparable to Leonardo da Vinci's Mona Lisa and Edvard Munch's The Scream.

Edward Hooper

Edward Hooper (1882-1967) was born into a wealthy New York family, but he had to endure years of struggle before his artistic breakthrough in 1923, shortly after his marriage to fellow-artist Josephine Nivison. Regarding Hooper's unusually quiet and shy personality, Josephine remarked, "Sometimes talking to Eddie is just like dropping a stone in a well, except that it doesn't thump when it hits bottom".

Wikipedia states that

Hopper fared better than many other artists during the Great Depression. His stature took a sharp rise in 1931 when major museums, including the Whitney Museum of American Art and the Metropolitan Museum of Art, paid thousands of dollars for his works. He sold 30 paintings that year, including 13 watercolors. The following year he participated in the first Whitney Annual, and he continued to exhibit in every annual at the museum for the rest of his life. In 1933, the Museum of Modern Art gave Hopper his first large-scale retrospective...

Nighthawks is a 1942 oil on canvas painting by Edward Hopper that portrays people in a downtown diner late at night as viewed through the diner's large glass window. Also portrayed are the exteriors of the urban structures across the street from the diner.

It has been described as Hopper's best-known work[1] and is one of the most recognizable paintings in American art. Within months of its completion, it was sold to the Art Institute of Chicago on May 13, 1942, for $3,000.

After Hooper's death in 1967, his wife, Josephine, bequeathed their joint collection of more than three thousand works of art to the Whitney Museum of American Art.

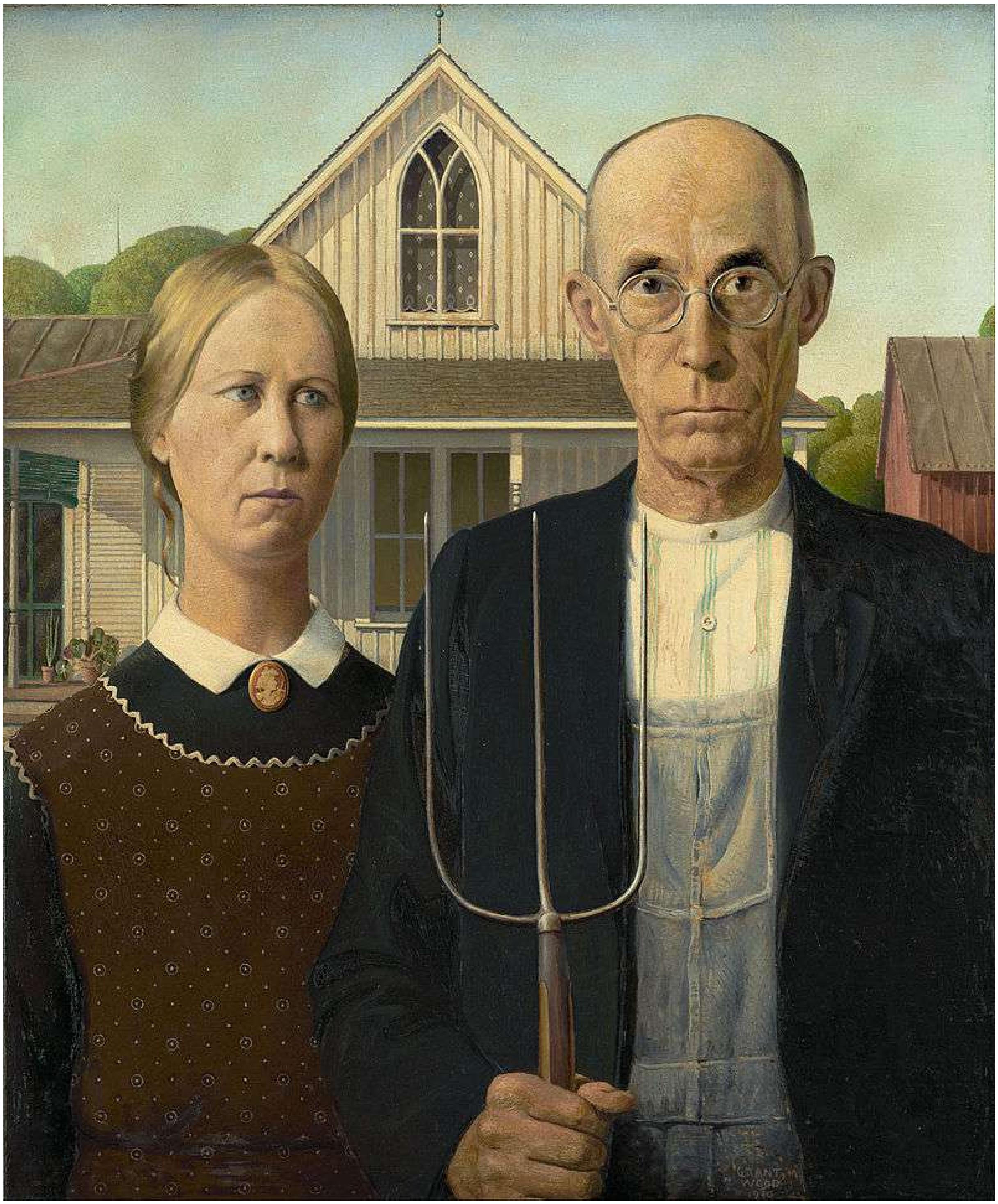

Figure 1.22: ***American Gothic*, 1930, by Grant Wood, Art Institute of Chicago.**

Figure 1.23: ***Nighthawks*, 1942, by Edward Hopper, Art Institute of Chicago.**

1.6 Georgia O'Keeffe

Georgia O'Keeffe (1887-1985) was married to the photographer Joseph Stieglitz. Her work was honored with the National Medal of Arts, the Presidential Medal of Freedom, and the Edward McDowell Medal. She holds the record (44.4 million dollars in 2014) for the highest price paid for a single painting by a woman.

Between 1905 and 1906, O'Keeffe studied at the School of the Art Institute of Chicago, where she was ranked at the top of her class. In 1907, she became a student at Art Students League in New York, where she came in contact with a number of young innovative artists, and where she won a prize for her still-life painting, *Dead Rabbit with Copper Pot*.

Her father's bankruptcy and her mother's serious illness almost put an end to Georgia O'Keeffe's studies, since her parents could no longer help her with finances. She worked as a commercial artist, and also took a number of teaching jobs. However, in the summer of 1912, she took a class at the University of Virginia, where she learned of the innovative ideas of Arthur Wesley Dow, an approach to art influenced by the bold Japanese style of composition. This helped O'Keeffe to develop her own personal style.

In 1918, Georgia O'Keeffe became acquainted with her future husband, the photographer Joseph Stieglitz, who was a pioneer of photography as an art-form. Stieglitz, who was 24 years her senior, gave her financial support, and provided a place for her to work. Their relationship deepened, and before long they were in love. They were married in 1924.

The Georgia O'Keeffe Museum opened in Santa Fe in 1997. The assets included a large body of her work, photographs, archival materials, and her Abiquiú house and library.

Figure 1.24: ***Blue and Green Music*, 1921, by Georgia O'Keeffe, Art Institute of Chicago. The painting expresses the subjective feelings which music inspired in the artist.**

Figure 1.25: **Georgia O'Keeff's *Bud* (1939), oil on canvas. The painting was commissioned by the Dole Pineapple Company of Hawaii, and shows the bud of a pineapple.**

1.7 Frida Kahlo and Diego Riviera

Frida was born in Mexico to a German father and a part-indigenous mother. She suffered polio as a child and a serious traffic accident at the age of 18. The accident left her crippled and in pain for the rest of her life. Magdalena Carmen Frida Kahlo y Calderón (1907-1954) grew up in her family home, *La Casa Azul*, or *The Blue House*. She later lived there with her husband, Diego Riviera. After Frida's death in 1954, Diego Riviera donated the large house and its contents to the nation as a museum, and it is now one of Mexico's most popular attractions.

Frida originally intended to study medicine, but polio left her crippled. Later, at the age of 18, she suffered a very serious traffic accident which left her totally crippled and in pain for the rest of her life. While confined to bed, recovering from the accident, Frida began to paint, with a special easel above her in the bed, and a system of mirrors so which allowed her to see the subject of her paintings - often herself or friends.

Against all odds, Frida managed not only to have a successful artistic career, but also to marry the famous Mexican artist; Diego Riviera, who was twenty years her senior. Riviera had begun painting and drawing at the age of 3, initially drawing on the walls of the family home. Instead of rebuking him, Riviera's understanding parents had covered the walls with canvas and provided the 3-year-old with painting materials. From this early start, Diego Riviera became Mexico's most famous mural painter.

The marriage between Frida and Diego was characterized by mutual admiration and love, combined with frequent infidelities. Diego's fame attracted many female admirers, whom he did not turn away. For her part, Frida had an affair with Leon Trotsky, before his assassination (by means of an ice-pick plunged through his skull).

Fridamania: Posthumous recognition

Wikipedia states that:

The Tate Modern considers Kahlo "one of the most significant artists of the twentieth century", while according to art historian Elizabeth Bakewell, she is "one of Mexico's most important twentieth-century figures". Kahlo's reputation as an artist developed late in her life and grew even further posthumously... She gradually gained more recognition in the late 1970s when feminist scholars began to question the exclusion of female and non-Western artists from the art historical canon and the Chicano Movement lifted her as one of their icons. The first two books about Kahlo were published in Mexico by Teresa del Conde and Raquel Tibol in 1976 and 1977, respectively...

[Mexico City] dedicated a park, Parque Frida Kahlo, to her in Coyoacán in 1985. The park features a bronze statue of Kahlo. In the United States, she became the first Hispanic woman to be honored with a U.S. postage stamp in 2001

Figure 1.26: **A self-portrait by Frida Kahlo (1907-1954).**

Figure 1.27: **Another of Frida's self-portraits.**

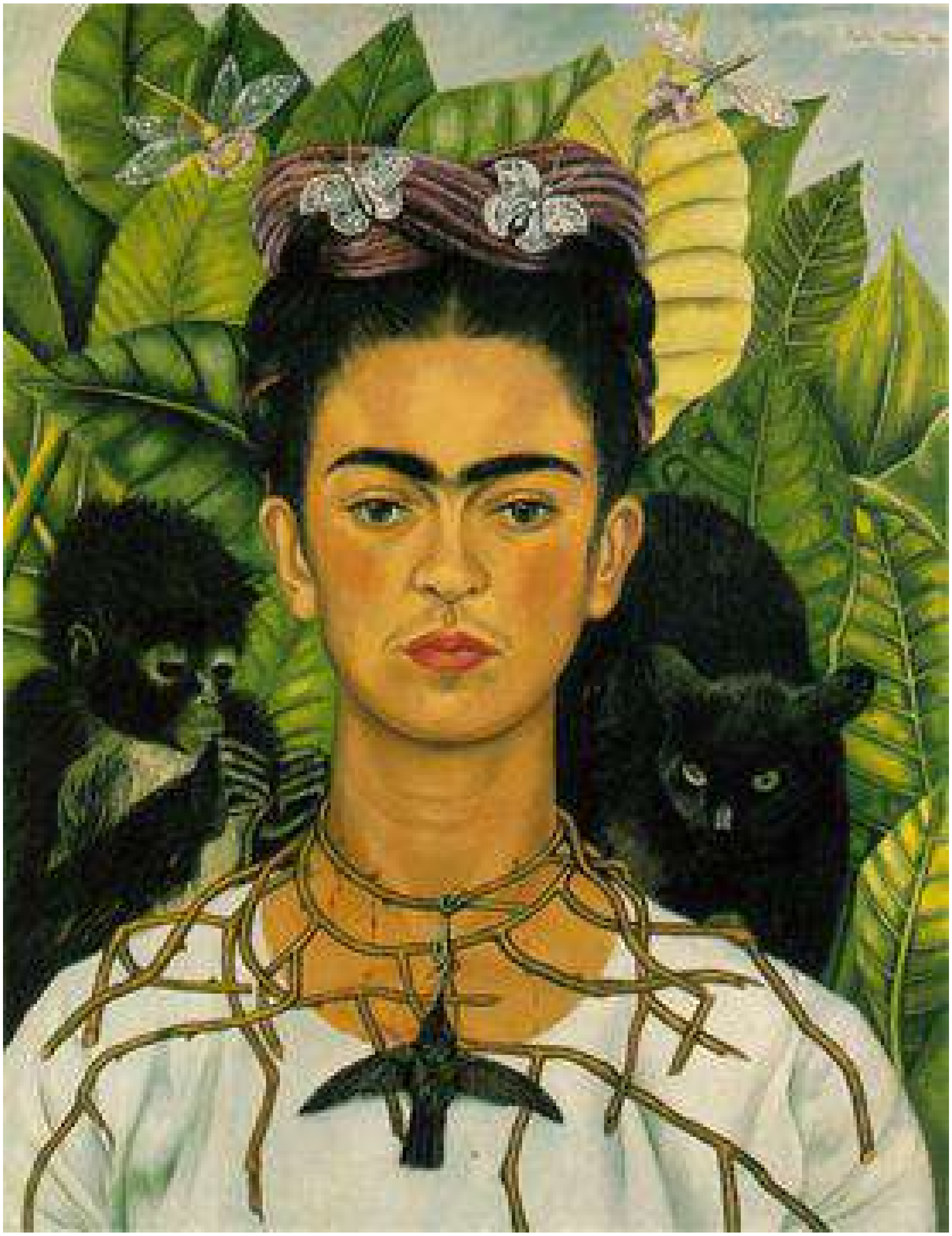

Figure 1.28: **Self-Portrait with Thorn Necklace and Hummingbird (1940).**

Figure 1.29: ***Mural of exploitation of Mexico by Spanish conquistadors*, by Diego Riviera, Palacio Nacional, Mexico City.**

Figure 1.30: ***Mural showing Aztec production of gold*, by Diego Riviera, Palacio Nacional, Mexico City.**

1.8 Kandinsky. Mondrian and Rothko

Non-representational art

Wassily Kandinsky

Wassily Kandinsky (1866-1944) was a pioneer of non-representational (abstract) art. He was born in Moscow, but spent his childhood in Ukraine. Kandinsky studied law and was offered a professorship in this field, but at the age of 30 he began painting and began to study art. After the Russian Revolution, he helped to establish Russia's Museum of Culture and Painting. However, he found the atmosphere in the Soviet Union uncongenial, and he spent the last part of his life in Germany (teaching at the Bauhaus), and in France.

Piet Mondrian

Wikipedia says of him: **Piet Mondrian (7 March 1972 - 1 February 1944) was a Dutch painter and theoretician who is regarded as one of the greatest artists of the 20th century. He is known for being one of the pioneers of 20th-century abstract art, as he changed his artistic direction from figurative painting to an increasingly abstract style, until he reached a point where his artistic vocabulary was reduced to simple geometric elements**

Mark Rothko

Markus Yakovlevich Rothkowitz (1903-1970), who later changed his name to Mark Rothko, was born in Latvia, then part of the Russian Empire. Fearing persecution because of their Jewish descent. the family emigrated to the United States. Although they were not financially not well off, the family was highly literate and intellectual. Rothko became a painter, but it was not until the 1950's that he began to make non-representational paintings. These now sell for enormous prices.

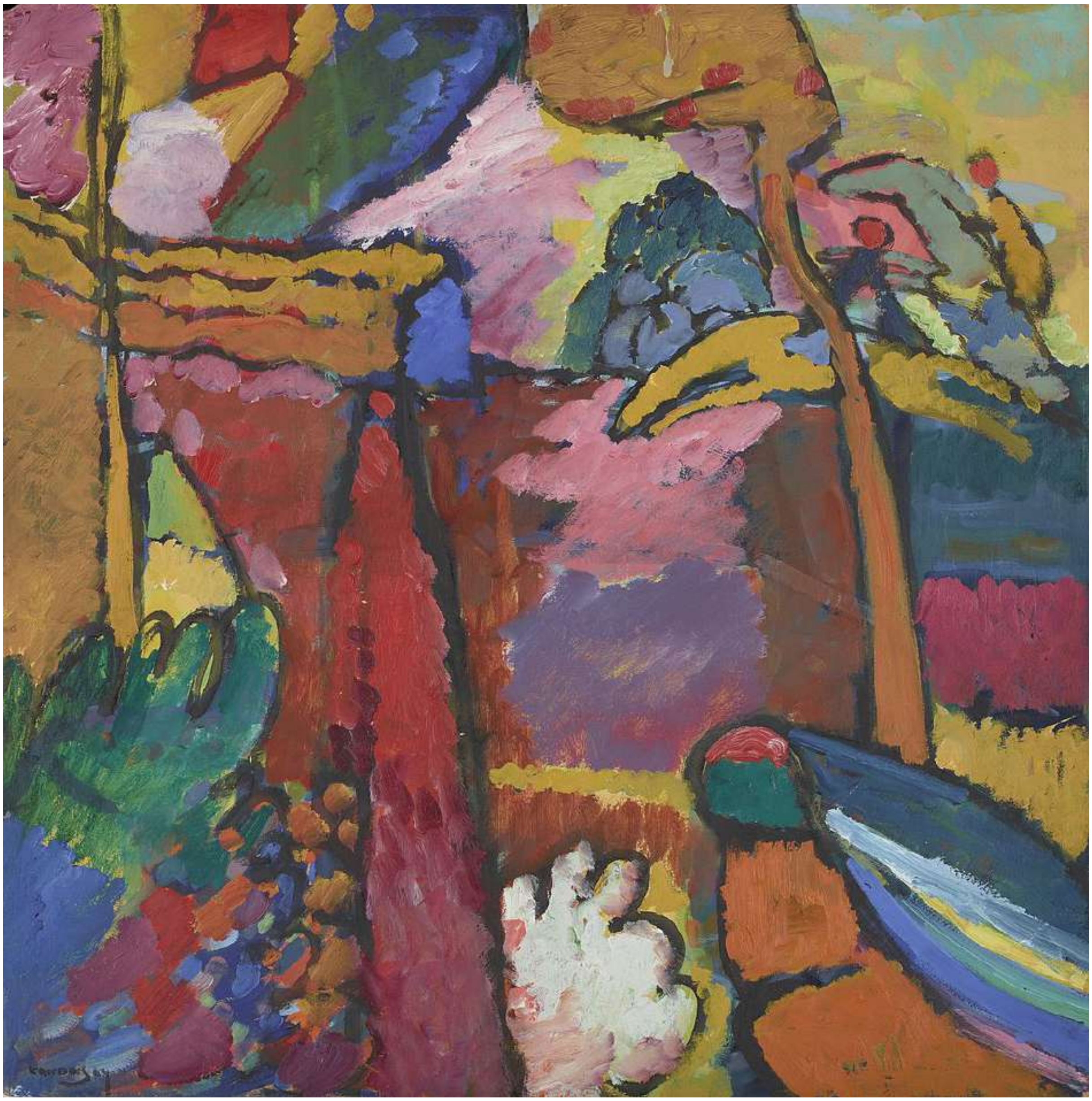

Figure 1.31: ***Study for Improvisation I*, 1910, by Wassily Kandinsky, Minneapolis Institute of Arts.**

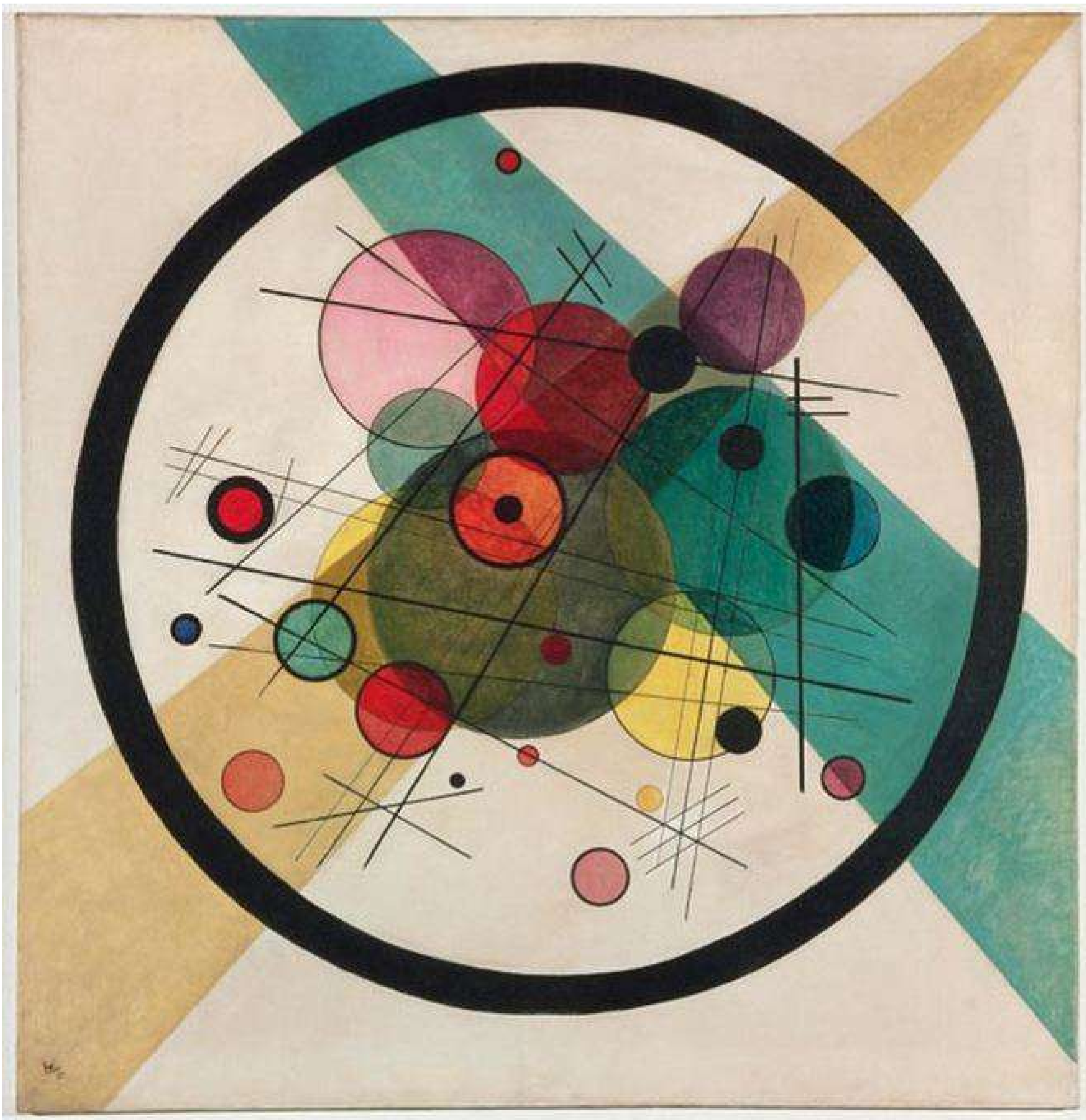

Figure 1.32: ***Circles in a Circle*, 1922, by Wassily Kandinsky, Philadelphia Museum of Art.**

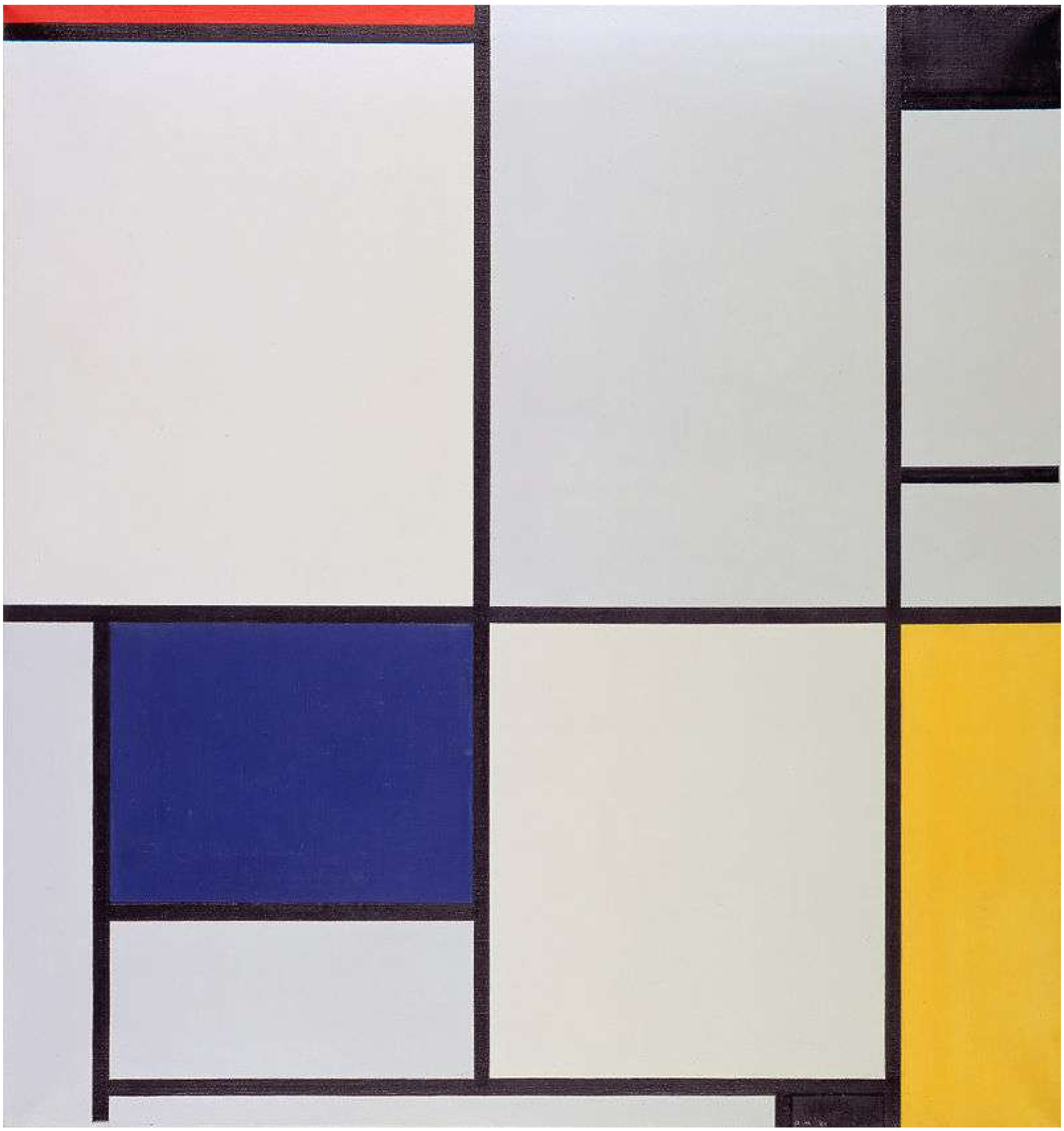

Figure 1.33: ***Tableau I*, 1921, by Piet Mondrian, Kunstmuseum Den Haag.**

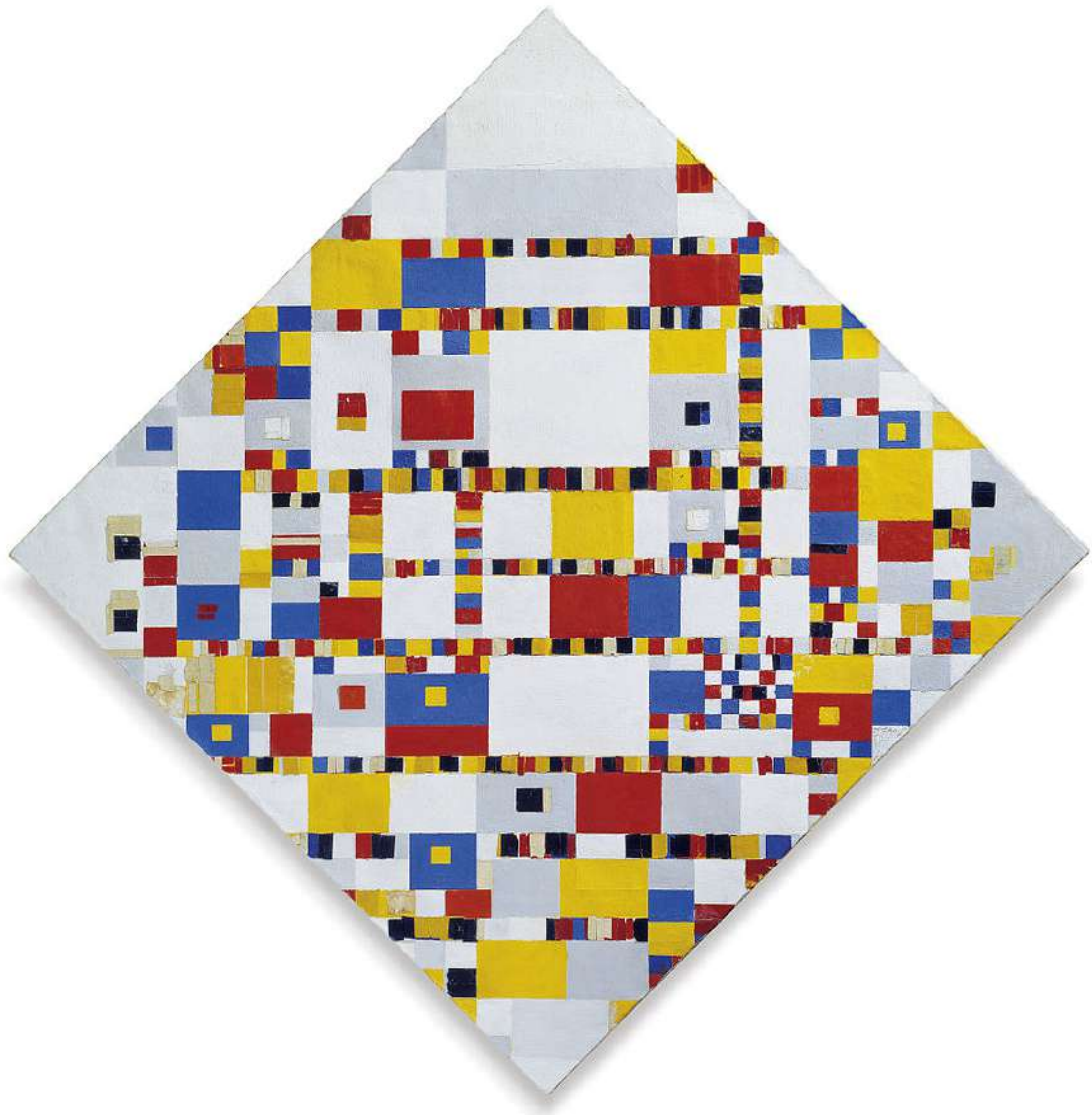

Figure 1.34: ***Victory Boogie Woogie*, 1942-1944, by Piet Mondrian, Kunstmuseum Den Haag.**

Figure 1.35: ***Magenta, Black, Green on Orange*, 1949, by Mark Rothko, Museum of Modern Art, New York City.**

Proponents of De Stijl advocated pure abstraction and universality by a reduction to the essentials of form and colour; they simplified visual compositions to vertical and horizontal, using only black, white and primary colors.

Figure 1.36: ***Rust and Blue*, 1953, by Mark Rothko, Museum of Contemporary Art, Los Angeles.**

1.9 De Stijl

The term "De Stijl" means "The Style" in Dutch. It refers to the work of Dutch non-representational artists between 1917 and 1931.

According to Wikipedia:

Proponents of De Stijl advocated pure abstraction and universality by a reduction to the essentials of form and colour; they simplified visual compositions to vertical and horizontal, using only black, white and primary colors.

De Stijl is also the name of a journal that was published by the Dutch painter, designer, writer, and critic Theo van Doesburg that served to propagate the group's theories. Along with van Doesburg, the group's principal members were the painters Piet Mondrian, Vilmos Huszár, Bart van der Leck, and the architects Gerrit Rietveld, Robert van 't Hoff, and J. J. P. Oud. The artistic philosophy that formed a basis for the group's work is known as Neoplasticism - the new plastic art (or Nieuwe Beelding in Dutch).

Suggestions for further reading

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Chapter 2

PHYSICS IN THE 20TH CENTURY

2.1 Albert Einstein

"I don't know what will be used in the next world war, but the 4th will be fought with stones."

Albert Einstein (1879-1955)

Besides being one of the greatest physicists of all time, Albert Einstein was a lifelong pacifist, and his thoughts on peace can speak eloquently to us today. We need his wisdom today, when the search for peace has become vital to our survival as a species.

Family background

Albert Einstein was born in Ulm, Germany, in 1879. He was the son of middle-class, irreligious Jewish parents, who sent him to a Catholic school. Einstein was slow in learning to speak, and at first his parents feared that he might be retarded; but by the time he was eight, his grandfather could say in a letter: "Dear Albert has been back in school for a week. I just love that boy, because you cannot imagine how good and intelligent he has become."

Remembering his boyhood, Einstein himself later wrote: "When I was 12, a little book dealing with Euclidean plane geometry came into my hands at the beginning of the school year. Here were assertions, as for example the intersection of the altitudes of a triangle in one point, which, though by no means self-evident, could nevertheless be proved with such certainty that any doubt appeared to be out of the question. The lucidity and certainty made an indescribable impression on me."

When Albert Einstein was in his teens, the factory owned by his father and uncle began to encounter hard times. The two Einstein families moved to Italy, leaving Albert alone and miserable in Munich, where he was supposed to finish his course at the gymnasium. Einstein's classmates had given him the nickname "Beidermeier", which means something like "Honest John"; and his tactlessness in criticizing authority soon got him into trouble. In Einstein's words, what happened next was the following: "When I was in the seventh grade at the Lutpold Gymnasium, I was summoned by my home-room teacher, who expressed the wish that I leave the school. To my remark that I had done nothing wrong, he replied only, 'Your mere presence spoils the respect of the class for me'."

Einstein left gymnasium without graduating, and followed his parents to Italy, where he spent a joyous and carefree year. He also decided to change his citizenship. "The over-emphasized military mentality of the German State was alien to me, even as a boy", Einstein wrote later. "When my father moved to Italy, he took steps, at my request, to have me released from German citizenship, because I wanted to be a Swiss citizen."

The financial circumstances of the Einstein family were now precarious, and it was clear that Albert would have to think seriously about a practical career. In 1896, he entered the famous Zürich Polytechnic Institute with the intention of becoming a teacher of mathematics and physics. However, his undisciplined and nonconformist attitudes again got him into trouble. His mathematics professor, Hermann Minkowski (1864-1909), considered Einstein to be a "lazy dog"; and his physics professor, Heinrich Weber, who originally had gone out of his way to help Einstein, said to him in anger and exasperation: "You're a clever fellow, but you have one fault: You won't let anyone tell you a thing! You won't let anyone tell you a thing!"

Einstein missed most of his classes, and read only the subjects which interested him. He was interested most of all in Maxwell's theory of electro-magnetism, a subject which was too "modern" for Weber. There were two major examinations at the Zürich Polytechnic Institute, and Einstein would certainly have failed them had it not been for the help of his loyal friend, the mathematician Marcel Grossman.

Grossman was an excellent and conscientious student, who attended every class and took meticulous notes. With the help of these notes, Einstein managed to pass his examinations; but because he had alienated Weber and the other professors who could have helped him, he found himself completely unable to get a job. In a letter to Professor F. Ostwald on behalf of his son, Einstein's father wrote: "My son is profoundly unhappy because of his present joblessness; and every day the idea becomes more firmly implanted in his mind that he is a failure, and will not be able to find the way back again."

From this painful situation, Einstein was rescued (again!) by his friend Marcel Grossman, whose influential father obtained for Einstein a position at the Swiss Patent Office: Technical Expert (Third Class). Anchored at last in a safe, though humble, position, Einstein married one of his classmates. He learned to do his work at the Patent Office very efficiently; and he used the remainder of his time on his own calculations, hiding them guiltily in a drawer when footsteps approached.

In 1905, this Technical Expert (Third Class) astonished the world of science with five papers, written within a few weeks of each other, and published in the Annalen der Physik. Of these five papers, three were classics: One of these was the paper in which Einstein applied Planck's quantum hypothesis to the photoelectric effect. The second paper discussed "Brownian motion", the zig-zag motion of small particles suspended in a liquid and hit randomly by the molecules of the liquid. This paper supplied a direct proof of the validity of atomic ideas and of Boltzmann's kinetic theory. The third paper was destined to estab-

Figure 2.1: **Einstein at the age of three in 1882.**

Figure 2.2: **Albert Einstein in 1893 (age 14).**

Figure 2.3: **Albert Einstein in 1904 (age 25).**

Figure 2.4: **Olympia Academy founders: Conrad Habicht, Maurice Solovine and Einstein.**

Figure 2.5: **Albert and Mileva Einstein, 1912.**

Figure 2.6: **Einstein with his second wife, Elsa, in 1921.**

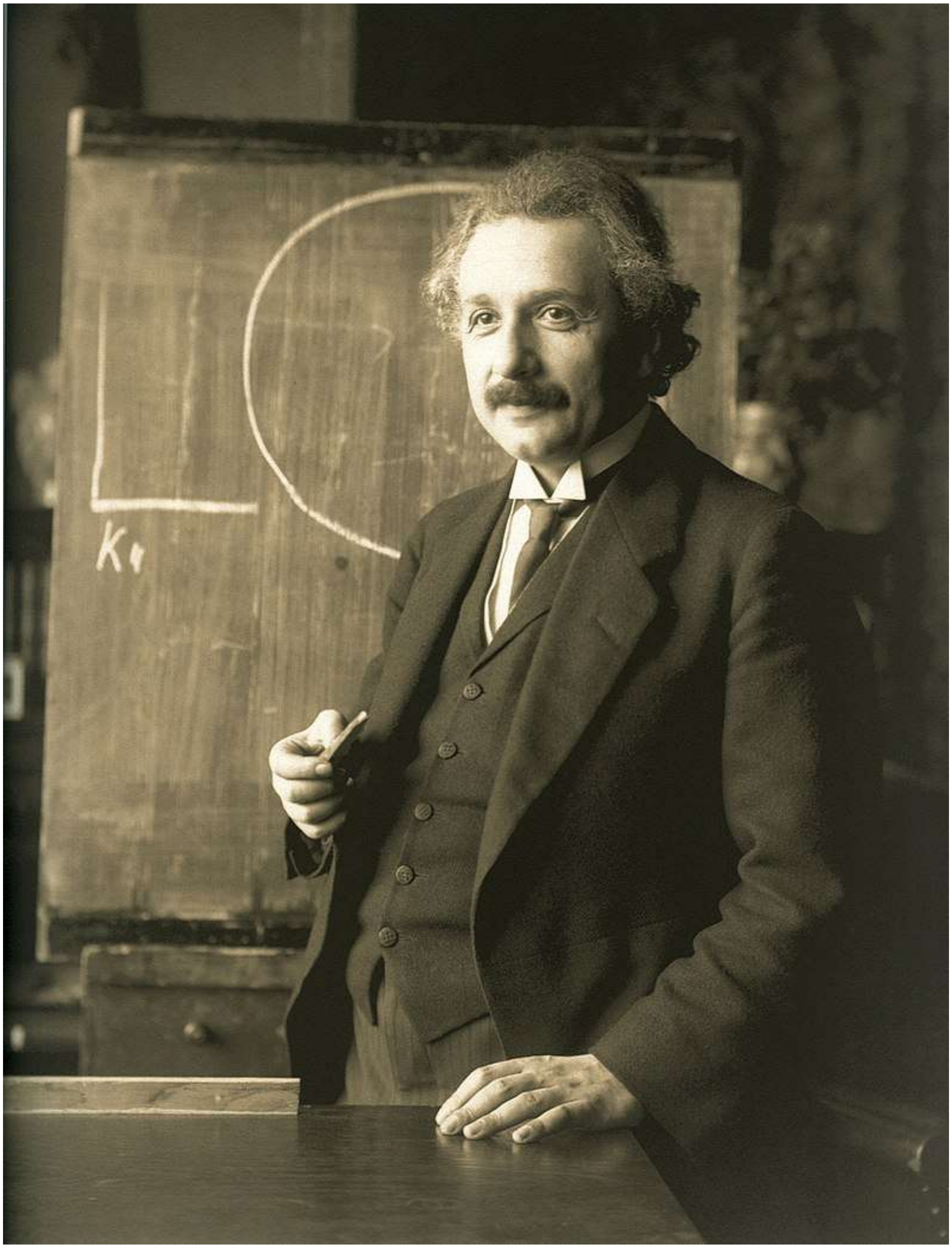

Figure 2.7: **Albert Einstein during a lecture in Vienna in 1921.**

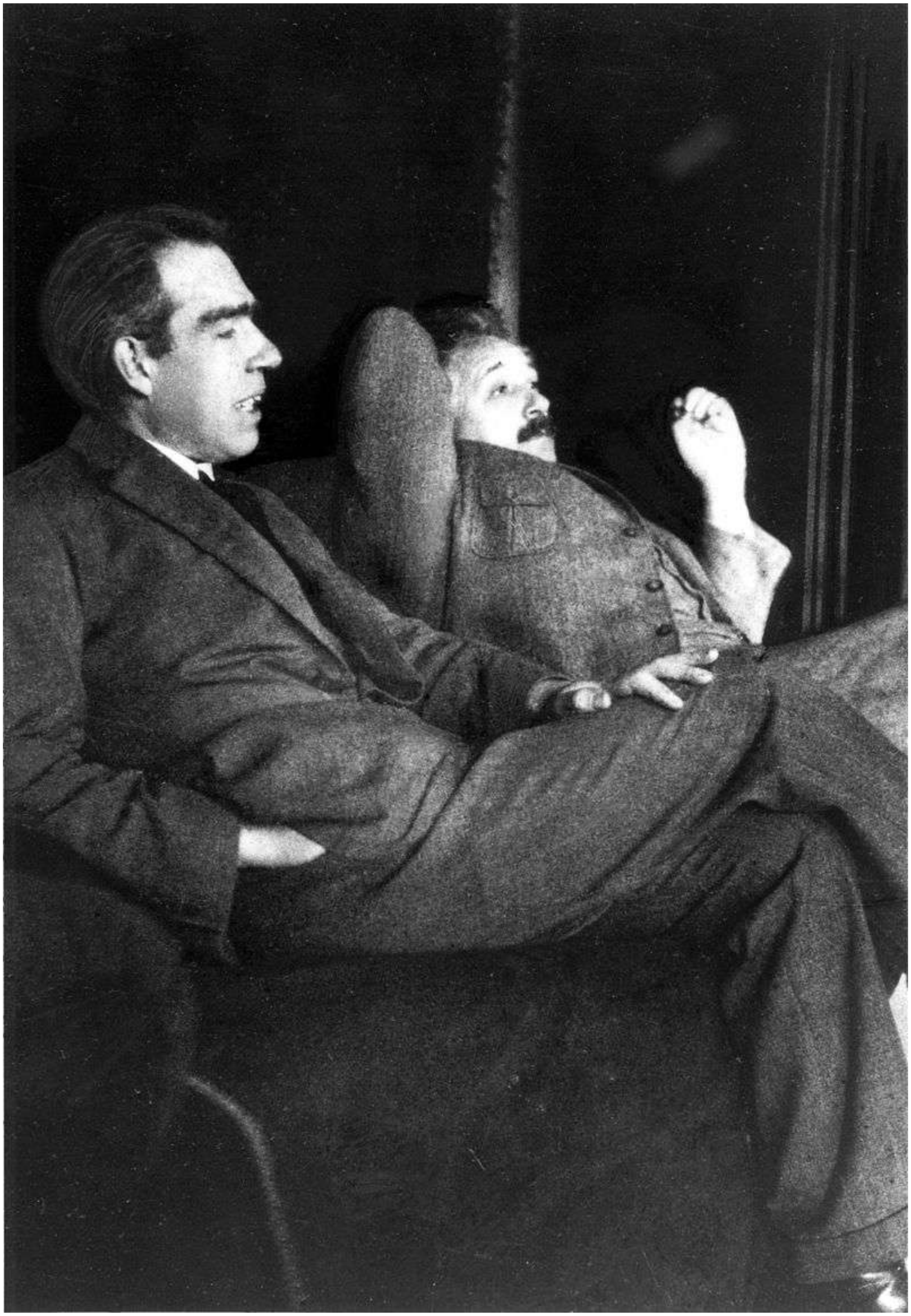

Figure 2.8: **Einstein and Niels Bohr, 1925.**

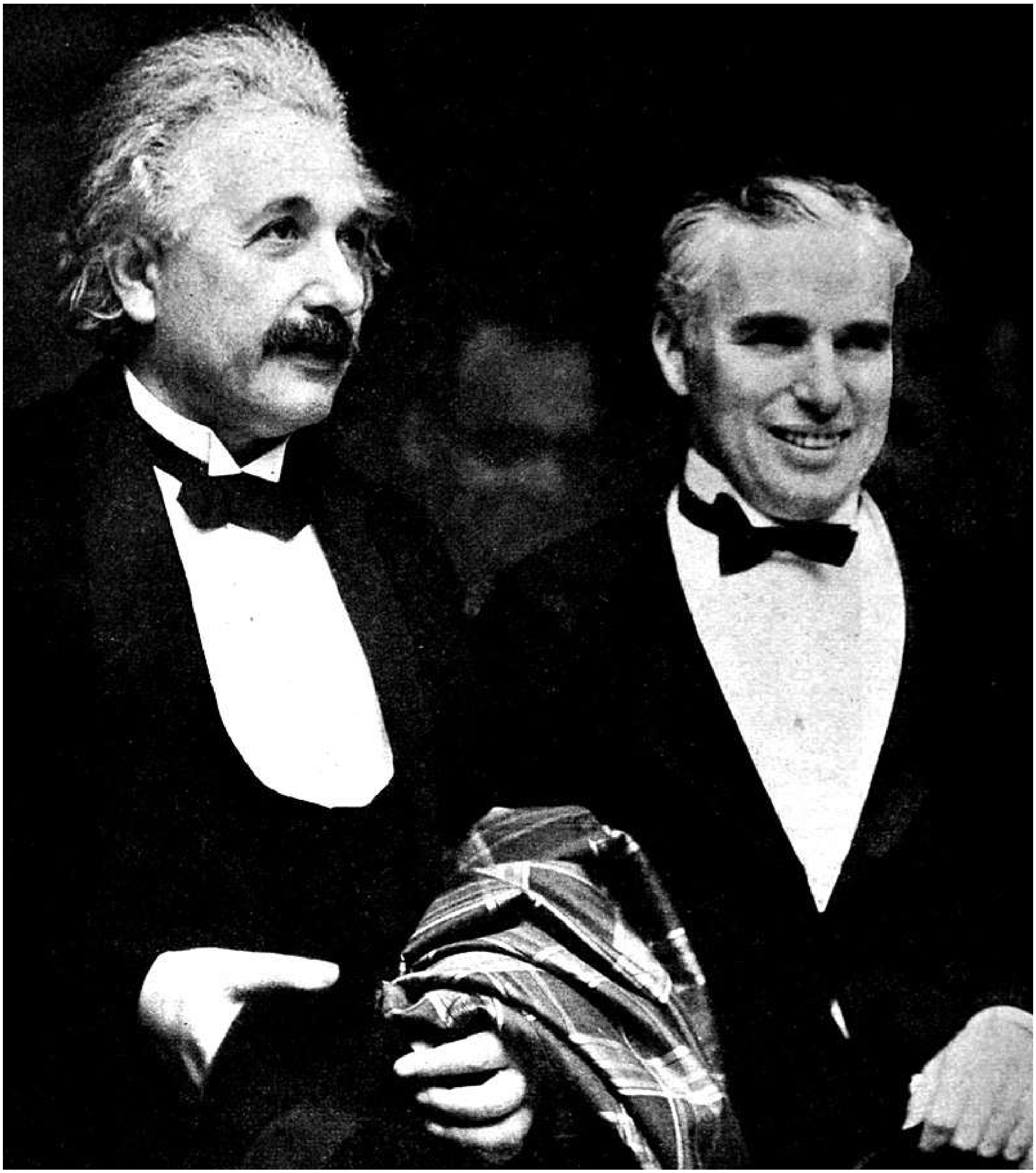

Figure 2.9: **Einstein (left) and Charlie Chaplin at the Hollywood premiere of City Lights, January 1931.**

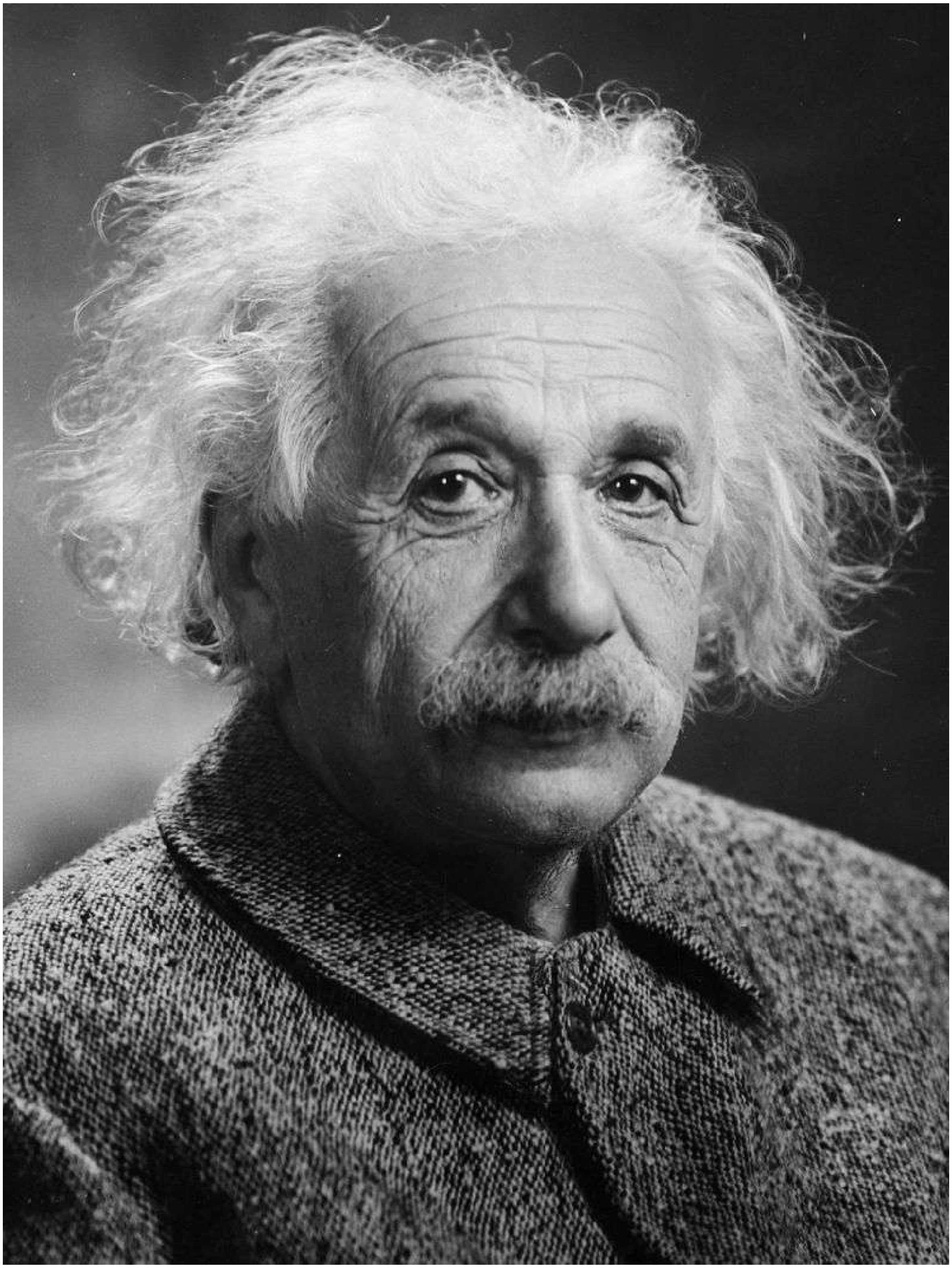

Figure 2.10: **Einstein in 1947.**

lish Einstein's reputation as one of the greatest physicists of all time. It was entitled "On the Electrodynamics of Moving Bodies", and in this paper, Albert Einstein formulated his special theory of relativity. Essentially, this theory maintained that all of the fundamental laws of nature exhibit a symmetry with respect to rotations in a 4-dimensional space-time continuum.

Special relativity theory

The theory of relativity grew out of problems connected with Maxwell's electromagnetic theory of light. Ever since the wavelike nature of light had first been demonstrated, it had been supposed that there must be some medium to carry the light waves, just as there must be some medium (for example air) to carry sound waves. A word was even invented for the medium which was supposed to carry electromagnetic waves: It was called the "ether".

By analogy with sound, it was believed that the velocity of light would depend on the velocity of the observer relative to the "ether". However, all attempts to measure differences in the velocity of light in different directions had failed, including an especially sensitive experiment which was performed in America in 1887 by A.A. Michelson and E.W. Morley.

Even if the earth had, by a coincidence, been stationary with respect to the "ether" when Michelson and Morley first performed their experiment, they should have found an "ether wind" when they repeated their experiment half a year later, with the earth at the other side of its orbit. Strangely, the observed velocity of light seemed to be completely independent of the motion of the observer!

In his famous 1905 paper on relativity, Einstein made the negative result of the Michelson-Morley experiment the basis of a far-reaching principle: He asserted that no experiment whatever can tell us whether we are at rest or whether we are in a state of uniform motion. With this assumption, the Michelson-Morley experiment of course had to fail, and the measured velocity of light had to be independent of the motion of the observer.

Einstein's Principle of Special Relativity had other extremely important consequences: He soon saw that if his principle were to hold, then Newtonian mechanics would have to be modified. In fact, Einstein's Principle of Special Relativity required that *all* fundamental physical laws exhibit a symmetry between space and time. The three space dimensions, and a fourth dimension, ict, had to enter every fundamental physical law in a symmetrical way. (Here i is the square root of -1, c is the velocity of light, and t is time.)

When this symmetry requirement is fulfilled, a physical law is said to be "Lorentz-invariant" (in honor of the Dutch physicist H.A. Lorentz, who anticipated some of Einstein's ideas). Today, we would express Einstein's principle by saying that every fundamental physical law must be Lorentz-invariant (i.e. symmetrical in the space and time coordinates). The law will then be independent of the motion of the observer, provided that the observer is moving uniformly.

Einstein was able to show that, when properly expressed, Maxwell's equations are already Lorentz-invariant; but Newton's equations of motion have to be modified. When the needed modifications are made, Einstein found, then the mass of a moving particle appears to increase as it is accelerated. A particle can never be accelerated to a velocity greater than the velocity of light; it merely becomes heavier and heavier, the added energy being converted into mass.

From his 1905 theory, Einstein deduced his famous formula equating the energy of a system to its mass multiplied by the square of the velocity of light. As we shall see, his formula was soon used to explain the source of the energy produced by decaying uranium and radium; and eventually it led to the construction of the atomic bomb. Thus Einstein, a lifelong pacifist, who renounced his German citizenship as a protest against militarism, became instrumental in the construction of the most destructive weapon ever invented - a weapon which casts an ominous shadow over the future of humankind.

Just as Einstein was one of the first to take Planck's quantum hypothesis seriously, so Planck was one of the first physicists to take Einstein's relativity seriously. Another early enthusiast for relativity was Hermann Minkowski, Einstein's former professor of mathematics. Although he once had characterized Einstein as a "lazy dog", Minkowski now contributed importantly to the mathematical formalism of Einstein's theory; and in 1907, he published the first book on relativity. In honor of Minkowski's contributions to relativity, the 4-dimensional space-time continuum in which we live is sometimes called "Minkowski space".

In 1908, Minkowski began a lecture to the Eightieth Congress of German Scientists and Physicians with the following words:

" From now on, space by itself, and time by itself, are destined to sink completely into the shadows; and only a kind of union of both will retain an independent existence."

Gradually, the importance of Einstein's work began to be realized, and he was much sought after. He was first made Assistant Professor at the University of Zürich, then full Professor in Prague, then Professor at the Zürich Polytechnic Institute; and finally, in 1913, Planck and Nernst persuaded Einstein to become Director of Scientific Research at the Kaiser Wilhelm Institute in Berlin. He was at this post when the First World War broke out

While many other German intellectuals produced manifestos justifying Germany's invasion of Belgium, Einstein dared to write and sign an anti-war manifesto. Einstein's manifesto appealed for cooperation and understanding among the scholars of Europe for the sake of the future; and it proposed the eventual establishment of a League of Europeans. During the war, Einstein remained in Berlin, doing whatever he could for the cause of peace, burying himself unhappily in his work, and trying to forget the agony of Europe, whose civilization was dying in a rain of shells, machine-gun bullets, and poison gas.

General relativity

The work into which Einstein threw himself during this period was an extension of his theory of relativity. He already had modified Newton's equations of motion so that they exhibited the space-time symmetry required by his Principle of Special Relativity. However, Newton's law of gravitation. remained a problem.

Obviously it had to be modified, since it disagreed with his Special Theory of Relativity; but how should it be changed? What principles could Einstein use in his search for a more correct law of gravitation? Certainly whatever new law he found would have to give results very close to Newton's law, since Newton's theory could predict the motions of the planets with almost perfect accuracy. This was the deep problem with which he struggled.

In 1907, Einstein had found one of the principles which was to guide him, the Principle of Equivalence of inertial and gravitational mass. After turning Newton's theory over and over in his mind, Einstein realized that Newton had used mass in two distinct ways: His laws of motion stated that the force acting on a body is equal to the mass of the body multiplied by its acceleration; but according to Newton, the gravitational force on a body is also proportional to its mass. In Newton's theory, gravitational mass, by a coincidence, is equal to inertial mass; and this holds for all bodies. Einstein decided to construct a theory in which gravitational and inertial mass necessarily have to be the same.

He then imagined an experimenter inside a box, unable to see anything outside it. If the box is on the surface of the earth, the person inside it will feel the pull of the earth's gravitational field. If the experimenter drops an object, it will fall to the floor with an acceleration of 32 feet per second per second. Now suppose that the box is taken out into empty space, far away from strong gravitational fields, and accelerated by exactly 32 feet per second per second. Will the enclosed experimenter be able to tell the difference between these two situations? Certainly no difference can be detected by dropping an object, since in the accelerated box, the object will fall to the floor in exactly the same way as before.

With this "thought experiment" in mind, Einstein formulated a general Principle of Equivalence: He asserted that no experiment whatever can tell an observer enclosed in a small box whether the box is being accelerated, or whether it is in a gravitational field. According to this principle, gravitation and acceleration are locally equivalent, or, to say the same thing in different words, gravitational mass and inertial mass are equivalent.

Einstein soon realized that his Principle of Equivalence implied that a ray of light must be bent by a gravitational field. This conclusion followed because, to an observer in an accelerated frame, a light beam which would appear straight to a stationary observer, must necessarily appear very slightly curved. If the Principle of Equivalence held, then the same slight bending of the light ray would be observed by an experimenter in a stationary frame in a gravitational field.

Another consequence of the Principle of Equivalence was that a light wave propagating upwards in a gravitational field should be very slightly shifted to the red. This followed because in an accelerated frame, the wave crests would be slightly farther apart than they normally would be, and the same must then be true for a stationary frame in a gravitational field. It seemed to Einstein that it ought to be possible to test experimentally both the gravitational bending of a light ray and the gravitational red shift.

This seemed promising; but how was Einstein to proceed from the Principle of Equivalence to a formulation of the law of gravitation? Perhaps the theory ought to be modeled after Maxwell's electromagnetic theory, which was a field theory, rather than an "action at a distance" theory. Part of the trouble with Newton's law of gravitation was that it allowed a signal to be propagated instantaneously, contrary to the Principle of Special Relativity.

A field theory of gravitation might cure this defect, but how was Einstein to find such a theory? There seemed to be no way.

From these troubles Albert Einstein was rescued (a third time!) by his staunch friend Marcel Grossman. By this time, Grossman had become a professor of mathematics in Zürich, after having written a doctoral dissertation on tensor analysis and non-Euclidean geometry, the very things that Einstein needed. The year was then 1912, and Einstein had just returned to Zürich as Professor of Physics at the Polytechnic Institute. For two years, Einstein and Grossman worked together; and by the time Einstein left for Berlin in 1914, the way was clear. With Grossman's help, Einstein saw that the gravitational field could be expressed as a curvature of the 4-dimensional space-time continuum.

In 1919, a British expedition, headed by Sir Arthur Eddington, sailed to a small island off the coast of West Africa. Their purpose was to test Einstein's prediction of the bending of light in a gravitational field by observing stars close to the sun during a total eclipse. The observed bending agreed exactly with Einstein's predictions; and as a result he became world-famous. The general public was fascinated by relativity, in spite of the abstruseness of the theory (or perhaps because of it). Einstein, the absent-minded professor, with long, uncombed hair, became a symbol of science. The world was tired of war, and wanted something else to think about.

Einstein met President Harding, Winston Churchill and Charlie Chaplin; and he was invited to lunch by the Archbishop of Canterbury. Although adulated elsewhere, he was soon attacked in Germany. Many Germans, looking for an excuse for the defeat of their nation, blamed it on the pacifists and Jews; and Einstein was both these things.

Einstein's letter to Freud: Why war?

Because of his fame, Einstein was asked to make several speeches at the Reichstag. and in all these speeches he condemned violence and nationalism, urging that these be replaced by and international cooperation and law under an effective international authority. He also wrote many letters and articles pleading for peace and for the renunciation of militarism and violence.

Einstein believed that the production of armaments is damaging, not only economically, but also spiritually. In 1930 he signed a manifesto for world disarmament sponsored by the Womens International League for Peace and Freedom. In December of the same year, he made his famous statement in New York that if two percent of those called for military service were to refuse to fight, governments would become powerless, since they could not imprison that many people. He also argued strongly against compulsory military service and urged that conscientious objectors should be protected by the international community. He argued that peace, freedom of individuals, and security of societies could only be achieved through disarmament, the alternative being "slavery of the individual and annihilation of civilization".

In letters, and articles, Einstein wrote that the welfare of humanity as a whole must take precedence over the goals of individual nations, and that we cannot wait until leaders give up their preparations for war. Civil society, and especially public figures, must take

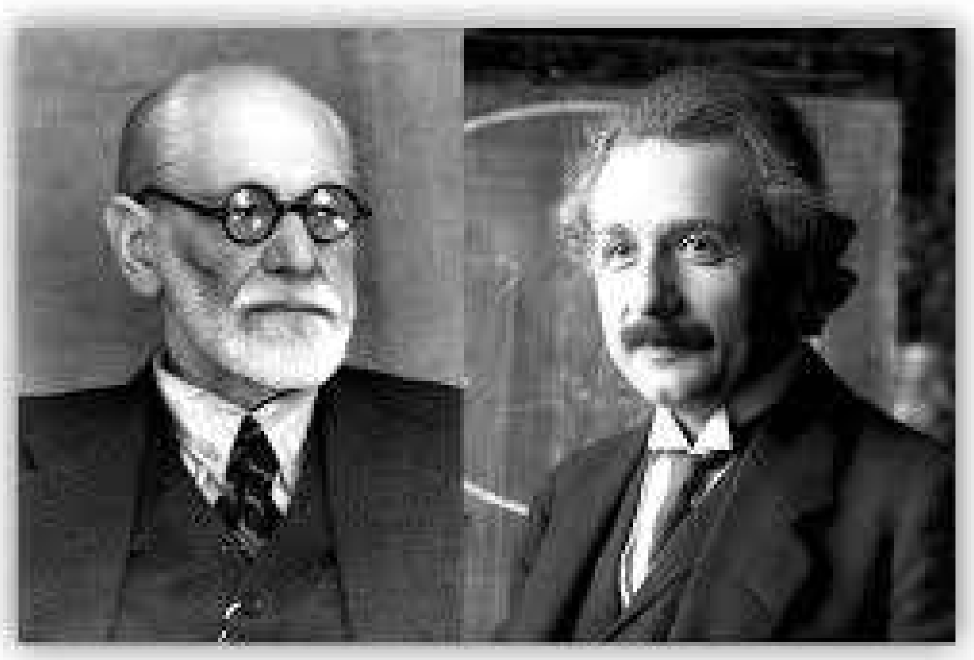

Figure 2.11: **Sigmund Freud and Albert Einstein (public domain). Their exchange of letters entitled "Why War?" deserves to be read by everyone concerned with the human future.**

the lead. He asked how decent and self-respecting people can wage war, knowing how many innocent people will be killed.

In 1931, the International Institute for Intellectual Cooperation invited Albert Einstein to enter correspondence with a prominent person of his own choosing on a subject of importance to society. The Institute planned to publish a collection of such dialogues. Einstein accepted at once, and decided to write to Sigmund Freud to ask his opinion about how humanity could free itself from the curse of war. A translation from German of the long letter that he wrote to Freud is as follows:

"Dear Professor Freud,

"Is there any way of delivering mankind from the menace of war?

"It is common knowledge that, with the advance of modern science, this issue has come to mean a matter of life and death for civilization as we know it; nevertheless, for all the zeal displayed, every attempt at its solution has ended in a lamentable breakdown.

"I believe, moreover, that those whose duty it is to tackle the problem professionally and practically are growing only too aware of their impotence to deal with it, and have now a very lively desire to learn the views of men who, absorbed in the pursuit of science, can see world-problems in the perspective distance lends. As for me, the normal objective of my thought affords no insight into the dark places of human will and feeling. Thus, in the enquiry now proposed, I can do little more than seek to clarify the question at issue and, clearing the ground of the more obvious solutions, enable you to bring the light of your far-reaching knowledge of man's instinctive life to bear upon the problem...

"As one immune from nationalist bias, I personally see a simple way of dealing with the superficial (i.e. administrative) aspect of the problem: the setting up, by international consent, of a legislative and judicial body to settle every conflict arising between nations. Each nation would undertake to abide by the orders issued by this legislative body, to invoke its decision in every dispute, to accept its judgments unreservedly and to carry out every measure the tribunal deems necessary for the execution of its decrees. But here, at the outset, I come up against a difficulty; a tribunal is a human institution which, in proportion as the power at its disposal is inadequate to enforce its verdicts, is all the more prone to suffer these to be deflected by extrajudicial pressure. This is a fact with which we have to reckon; law and might inevitably go hand in hand, and juridical decisions approach more nearly the ideal justice demanded by the community (in whose name and interests these verdicts are pronounced) in so far as the community has effective power to compel respect of its juridical ideal. But at present we are far from possessing any supranational organization competent to render verdicts of incontestable authority and enforce absolute submission to the execution of its verdicts. Thus I am led to my first axiom: the

quest of international security involves the unconditional surrender by every nation, in a certain measure, of its liberty of action, its sovereignty that is to say, and it is clear beyond all doubt that no other road can lead to such security.

"The ill-success, despite their obvious sincerity, of all the efforts made during the last decade to reach this goal leaves us no room to doubt that strong psychological factors are at work, which paralyse these efforts. Some of these factors are not far to seek. The craving for power which characterizes the governing class in every nation is hostile to any limitation of the national sovereignty. This political power-hunger is wont to batten on the activities of another group, whose aspirations are on purely mercenary, economic lines. I have specially in mind that small but determined group, active in every nation, composed of individuals who, indifferent to social considerations and restraints, regard warfare, the manufacture and sale of arms, simply as an occasion to advance their personal interests and enlarge their personal authority.

"But recognition of this obvious fact is merely the first step towards an appreciation of the actual state of affairs. Another question follows hard upon it: how is it possible for this small clique to bend the will of the majority, who stand to lose and suffer by a state of war, to the service of their ambitions? (In speaking of the majority, I do not exclude soldiers of every rank who have chosen war as their profession, in the belief that they are serving to defend the highest interests of their race, and that attack is often the best method of defense.) An obvious answer to this question would seem to be that the minority, the ruling class at present, has the schools and press, usually the Church as well, under its thumb. This enables it to organize and sway the emotions of the masses, and make its tool of them.

"Yet even this answer does not provide a complete solution. Another question arises from it: How is it these devices succeed so well in rousing men to such wild enthusiasm, even to sacrifice their lives? Only one answer is possible. Because man has within him a lust for hatred and destruction. In normal times this passion exists in a latent state, it emerges only in unusual circumstances; but it is a comparatively easy task to call it into play and raise it to the power of a collective psychosis. Here lies, perhaps, the crux of all the complex of factors we are considering, an enigma that only the expert in the lore of human instincts can resolve.

"And so we come to our last question. Is it possible to control man's mental evolution so as to make him proof against the psychoses of hate and destructiveness? Here I am thinking by no means only of the so-called uncultured masses. Experience proves that it is rather the so-called 'Intelligentzia' that is most apt to yield to these disastrous collective suggestions, since the intellectual has no direct contact with life in the raw, but encounters it in its easiest, synthetic form upon the printed page.

"To conclude: I have so far been speaking only of wars between nations;

what are known as international conflicts. But I am well aware that the aggressive instinct operates under other forms and in other circumstances. (I am thinking of civil wars, for instance, due in earlier days to religious zeal, but nowadays to social factors; or, again, the persecution of racial minorities). But my insistence on what is the most typical, most cruel and extravagant form of conflict between man and man was deliberate, for here we have the best occasion of discovering ways and means to render all armed conflicts impossible.

"Yours very sincerely,

"A. Einstein"

Freud replied with a long and thoughtful letter in which he said that a tendency towards conflict is an intrinsic part of human emotional nature, but that emotions can be overridden by rationality, and that rational behavior is the only hope for humankind.

The fateful letter to Roosevelt

Albert Einstein's famous relativistic formula, relating energy to mass, soon yielded an understanding of the enormous amounts of energy released in radioactive decay. Marie and Pierre Curie had noticed that radium maintains itself at a temperature higher than its surroundings. Their measurements and calculations showed that a gram of radium produces roughly 100 gram-calories of heat per hour. This did not seem like much energy until Rutherford found that radium has a half-life of about 1,000 years. In other words, after a thousand years, a gram of radium will still be producing heat, its radioactivity only reduced to one-half its original value. During a thousand years, a gram of radium produces about a million kilocalories, an enormous amount of energy in relation to the tiny size of its source! Where did this huge amount of energy come from? Conservation of energy was one of the most basic principles of physics. Would it have to be abandoned?

The source of the almost-unbelievable amounts of energy released in radioactive decay could be understood through Einstein's formula equating the energy of a system to its mass multiplied by the square of the velocity of light, and through accurate measurements of atomic weights. Einstein's formula asserted that mass and energy are equivalent. It was realized that in radioactive decay, neither mass nor energy is conserved, but only a quantity more general than both, of which mass and energy are particular forms. Scientists in several parts of the world realized that Einstein's discovery of the relationship between mass and energy, together with the discovery of fission of the heavy element uranium meant that it might be possible to construct a uranium-fission bomb of immense power.

Meanwhile night was falling on Europe. In 1929, an economic depression had begun in the United States and had spread to Europe. Without the influx of American capital, the postwar reconstruction of the German economy collapsed. The German middle class, which had been dealt a severe blow by the great inflation of 1923, now received a second heavy blow. The desperate economic chaos drove German voters into the hands of political extremists.

On January 30, 1933, Adolf Hitler was appointed Chancellor and leader of a coalition cabinet by President Hindenburg. Although Hitler was appointed legally to this post, he quickly consolidated his power by unconstitutional means: On May 2, Hitler's police seized the headquarters of all trade unions, and arrested labor leaders. The Communist and Socialist parties were also banned, their assets seized and their leaders arrested. Other political parties were also smashed. Acts were passed eliminating Jews from public service; and innocent Jewish citizens were boycotted, beaten and arrested. On March 11, 1938, Nazi troops entered Austria.

On March 16, 1939, the Italian physicist Enrico Fermi (who by then was a refugee in America) went to Washington to inform the Office of Naval Operations that it might be possible to construct an atomic bomb; and on the same day, German troops poured into Czechoslovakia.

A few days later, a meeting of six German atomic physicists was held in Berlin to discuss the applications of uranium fission. Otto Hahn, the discoverer of fission, was not present, since it was known that he was opposed to the Nazi regime. He was even said to have exclaimed: "I only hope that you physicists will never construct a uranium bomb! If Hitler ever gets a weapon like that, I'll commit suicide."

The meeting of German atomic physicists was supposed to be secret; but one of the participants reported what had been said to Dr. S. Flügge, who wrote an article about uranium fission and about the possibility of a chain reaction. Flügge's article appeared in the July issue of Naturwissenschaften, and a popular version in the Deutsche Allgemeine Zeitung. These articles greatly increased the alarm of American atomic scientists, who reasoned that if the Nazis permitted so much to be printed, they must be far advanced on the road to building an atomic bomb.

In the summer of 1939, while Hitler was preparing to invade Poland, alarming news reached the physicists in the United States: A second meeting of German atomic scientists had been held in Berlin, this time under the auspices of the Research Division of the German Army Weapons Department. Furthermore, Germany had stopped the sale of uranium from mines in Czechoslovakia.

The world's most abundant supply of uranium, however, was not in Czechoslovakia, but in Belgian Congo. Leo Szilard, a refugee Hungarian physicist who had worked with Fermi to measure the number of neutrons produced in uranium fission, was deeply worried that the Nazis were about to construct atomic bombs; and it occurred to him that uranium from Belgian Congo should not be allowed to fall into their hands.

Szilard knew that his former teacher, Albert Einstein, was a personal friend of Elizabeth, the Belgian Queen Mother. Einstein had met Queen Elizabeth and King Albert of Belgium at the Solvay Conferences, and mutual love of music had cemented a friendship between them. When Hitler came to power in 1933, Einstein had moved to the Institute of Advanced Studies at Princeton; and Szilard decided to visit him there. Szilard reasoned that because of Einstein's great prestige, and because of his long-standing friendship with the Belgian Royal Family, he would be the proper person to warn the Belgians not to let their uranium fall into the hands of the Nazis. Einstein agreed to write to the Belgian king and queen.

On August 2, 1939, Szilard again visited Einstein, accompanied by Edward Teller and Eugene Wigner, who (like Szilard) were refugee Hungarian physicists. By this time, Szilard's plans had grown more ambitious; and he carried with him the draft of another letter, this time to the American President, Franklin D. Roosevelt. Einstein made a few corrections, and then signed the fateful letter, which reads (in part) as follows:

"Some recent work of E. Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into an important source of energy in the immediate future. Certain aspects of the situation seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe, therefore, that it is my duty to bring to your attention the following.."

"It is conceivable that extremely powerful bombs of a new type may be constructed. A single bomb of this type, carried by boat and exploded a port, might very well destroy the whole port, together with some of the surrounding territory.."

The letter also called Roosevelt's attention to the fact that Germany had already stopped the export of uranium from the Czech mines under German control. After making a few corrections, Einstein signed it. On October 11, 1939, three weeks after the defeat of Poland, Roosevelt's economic adviser, Alexander Sachs, personally delivered the letter to the President. After discussing it with Sachs, the President commented,"This calls for action." Later, when atomic bombs were dropped on civilian populations in an already virtually-defeated Japan, Einstein bitterly regretted having signed Szilard's letter to Roosevelt. He said repeatedly that signing the letter was the greatest mistake of his life, and his remorse was extreme.

Throughout the remainder of his life, in addition to his scientific work, Einstein worked tirelessly for peace, international understanding and nuclear disarmament. His last public act, only a few days before his death in 1955, was to sign the Russell-Einstein Manifesto, warning humankind of the catastrophic consequences that would follow from a war with nuclear weapons.

A few more things that Einstein said about peace:

We cannot solve our problems with the same thinking that we used when we created them.

It has become appallingly obvious that our technology has exceeded our humanity.

Peace cannot be kept by force; it can only be achieved by understanding.

The world is a dangerous place to live; not because of the people who are evil, but because of the people who don't do anything about it.

Insanity: doing the same thing over and over again and expecting to get different results.

Nothing will end war unless the people themselves refuse to go to war.

Past thinking and methods did not prevent world wars. Future thinking must prevent war.

You cannot simultaneously prevent and prepare for war.

Never do anything against conscience, even if the state demands it.

Taken as a whole, I would believe that Gandhi's views were the most enlightened of all political men of our time.

Without ethical culture, there is no salvation for humanity.

War seems to me to be a mean, contemptible thing: I would rather be hacked in pieces than take part in such an abominable business. And yet so high, in spite of everything, is my opinion of the human race that I believe this bogey would have disappeared long ago, had the sound sense of the nations not been systematically corrupted by commercial and political interests acting through the schools and the Press.

2.2 Niels Bohr

Christian Bohr's household

Christian Bohr (1855-1911) was appointed professor of physiology at the University of Copenhagen in 1886. In this position, he made a number of important discoveries connected with respiration in mammals, including what is now known as the "Bohr effect", i.e. the tendency of high concentrations of CO_2 and of H^+ ions to increase the efficiency of hemoglobin in releasing oxygen. Christian Bohr was also the teacher of August Krogh, who later won a Nobel Prize in Medicine and Physiology.

Christian Bohr's wife, Ellen Adler Bohr, belonged to a wealthy Jewish banking family, and Niels Bohr was born in the impressive multi-story Adler mansion that still stands today near one of Copenhagen's canals opposite the Danish Parliament. During the time that Niels and Harold Bohr were growing up, this house was the meeting place for many of Copenhagen's leading intellectuals, and the boys were allowed to attend meetings where scientific and philosophical questions were debated. This upbringing contributed to the fact that both Niels and Harold later became famous in their respective fields, physics and mathematics.

The Bohr family has produced outstanding scientists for four generations. Besides Christian, Niels and Harold Bohr, there is also Niels' son Aage, who shared a Nobel Prize in Physics for his work on the excited states of nuclei. Aage's sons, Wilhelm and Thomas, are also outstanding scientists.

Having been brought up in a highly intellectual household, Niels Bohr's scientific abilities developed early. In 1905, when Niels was 20, a gold medal competition was announced by the Royal Danish Society of Sciences and Letters. The challenge was to investigate a method for determining the surface tension of liquids. The method had been proposed earlier by Lord Raleigh, and it involved measuring the frequency of oscillations on the surface of a water jet. After working in his father's laboratory, making his own glassware to produce elliptical water jets, and presenting his results together with a mathematical analysis, Niels Bohr won the gold medal.

Planck, Einstein and Bohr

According to the model proposed by Rutherford in 1911, every atom has an extremely tiny nucleus, which contains almost all of the mass of the atom. Around this tiny but massive nucleus, Rutherford visualized light, negatively-charged electrons circulating in orbits, like planets moving around the sun. Rutherford calculated that the diameter of the whole atom had to be several thousand times as large as the diameter of the nucleus.

Rutherford's model of the atom explained beautifully the scattering experiments of Geiger and Marsden, but at the same time it presented a serious difficulty: According to Maxwell's equations, the electrons circulating in their orbits around the nucleus ought to produce electromagnetic waves. It could easily be calculated that the electrons in Rutherford's atom ought to lose all their energy of motion to this radiation, and spiral in

Figure 2.12: **Christian Bohr (1855-1911), the father of Niels and Harold Bohr. He was Professor of Physiology at the University of Copenhagen.**

Figure 2.13: **Niels Bohr (1885-1952) as a young man.**

Figure 2.14: **Niels Bohr and his wife, Margrethe.**

towards the nucleus. Thus, according to classical physics, Rutherford's atom could not be stable. It had to collapse.

Niels Bohr became aware of this paradox when he worked at Rutherford's Manchester laboratory during the years 1911-1913. Bohr was not at all surprised by the failure of classical concepts when applied to Rutherford's nuclear atom. Since he had been educated in Denmark, he was more familiar with the work of German physicists than were his English colleagues at Manchester. In particular, Bohr had studied the work of Max Planck (1858-1947) and Albert Einstein (1879-1955).

Just before the turn of the century, the German physicist, Max Planck, had been studying theoretically the electromagnetic radiation coming from a small hole in an oven. The hole radiated as though it were an ideally black body. This "black body radiation" was very puzzling to the physicists of the time, since classical physics failed to explain the frequency distribution of the radiation and its dependence on the temperature of the oven.

In 1901, Max Planck had discovered a formula which fitted beautifully with the experimental measurements of the frequency distribution of black body radiation; but in order to derive his formula, he had been forced to make a radical assumption which broke away completely from the concepts of classical physics.

Planck had been forced to assume that light (or, more generally, electromagnetic radiation of any kind) can only be emitted or absorbed in amounts of energy which Planck called "quanta". The amount of energy in each of these "quanta" was equal to the frequency of the light multiplied by a constant, h, which came to be known as "Planck's constant".

This was indeed a strange assumption! It seemed to have been pulled out of thin air; and it had no relation whatever to anything that had been discovered previously in physics. The only possible justification for Planck's quantum hypothesis was the brilliant success of his formula in explaining the puzzling frequency distribution of the black body radiation. Planck himself was greatly worried by his own radical break with classical concepts, and he spent many years trying unsuccessfully to relate his quantum hypothesis to classical physics.

In 1905, Albert Einstein published a paper in the *Annalen der Physik* in which he applied Planck's quantum hypothesis to the photoelectric effect. (At that time, Einstein was 25 years old, completely unknown, and working as a clerk at the Swiss Patent Office.) The photoelectric effect was another puzzling phenomenon which could not in any way be explained by classical physics. The German physicist Lenard had discovered in 1903 that light with a frequency above a certain threshold could knock electrons out of the surface of a metal; but below the threshold frequency, nothing at all happened, no matter how long the light was allowed to shine.

Using Planck's quantum hypothesis, Einstein offered the following explanation for the photoelectric effect: A certain minimum energy was needed to overcome the attractive forces which bound the electron to the metal surface. This energy was equal to the threshold frequency multiplied by Planck's constant. Light with a frequency equal to or higher than the threshold frequency could tear an electron out of the metal; but the quantum of energy supplied by light of a lower frequency was insufficient to overcome the attractive forces.

Einstein later used Planck's quantum formula to explain the low-temperature behavior

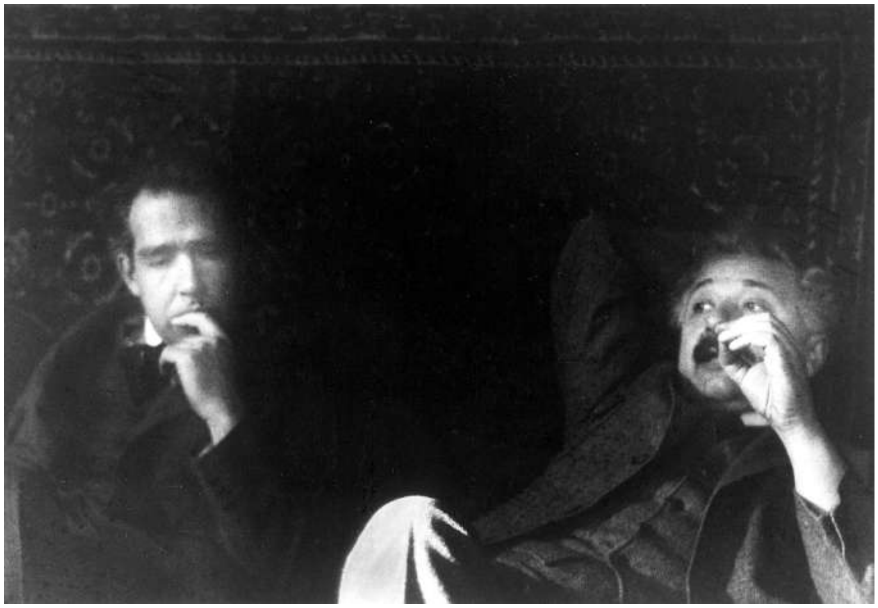

Figure 2.15: **Niels Bohr and Albert Einstein in a photo by Paul Ehrenfest. Public domain, Wikimedia Commons**

of the specific heats of crystals, another puzzling phenomenon which defied explanation by classical physics. These contributions by Einstein were important, since without this supporting evidence it could be maintained that Planck's quantum hypothesis was an *ad hoc* assumption, introduced for the sole purpose of explaining black body radiation.

As a student, Niels Bohr had been profoundly impressed by the radical ideas of Planck and Einstein. In 1912, as he worked with Rutherford at Manchester, Bohr became convinced that the problem of saving Rutherford's atom from collapse could only be solved by means of Planck's quantum hypothesis.

Returning to Copenhagen, Bohr continued to struggle with the problem. In 1913, he found the solution: The electrons orbiting around the nucleus of an atom had "angular momentum". Assuming circular orbits, the angular momentum was given by the product of the mass and velocity of the electron, multiplied by the radius of the orbit. Bohr introduced a quantum hypothesis similar to that of Planck: He assumed that the angular momentum of an electron in an allowed orbit, (multiplied by 2 pi), had to be equal to an integral multiple of Planck's constant. The lowest value of the integer, n=1, corresponded to the lowest allowed orbit. Thus, in Bohr's model, the collapse of Rutherford's atom was avoided.

Bohr calculated that the binding energies of the various allowed electron orbits in a hydrogen atom should be a constant divided by the square of the integer n; and he calculated the value of the constant to be 13.5 electron-Volts. This value fit exactly the observed ionization energy of hydrogen. After talking with the Danish spectroscopist, H.M. Hansen, Bohr realized with joy that by combining his formula for the allowed orbital energies with the Planck-Einstein formula relating energy to frequency, he could explain the mysterious line spectrum of hydrogen.

When Niels Bohr published all this in 1913, his paper produced agonized cries of "foul!" from the older generation of physicists. When Lord Rayleigh's son asked him if he had seen Bohr's paper, Rayleigh replied: "Yes, I have looked at it; but I saw that it was of no use to me. I do not say that discoveries may not be made in that sort of way. I think very likely they may be. But it does not suit me." However, as more and more atomic spectra and properties were explained by extensions of Niels Bohr's theories, it became clear that Planck, Einstein and Bohr had uncovered a whole new stratum of phenomena, previously unsuspected, but of deep and fundamental importance.

Atomic numbers

Bohr's atomic theory soon received strong support from the experiments of one of the brightest of Rutherford's bright young men - Henry Moseley (1887-1915). Moseley came from a distinguished scientific family. Not only his father, but also both his grandfathers, had been elected to the Royal Society. After studying at Oxford, where his father had once been a professor, Moseley found it difficult to decide where to do his postgraduate work. Two laboratories attracted him: the great J.J. Thomson's Cavendish Laboratory at Cambridge, and Rutherford's laboratory at Manchester. Finally, he decided on Manchester, because of the revolutionary discoveries of Rutherford, who two years earlier had won the 1908 Nobel Prize for Chemistry.

Rutherford's laboratory was like no other in the world, except J.J. Thomson's. In fact, Rutherford had learned much about how to run a laboratory from his old teacher, Thomson. Rutherford continued Thomson's tradition of democratic informality and cheerfulness. Like Thomson, he had a gift for infecting his students with his own powerful scientific curiosity, and his enthusiastic enjoyment of research.

Thomson had also initiated a tradition for speed and ingenuity in the improvisation of experimental apparatus - the so-called "sealing-wax and string" tradition - and Rutherford continued it. Niels Bohr, after working with Rutherford, was later to continue the tradition of informality and enthusiasm at the Institute for Theoretical Physics which Bohr founded in Copenhagen in 1920.

Niels Bohr had shown that the binding energies of the allowed orbits in a hydrogen atom are equal to Rydberg's constant , R (named after the distinguished Swedish spectroscopist, Johannes Robert Rydberg), divided by the square of an integral "quantum number", n. He had also shown that for heavier elements, the constant, R, is equal to the square of the nuclear charge, Z, multiplied by a factor which is the same for all elements. The constant, R, could be observed in Moseley's studies of X-ray spectra: Since X-rays are produced when electrons are knocked out of inner orbits and outer electrons fall in to replace them, Moseley could use the Planck-Einstein relationship between frequency and energy to find the energy difference between the orbits, and Bohr's theory to relate this to R.

Moseley found complete agreement with Bohr's theory. He also found that the nuclear charge, Z, increased regularly in integral steps as he went along the rows of the periodic table: Hydrogen had Z=1, helium Z=2, lithium Z=3, and so on up to uranium with Z=92.

Figure 2.16: **Another photo of Bohr and Einstein by Ehrenfest. Public domain, Wikimedia Commons**

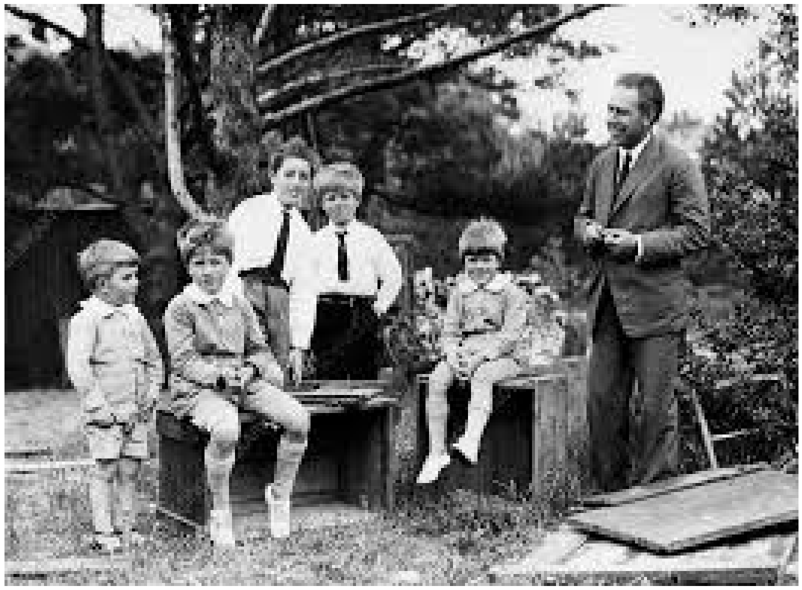

Figure 2.17: **Niels Bohr with his sons at their summer house in Tisvilde.**

The 92 electrons of a uranium atom made it electrically neutral, exactly balancing the charge of the nucleus. The number of electrons of an element, and hence its chemical properties, Moseley found, were determined uniquely by its nuclear charge, which Moseley called the "atomic number".

Moseley's studies of the nuclear charges of the elements revealed that a few elements were missing. In 1922, Niels Bohr received the Nobel Prize for his quantum theory of the atom; and he was able to announce at the presentation ceremony that one of Moseley's missing elements had been found at his institute. Moseley, however, was dead. He was one of the ten million young men whose lives were needlessly thrown away in Europe's most tragic blunder - the First World War.

Bohr's Institute of Theoretical Physics

In 1916, Niels Bohr was appointed professor of theoretical physics at the University of Copenhagen, a post that had been created especially for him. The following year, in 1917, he started to raise money for the construction of a new institute in which his new department could be housed. The project received large contributions from the Danish government and the Carlsberg Foundation, and from wealthy Danish businessmen. Bohr himself designed the building, which opened in 1920.

During the period when Hitler's Nazi party was coming to power in Germany, Bohr was able to offer a refuge at his Institute of Theoretical Physics to many important physicists who could no longer remain in Germany. Those to whom Bohr gave refuge included Guido Beck, Felix Bloch, James Franck, George de Hevesy, Otto Frisch, Hilde Levi, Lise Meitner, George Placzek, Eugene Rabinowitch, Stefan Rozental, Erich Ernst Schneider, Edward Teller, Arthur von Hippel and Victor Weisskopf. Because of this, because of Bohr's dynamic and inspiring presence, and because he was able to continue the tradition of informality, enthusiasm and speed which characterized J.J. Thomson's Cavendish and Rutherford's Manchester laboratories, Bohr's institute became the world's most important center for theoretucl physics, especially during the 1930's.

Bohr was tirelessly energetic. He liked to discuss his ideas in dialogue with one of the bright young men at his institute, putting forward an idea, and expecting a counter-argument to be thrown back. It was like a game of ping-pong. In this way, a new idea could be tested by exploring all of its consequences.

When a new scientist arrived at his institute, Bohr liked to invite the newcomer to accompany him on a two-day walking tour to his summer house in Tisvilde, about 50 kilometers north of Copenhagen. In his autobiographical book "Physics and Beyond", Werner Heisenberg describes such a two-man tour together with Bohr. This custom allowed Bohr to get to know both the personality and the potential scientific contributions of the new arrival. It also allowed Bohr to get some exercise and to keep himself in good physical condition.

The Nazi occupation of Denmark

On 9 April, 1940, Nazi Germany invaded and quickly occupied Denmark. The Germans explained that their purpose was "to protect Denmark from a British invasion". During the first three years of occupation the Germans allowed the Danish government, police force and army to exist. However, in 1943, after extensive sabotage actions by the Danish resistance movement, the German policy changed and became much harsher.

Shortly after this sudden change, the Danes became aware that their Jewish population was in danger of being arrested and sent to concentration camps. Luckily it was possible for Danish citizens to organize a secret rescue operation, in which almost all members of Denmark's Jewish community escaped to Sweden in small boats. Among them were Niels Bohr and his son Aage.

Niels and Aage Bohr fly to England

After some time in Sweden, where he helped to organize aid for Jewish refugees from Denmark, Niels Bohr and his son Aage flew to England in a small aircraft. It flew at a high altitude in order to avoid observation. Niels Bohr's oxygen mask did not fit properly because of his unusually large head, and he became unconscious. Luckily this was noticed before anything very serious happened.

Figure 2.18: **The Institute of Theoretical Physics, established by Niels Bohr at the University of Copenhagen. Today it is known as the Niels Bohr Institute**

Bohr anticipates the nuclear arms race

After escaping from Denmark to Sweden in a fishing boat in 1943, Niels Bohr and his son Aage flew to England, and then to Los Alamos in the United States, where work on a nuclear bomb was in progress. In 1943, a special intelligence unit called "Aslos" had been set up to determine how far German work on a nuclear bomb had progressed. Advanced units, entering mainland Europe after D-Day, intervied captured German scientists and found that the German program had never come near to producing a nuclear bomb.

The news that the Germans would not produce atomic bombs was classified as a secret. Nevertheless, it passed through the grapevine to the scientists working on the atomic bomb project in America; and it reversed their attitude to the project. Until then, they had been worried that Hitler would be the first to produce nuclear weapons. In 1944, they began to worry instead about what the American government might do if it came to possess such weapons.

At Los Alamos, Niels Bohr became the center of discussion and worry about the ethics of continued work on the bomb project. He was then 59 years old; and he was universally respected both for his pioneering work in atomic physics, and for his outstandingly good character.

Bohr was extremely worried because he foresaw a postwar nuclear arms race unless international control of atomic energy could be established. Consequently, as a spokesman for the younger atomic scientists, he approached both Roosevelt and Churchill to urge them to consider means by which international control might be established.

Roosevelt, too, was worried about the prospect of a postwar nuclear armaments race; and he was very sympathetic towards Bohr's proposals for international control. He sug-

Figure 2.19: **Another view of the Niels Bohr Institute.**

gested that Bohr travel to England and contact Churchill, to obtain his point of view.

Churchill was desperately busy, and basically unsympathetic towards Bohr's proposals; but on May 16, 1944, he agreed to a half-hour interview with the scientist. The meeting was a complete failure. Churchill and his scientific advisor, Lord Cherwell, spent most of the time talking with each other, so that Bohr had almost no time to present his ideas.

Although he could be very persuasive in long conversations, Bohr was unable to present his thoughts briefly. He wrote and spoke in a discursive style, similar to that of Henry James. Each of his long, convoluted sentences was heavily weighted with qualifications and dependent clauses. At one point in the conversation, Churchill turned to Lord Cherwell and asked: "What's he talking about, physics or politics?"

Bohr's low, almost whispering, way of speaking irritated Churchill. Furthermore, the two men were completely opposed in their views: Bohr was urging openness in approaching the Russians, with a view to establishing international control of nuclear weapons. Churchill, a defender of the old imperial order, was concerned mainly with maintaining British and American military supremacy.

After the interview, Churchill became worried that Bohr would give away "atomic secrets" to the Russians; and he even suggested that Bohr be arrested. However, Lord Cherwell explained to the Prime Minister that the possibility of making atomic bombs, as well as the basic means of doing so, had been common knowledge in the international scientific community ever since 1939.

After his disastrous interview with Churchill, Niels Bohr carefully prepared a memorandum to be presented to President Roosevelt. Realizing how much depended on its success or failure, Bohr wrote and rewrote the memorandum, sweating in the heat of Washington's summer weather. Aage Bohr, who acted as his father's secretary, typed the memorandum

Figure 2.20: **Aage Bohr (1922-2008), one of Niels and Margrethe Bohr's sons. Together with Ben Mottelson, he was awarded the 1975 Nobel Prize in Physics for developing a successful theory of the excited states of nuclei.**

Figure 2.21: **Ben Roy Mottelson (born in 1926), who shared the 1975 Nobel Prize in Physics with Aage Bohr. Although now very old, he still comes in to work at the Niels Bohr Institute.**

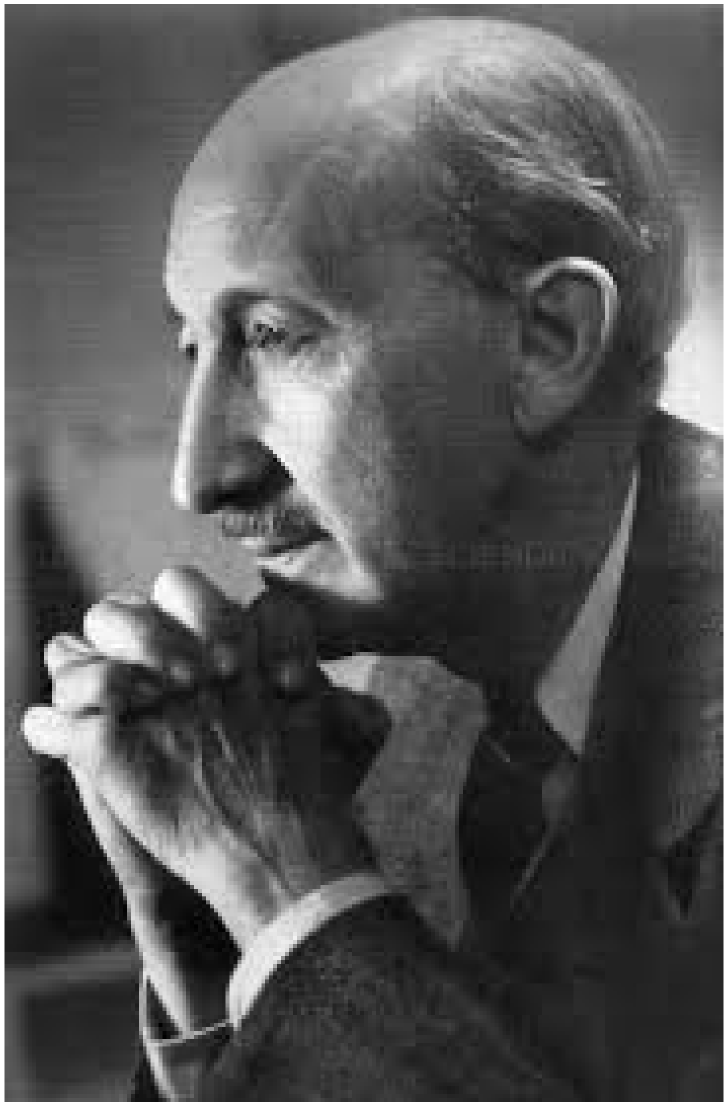

Figure 2.22: **George de Hevesy (1885-1966), co-discoverer of the element Haffnium, and pioneer of the use of radioactive tracer elements in biochemistry. He received the Nobel Prize in Chemistry in 1943 for work which he performed at the Niels Bohr Institute. The name "Haffnium" is derived from the Latin name for Copenhagen.**

over and over, following his father's many changes of mind.

Finally, in July, 1944, Bohr's memorandum was presented to Roosevelt. It contains the following passages:

"...Quite apart from the question of how soon the weapon will be ready for use, and what role it will play in the present war, this situation raises a number of problems which call for urgent attention. Unless, indeed, some agreement about the control of the new and active materials can be obtained in due time, any temporary advantage, however great, may be outweighed by a perpetual menace to human society."

"Ever since the possibilities of releasing atomic energy on a vast scale came into sight, much thought has naturally been given to the question of control; but the further the exploration of the scientific problems is proceeding, the clearer it becomes that no kind of customary measures will suffice for this purpose, and that the terrifying prospect of a future competition between nations about a weapon of such formidable character can only be avoided by a universal agreement in true confidence..."

Roosevelt was sympathetic with the ideas expressed in this memorandum. In an interview with Bohr, he expressed his broad agreement with the idea of international control of atomic energy. Unfortunately, the President had only a few months left to live.

Roosevelt's successor, Harry Truman, had not known about the existence of nuclear weapons before taking office, and he was cautiously feeling his way. Meanwhile, General Leslie Groves, the military commander of the Los Alamos project, was very anxious to get credit for ending World War II, rather than being blamed for wasting billions of dollars of the taxpayers' money. It was easy for Groves to convince Truman to give the order to drop bombs on Hiroshima and Nagasaki. Thus Bohr's efforts to prevent this tragedy failed, and the postwar nuclear arms race which he anticipated still casts a dark shadow over the future of human civilization and the biosphere.

2.3 J.J. Thomson and G.P. Thomson

In the late 1880's and early a 1890's, a feeling of satisfaction, perhaps even smugness, prevailed in the international community of physicists. It seemed to many that Maxwell's electromagnetic equations, together with Newton's equations of motion and gravitation, were the fundamental equations which could explain all the phenomena of nature. Nothing remained for physicists to do (it was thought) except to apply these equations to particular problems and to deduce the consequences. The inductive side of physics was thought to be complete.

However, in the late 1890's, a series of revolutionary discoveries shocked the physicists out of their feeling of complacency and showed them how little they really knew. The first of these shocks was the discovery of a subatomic particle, the electron. In Germany, Julius Plücker (1801-1868), and his friend, Heinrich Geisler (1814-1879), had discovered that an electric current could be passed through the gas remaining in an almost completely evacuated glass tube, if the pressure were low enough and the voltage high enough. When this happened, the gas glowed, and sometimes the glass sides of the tube near the cathode (the negative terminal) also glowed. Plücker found that the position of the glowing spots on the glass near the cathode could be changed by applying a magnetic field.

In England, Sir William Crookes (1832-1919) repeated and improved the experiments of Plücker and Geisler: He showed that the glow on the glass was produced by rays of some kind, streaming from the cathode; and he demonstrated that these "cathode rays" could cast shadows, that they could turn a small wheel placed in their path, and that they heated the glass where they struck it.

Thomson's discovery of electrons

Sir William Crookes believed that the cathode rays were electrically charged particles of a new kind - perhaps even a "fourth state of matter". His contemporaries laughed at these speculations; but a few years later a brilliant young physicist named J.J.Thomson (1856-1940), working at Cambridge University, entirely confirmed Crookes' belief that the cathode rays were charged particles of a new kind.

Thomson, an extraordinarily talented young scientist, had been appointed full professor and head of the Cavendish Laboratory at Cambridge at the age of 27. His predecessors in this position had been James Clerk Maxwell and the distinguished physicist, Lord Rayleigh, so the post was quite an honor for a man as young as Thomson. However, his brilliant performance fully justified the expectations of the committee which elected him. Under Thomson's direction, and later under the direction of his student, Ernest Rutherford, the Cavendish Laboratory became the world's greatest center for atomic and subatomic research; and it maintained this position during the first part of the twentieth century.

J.J. Thomson's first achievement was to demonstrate conclusively that the "cathode rays" observed by Plücker, Geisler and Crookes were negatively charged particles. He and his students also measured their ratio of charge to mass. If the charge was the same as that on an ordinary negative ion, then the mass of the particles was astonishingly small - almost two thousand times smaller than the mass of a hydrogen atom! Since the hydrogen atom is the lightest of all atoms, this indicated that the cathode rays were *subatomic* particles.

The charge which the cathode rays particles carried was recognized to be the fundamental unit of electrical charge, and they were given the name "electrons". All charges observed in nature were found to be integral multiples of the charge on an electron. The discovery of the electron was the first clue that the atom, thought for so long to be eternal and indivisible, could actually be torn to pieces.

Thomson taught 9 Nobel Prize winners

Figure 2.23: **Heinrich Geissler (1814-1879) was a German physicist and skilled glassblower who pioneered the development of the low pressure gas-discharge tube.**

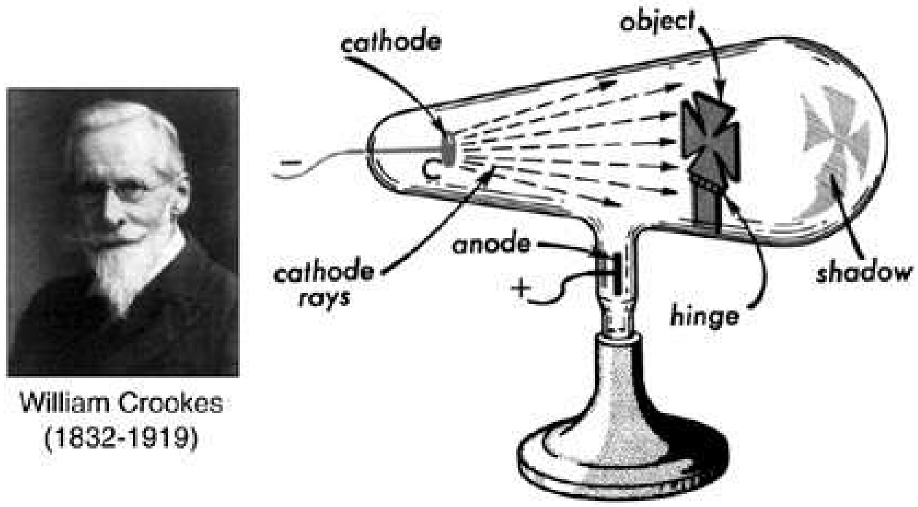

Figure 2.24: **Sir William Crookes showed that cathode rays could cast shadows.**

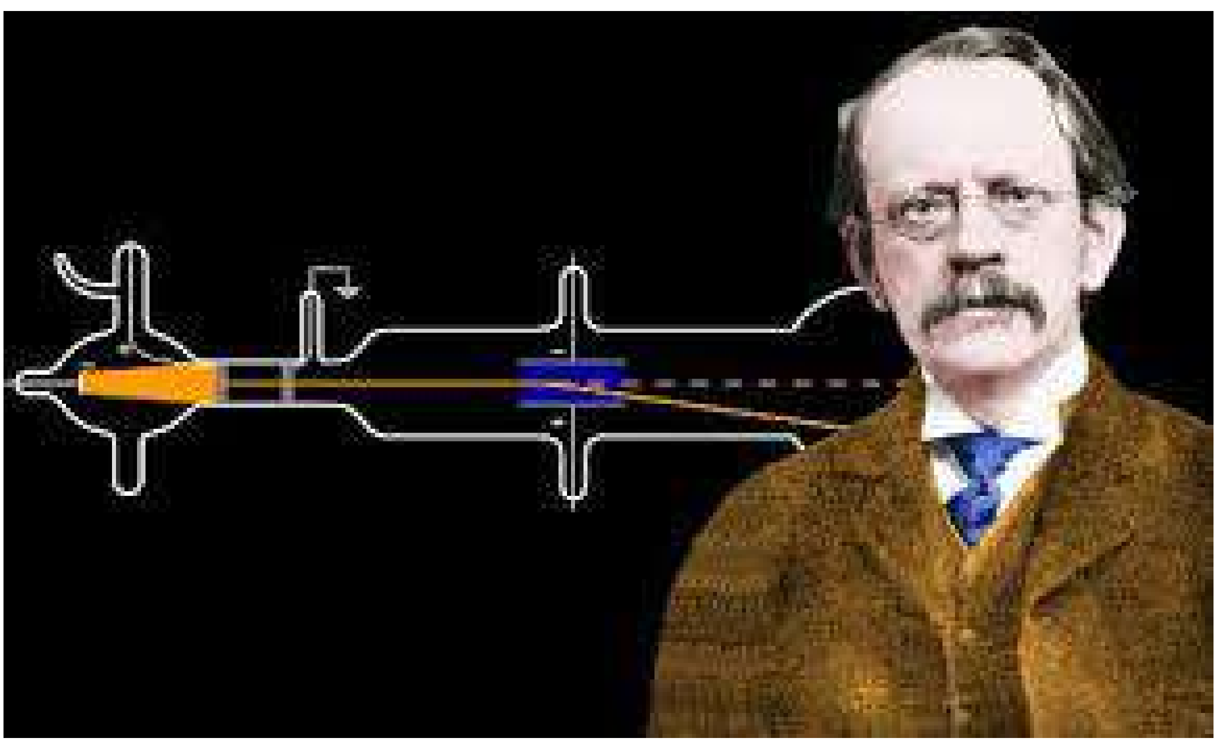

Figure 2.25: **Sir Joseph John Thomson (1856-1940). Thomson's informality, enthusiasm and speed made him an inspiring teacher. It is remarkable that 9 of his students and research associates, including his own son, were awarded either the Nobel Prize in Physics or the Nobel Prize in Chemistry.**

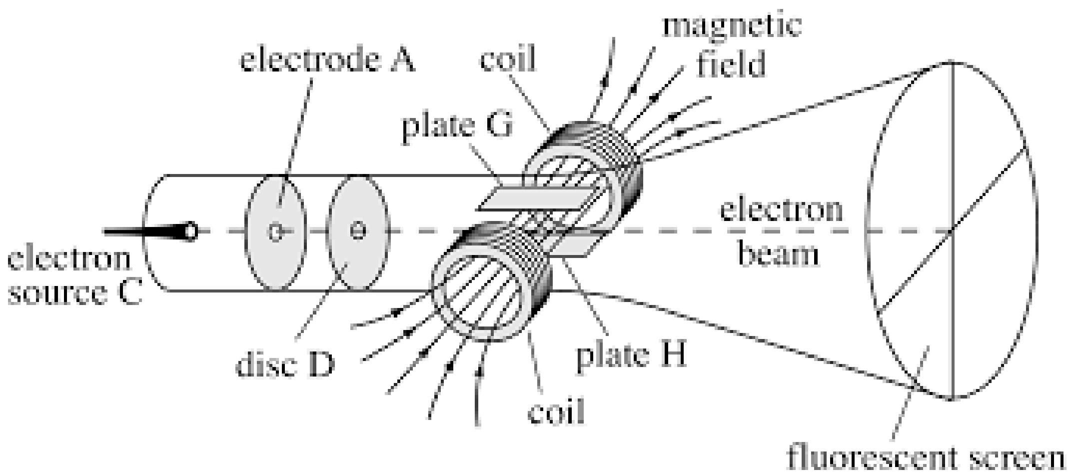

Figure 2.26: **This figure shows how Thomson determined the ratio of the electron's charge to its mass. A beam of electrons passes through a region of the vacuum tube in which there is both a vertical electric field and a horizontal magnetic field. The trajectory of the electron then depends on the charge to mass ratio.**

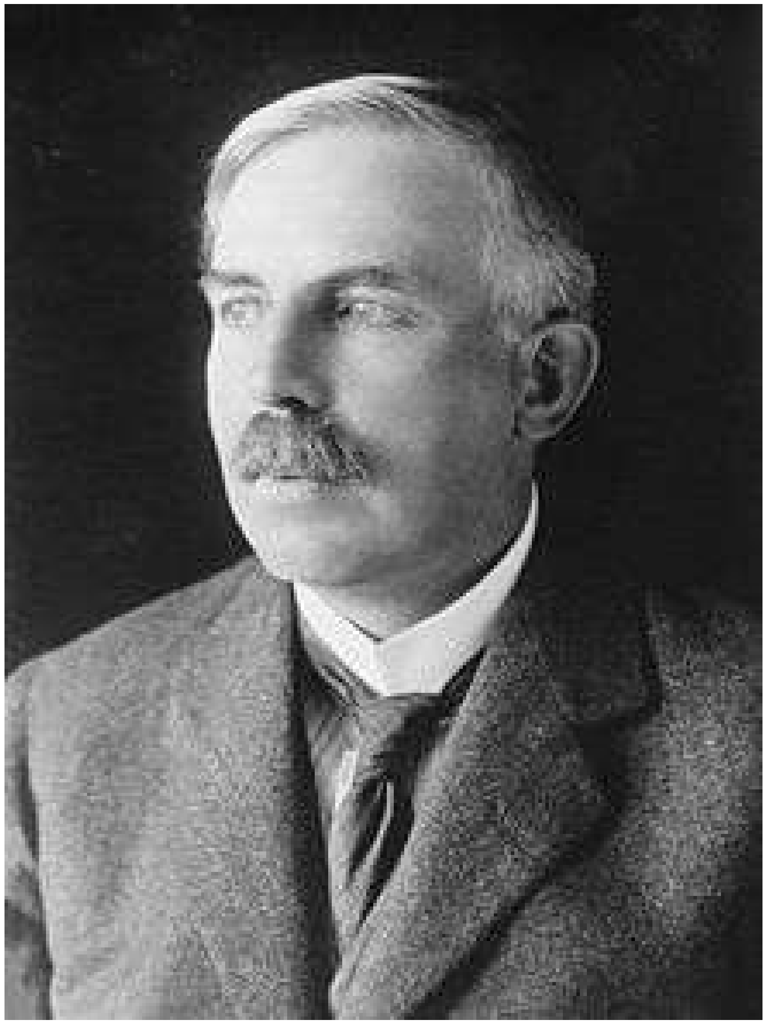

Figure 2.27: **Lord Rutherford of Nelson (1871-1937). As a young physics graduate in New Zealand, Rutherford was awarded a fellowship for postgraduate study under Thomson at Cambridge University's Cavendish Laboratory. At the end of his time at the Cavendish, Thomson was able to obtain a position for Rutherford at McGill University in Canada. It was in Canada that Rutherford did the pioneering studies of radioactive decay of elements for which he was awarded the Nobel Prize in Chemistry in 1908. Returning to England, Rutherford established a research group at what is now the University of Manchester. It was here that he and his coworkers performed the scattering experiment which led to Rutherford's model of the atom. In 1919 he became the Director of the Cavendish Laboratory, and in 1925, President of the Royal Society. Rutherford has been called the "father of nuclear physics", and is considered to be the greatest experimental physicist since Michael Faraday.**

Figure 2.28: **Charles Glover Barkla (1877-1944), who studied under Thomson at the Cavendish. He was awarded the Nobel Prize in Physics in 1917. The motivation for the award, cited by the Nobel Committee, was as follows: "Following the discovery of X-rays, it was soon established that an irradiated compound emitted secondary X-rays. In secondary spectra, lines appeared corresponding to different wavelengths. Around 1906, Charles Barkla showed that each element's secondary spectrum was unique, irrespective of temperature, structure, and chemical composition. Its spectrum was therefore a characteristic property of an atom and thus became an important tool in atomic research."**

Figure 2.29: **Niels Bohr (1885-1962). When he went to England in 1911 to meet J.J. Thomson, Bohr brought with him a detailed list of errors in Thomson's papers, which he presented to the older scientist, mistakenly expecting Thomson to be pleased. Thomson gave Bohr some experimental work to do which Bohr considered to be too trivial to be interesting. However, while at the Cavendish, Bohr met Ernst Rutherford, who invited him to work at his laboratory in Manchester. Bohr was destined to propose a quantum explation of the mysterious stability of Rutherford's model of the atom. In 1922, Bohr received a Nobel Prize in Physics for his work on the quantum theory of atomic structure.**

Figure 2.30: **Max Born (1882-1970). In 1907, he studied for six months under J.J. Thomson at the Cavendish Laboratory. In 1954, Max Born was awarded a Nobel Prize in Physics for his numerous contributions to quantum theory. In fact, Born made important contributions to many branches of physics, including solid state physics, optics, and the theory of elasticity.**

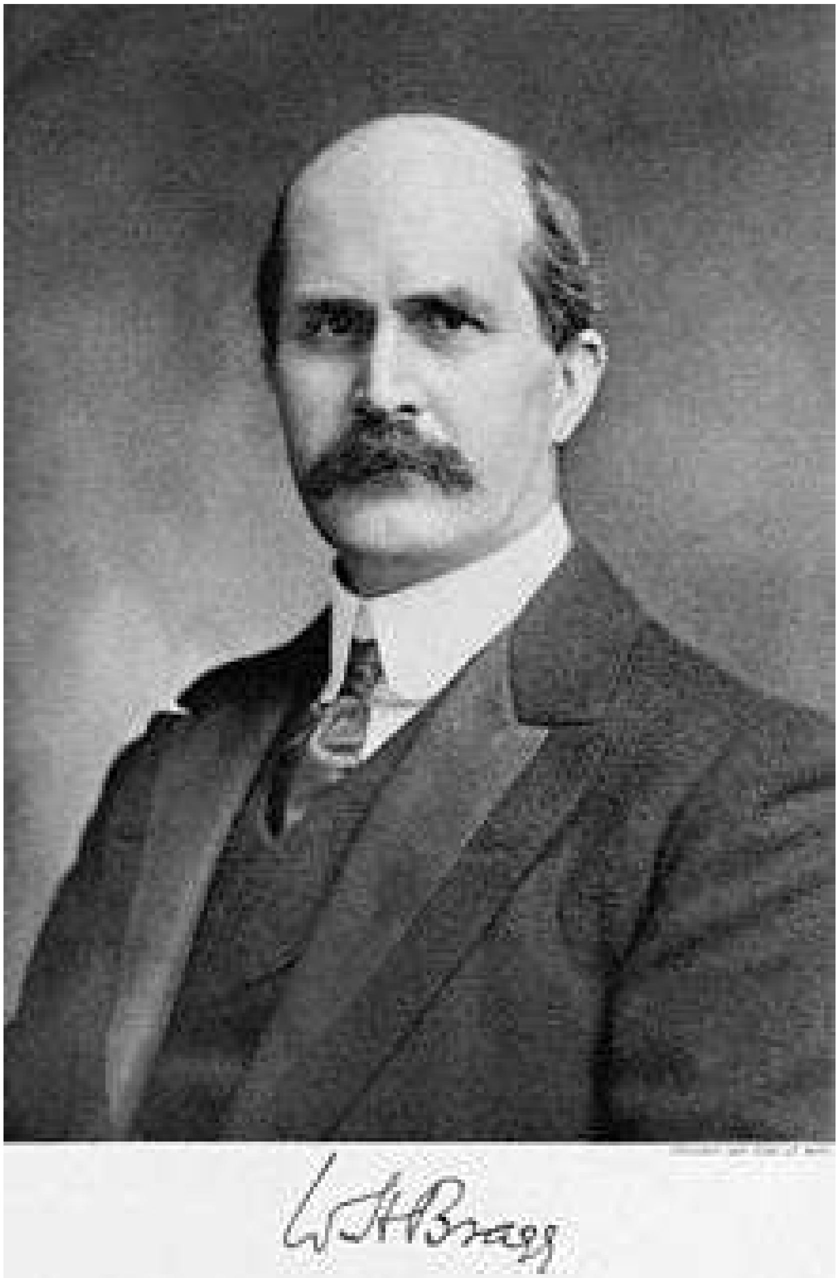

Figure 2.31: **Sir William Henry Bragg (1862-1942). He and his son, Lawrence Bragg shared the 1915 Nobel Prize in Physics "for their services to the analysis of crystal structure by means of X-rays". He studied with J.J. Thomson at Cambridge University after having won a scholarship to Trinity College in 1885. X-ray crystallography, pioneered by Bragg and his son, has proved to be enormously important both in chemistry and in biology. It has allowed us to understand the structure of both organic and inorganic molecules, and initiated the science of molecular biology.**

Figure 2.32: **Sir Owan Willans Richardson (1879-1959) is shown here together with Niels Bohr. He began research at the Cavendish in 1900, studying the emission of electrons from a hot wire. This led to his discovery of what came to be known as Richardson's Law: $s = AT^{1/2}e^{-b/T}$. Here s is the current, T is the temperature, and A and b are constants. Richardson's work on thermionic emission was honored with a Nobel Prize in Physics in 1928.**

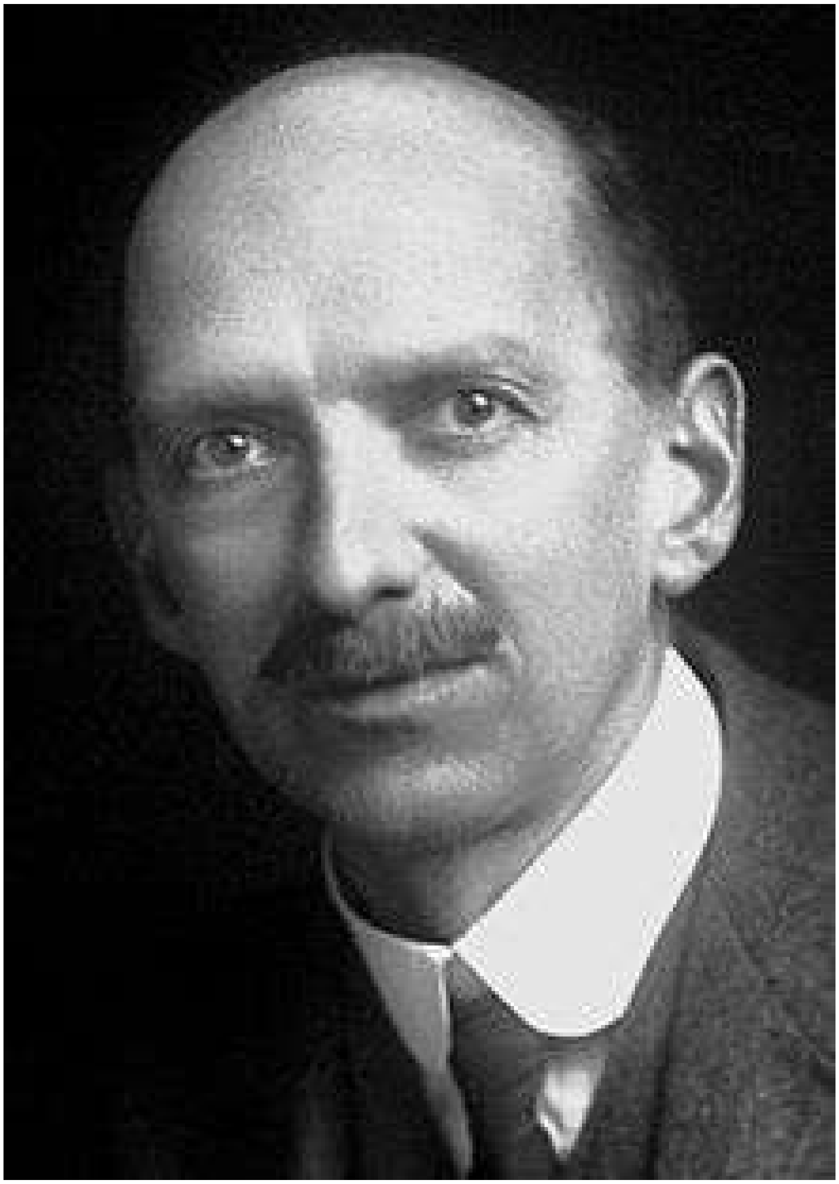

Figure 2.33: **Charles Thomson Rees Wilson (1869-1959). He won a Nobel Prize in Physics in 1927 for his invention of the cloud chamber. This invention, which paved the way for advances in modern particle physics, was the outcome of work which Wilson did at the Cavendish Laboratory under J.J. Thomson, starting in 1895. In Wilson's cloud chambers humid air is rapidly expanded. Condensation can then be observed along the paths of fast-moving charged particles, which leave trails of ions on which water condenses.**

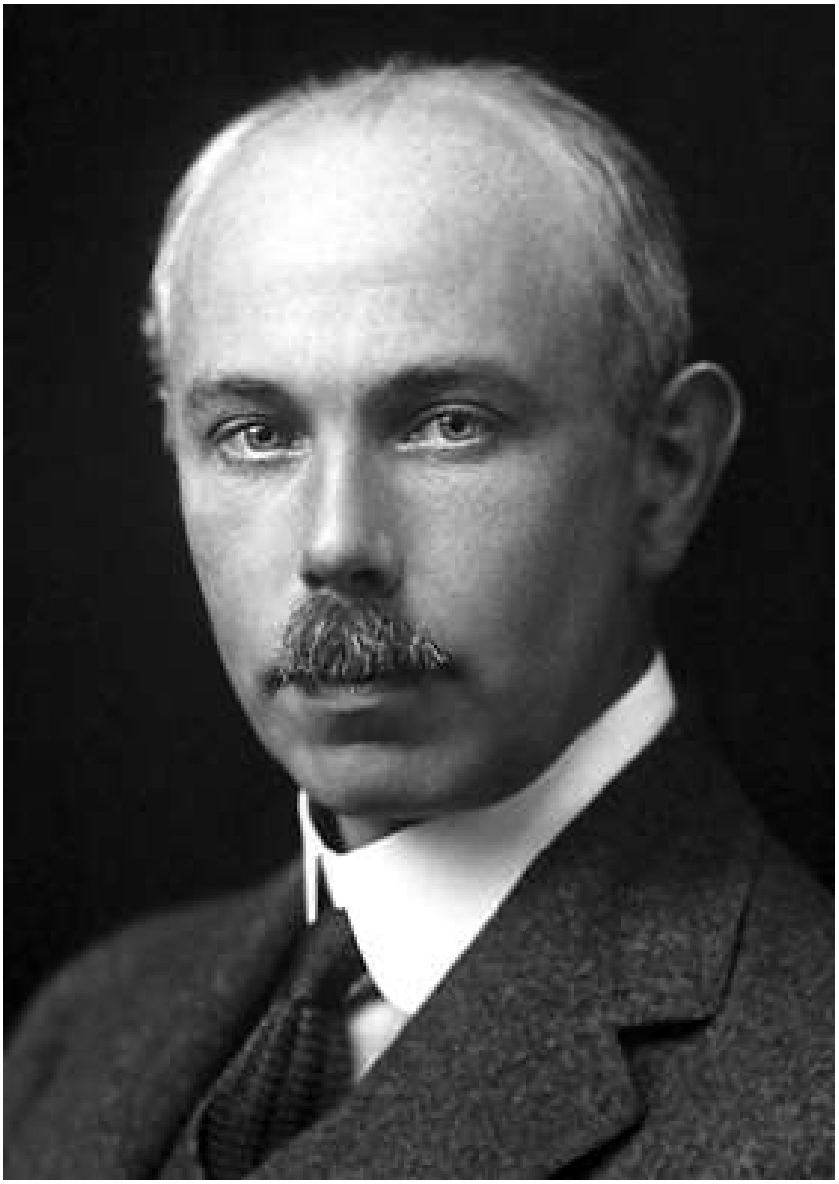

Figure 2.34: **Francis William Aston (1877-1945). In 1911 he began research at the Cavendish Laboratory at the invitation of J.J. Thomson. Using crossed eclectic and magnetic fields, just as Thomson had done in determining the charge to mass ratio of the electron, Aston determined this ratio for ionized atoms. He was able to determine the mass of many atoms with great accuracy. Using his mass spectrometer, Aston found that the masses of atoms are approximately (but not exactly) integral multiples of the mass of the hydrogen atom. He also discovered the isotopes of many non-radioactive elements. His work was honored with a Nobel Prize in Chemistry in 1922.**

Figure 2.35: **Sir George Paget Thomson (1892-1975), J.J. Thomson's son. While his father regarded the electron as a particle, G.P. Thomson demonstrated experimentally that it also had wavelike properties. He passed a beam of electrons through a thin metal foil and observed a diffraction pattern, as had been predicted by the French aristocrat and physicist Louis de Broglie in 1924. G.P. Thomson shared the 1937 Nobel Prize in Physics with C.J. Davidson and L.H. Germer, who had independently performed a similar experiment at the same time.**

Figure 2.36: **J.J. Thomson deserves credit for making Cambridge University's Cavendish Laboratory the world's most important center for physics for a long period. In the 1930's the center of interest shifted to Niels Bohr's Institute for Theoretical Physics in Copenhagen, but the Cavendish Laboratory continued to make important contributions. For example, it was at the Cavendish that Crick and Watson constructed their famous model of DNA.**

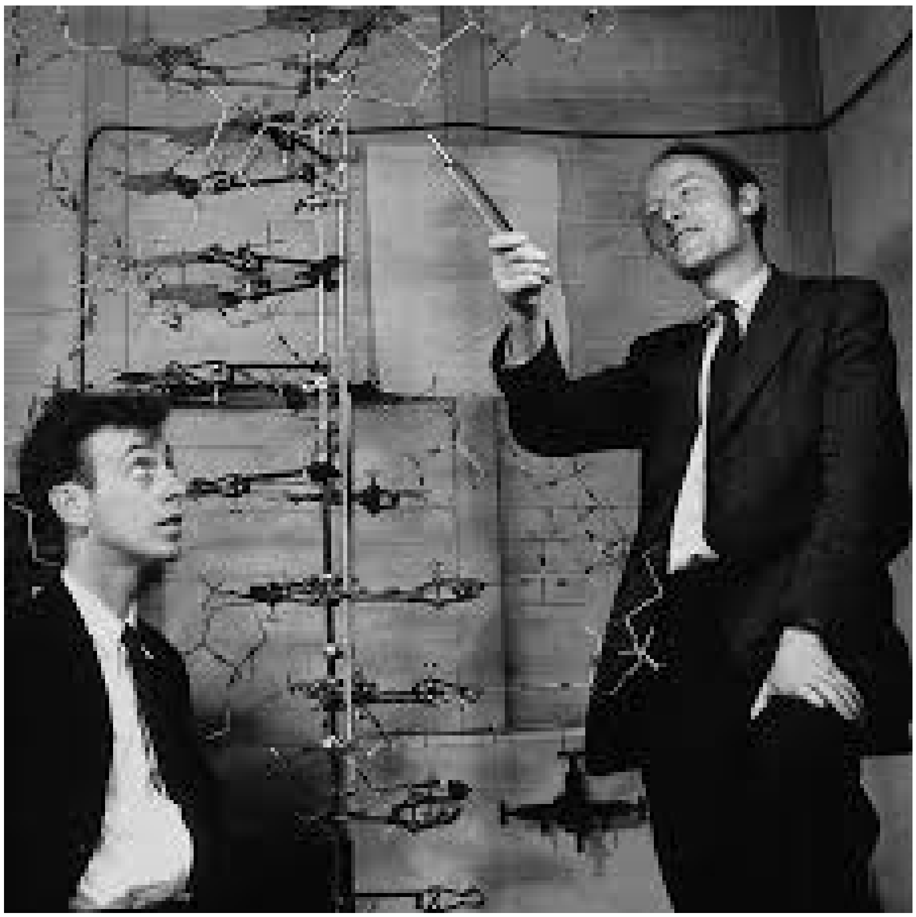

Figure 2.37: **Francis Crick (1916-2004) and James Dewey Watson (born 1928) at the Cavendish Laboratory with their model of DNA. After their discovery of the structure of DNA, it became clear that it was this molecule that carried genetic information between generations. Crick was originally a physicist, but his interest shifted to biology after he read Erwin Schrödinger's book, *What is Life?*.**

2.4 Quantum theory

A wave equation for matter

In 1926, the difficulties surrounding the "old quantum theory" of Max Planck, Albert Einstein and Niels Bohr were suddenly solved, and its true meaning was understood. Two years earlier, a French aristocrat, Louis de Broglie, writing his doctoral dissertation at the Sorbonne in Paris, had proposed that very small particles, such as electrons, might exhibit wavelike properties. The ground state and higher excited states of the electron in Bohr's model of the hydrogen atom would then be closely analogous to the fundamental tone and higher overtones of a violin string.

Almost the only person to take de Broglie's proposal seriously was Albert Einstein, who mentioned it in one of his papers. Because of Einstein's interest, de Broglie's matter-waves came to the attention of other physicists. The Austrian theoretician, Erwin Schrödinger, working at Zürich, searched for the underlying wave equation which de Broglie's matter-waves obeyed.

Schrödinger's gifts as a mathematician were so great that it did not take him long to solve the problem. The Schrödinger wave equation for matter is now considered to be more basic than Newton's equations of motion. The wavelike properties of matter are not apparent to us in our daily lives because the wave-lengths are extremely small in comparison with the sizes of objects which we can perceive. However, for very small and light particles, such as electrons moving in their orbits around the nucleus of an atom, the wavelike behavior becomes important.

Schrödinger was able to show that Niels Bohr's atomic theory, including Bohr's seemingly arbitrary quantization of angular momentum, can be derived by solving the wave equation for the electrons moving in the attractive field of the nucleus. The allowed orbits of Bohr's theory correspond in Schrödinger's theory to harmonics, similar to the fundamental harmonic and higher overtones of an organ pipe or a violin string. (If Pythagoras had been living in 1926, he would have rejoiced to see the deepest mysteries of matter explained in terms of harmonics!)

Bohr himself believed that a complete atomic theory ought to be able to explain the chemical properties of the elements in Mendeléev's periodic system. Bohr's 1913 theory failed to pass this test, but the new de Broglie-Schrödinger theory succeeded! Through the work of Pauli, Heitler, London, Slater, Pauling, Hund, Mulliken, Hückel and others, who applied Schrödinger's wave equation to the solution of chemical problems, it became apparent that the wave equation could indeed (in principle) explain all the chemical properties of matter.

Strangely, the problem of developing the fundamental quantum theory of matter was solved not once, but three times in 1926! At the University of Göttingen in Germany, Max Born (1882-1970) and his brilliant young students Werner Heisenberg and Pascal Jordan solved the problem in a completely different way, using matrix methods. At the same time, a theory similar to the "matrix mechanics" of Heisenberg, Born and Jordan was developed independently at Cambridge University by a 24 year old mathematical

Figure 2.38: **Bust of Erwin Schrödinger in the courtyard arcade of the main building, University of Vienna.**

genius named Paul Adrian Maurice Dirac. At first, the Heisenberg-Born-Jordan-Dirac quantum theory seemed to be completely different from the Schrödinger theory; but soon the Göttingen mathematician David Hilbert (1862-1943) was able to show that the theories were really identical, although very differently expressed.

Felix Bloch's story about Schrödinger

There is an interesting story about Erwin Schrödinger's derivation of his famous wave equation. According to the solid state physicist Felix Bloch, Peter Debye was chairing a symposium in Zürich, Switzerland, at which de Broglie's waves were being discussed. At one point during the symposium, Debye said: "Well, if there are waves associated with every particle, there must be a wave equation." Then, turning to Schrödinger, he said: "You, Erwin. You're not doing anything important at the moment. Why don't you find the wave equation obeyed by de Broglie's waves?"

During the following weekend, the whole group started off for a skiing trip. "Come with us, Erwin!", they said, but Schrödinger replied: "No, forgive me, I think I will stay here and work." By the end of the weekend he had derived his famous non-relativistic wave equation. He had first tried a relativistic equation (now known as the Klein-Gordon equation), but had rejected it because he believed that the equation had to be first-order in time.

Later, Felix Bloch asked Peter Debye, "Aren't you sorry that you didn't derive the wave equation yourself, instead of giving the job to Schrödinger?" Debye replied wistfully, "At least I was right about the need for a wave equation, wasn't I?"

Dirac's relativistic wave equation

In 1928, P.A.M. Dirac derived a relativistic wave equation that was first-order in time. To do this, he made use of a set of four anticommuting matrices. Solutions to the Dirac equation in the absence of external fields also obey the Klein-Gordon equation, which is second-order in time, the equation that Schrödinger first tried and then abandoned. Dirac's relativistic equation explained for the first time many details of the spectrum of hydrogen, but critics complained that it predicted the existence of negative energy states, and they asked, "Why don't the positive energy electrons fall down into these states?" Dirac replied "Because the negative energy states are all occupied." 'But then", the critics said, "an extremely energetic photon could create an electron-hole pair!" "Keep looking", Dirac answered, "and you will find that it sometimes happens." Thus, an astonishing consequence of Dirac's relativistic wave equation was the prediction of the existence of antimatter!

Years passed. Then, in 1932, the physicist Carl David Anderson observed in a cosmic ray photographic plate an event that confirmed Dirac's prediction of the existence of antimatter. A highly-energetic photon was annihilated, and converted into an electron-antielectron pair. The antielectron was given the name "positron". Since that time, the

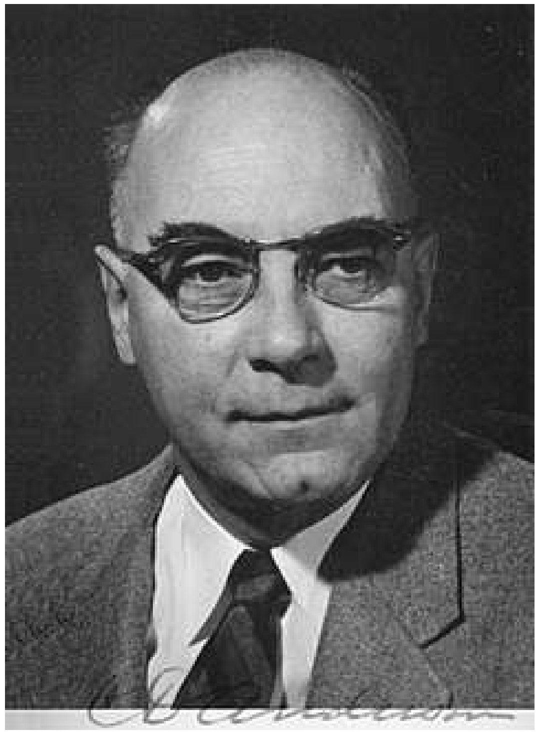

Figure 2.39: **Carl David Anderson in 1936.**

antiparticles of other particles have been discovered, created in high-energy events where a photon is annihilated and a particle-antiparticle pair created.

Some equations

For readers with some mathematematical background, a few equations are included here.

The relativistic relationship between energy and momentum

$$E^2 - p^2c^2 = m^2c^4 \tag{2.1}$$

Here E stands for energy, p for momentum, m for mass, and c for the velocity of light.

The Klein-Gordon equation

$$\left(-\frac{\hbar^2}{c^2}\frac{\partial^2}{\partial^2 t} + \hbar^2\nabla^2\right)\psi = m^2c^2\psi \tag{2.2}$$

The Klein-Gordon equation can be derived from equation 2.1 by making the substitutions

$$E \quad \rightarrow \quad \frac{\hbar}{i}\frac{\partial}{\partial x_4} \qquad x_4 \equiv ict$$

Figure 2.40: **Louis Victor Pierre Raymond, duc de Broglie, (1892-1987).**

Figure 2.41: **Heisenberg in 1933**

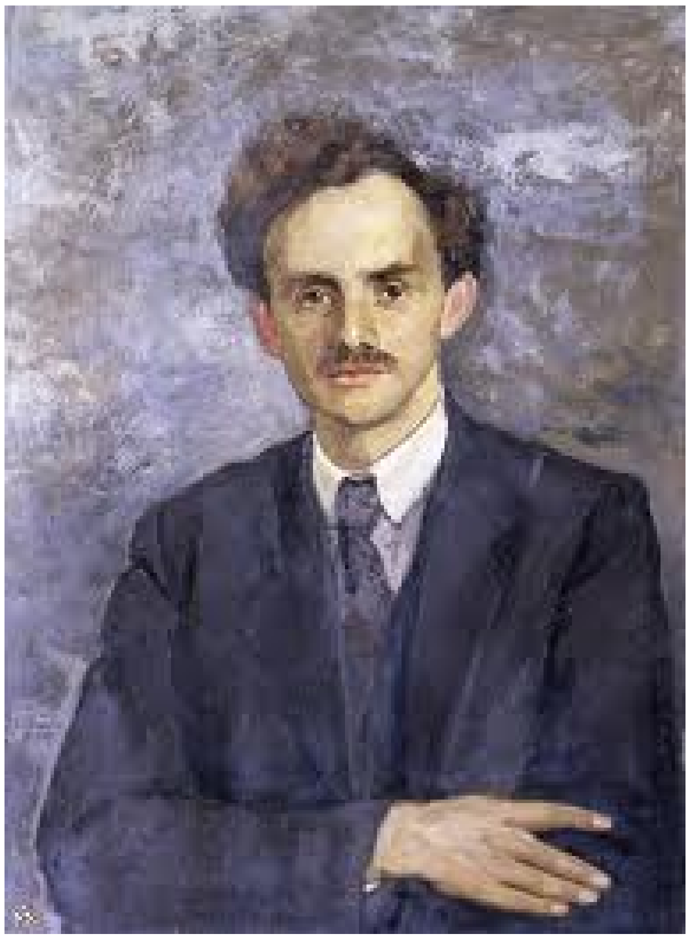

Figure 2.42: **P.A.M. Dirac, the greatest British physicist of the 20th century. A memorial inscribed with his relativistic wave equation stands in Westminister Cathedral, near to the statue of Newton.**

Figure 2.43: **Niels Bohr, Werner Heisenberg and Wolfgang Pauli, c. 1935.**

$$p_j \quad \to \quad \frac{\hbar}{i}\frac{\partial}{\partial x_j} \qquad j = 1, 2, 3 \tag{2.3}$$

where $\hbar$ is Planck's constant.

Schrödinger's non-relativistic wave equation

The non-relativistic relationship between energy and momentum is given by

$$E = c\sqrt{p^2 + m^2c^2} + V \approx \frac{p^2}{2m} + V \qquad m^2c^2 >> p^2 \tag{2.4}$$

Schrödinger's non-relativistic wave equation,

$$\left(-\frac{\hbar^2}{2m}\nabla^2 + V\right)\psi = E\psi \tag{2.5}$$

can be derived by making the substitutions

$$p_j \quad \to \quad \frac{\hbar}{i}\frac{\partial}{\partial x_j} \qquad j = 1, 2, 3 \tag{2.6}$$

If the wave function ψ has time-dependence of the form

$$\psi(\mathbf{x}, t) = \psi(\mathbf{x})e^{iEt/\hbar} \tag{2.7}$$

Figure 2.44: **Peter Debye, (1884-1966).**

then we can write

$$i\hbar\frac{\partial\psi}{\partial t} = H\psi \tag{2.8}$$

where

$$H \equiv \left(-\frac{\hbar^2}{2m}\nabla^2 + V\right) \tag{2.9}$$

2.5 John Bardeen

John Bardeen (1908-1991) was the only person ever to be awarded the Nobel Prize in Physics twice. He was first awarded the the prize in 1956, together with William Shockley and Walter Brattain, for the invention of the transistor. His second Nobel Prize in Physics was shared with Leon N Cooper and John Robert Schrieffer, for their theory of superconductivity (BCS Theory)

Bardeen's father was the Dean of Medicine at the University of Wisconsin. Not wishing to follow in his father's academic footsteps, John Bardeen first studied engineering, and worked as an engineer. However, work as an engineer failed to keep his interest, and in 1933 he became a graduate student in mathematics at Princeton University. At Princeton he worked under the Nobel Laureate physicist, Eugene Wigner (Dirac's brother-in-law), and wrote a thesis in solid state physics.

Bell Laboratories

The invention of the transistor, for which Bardeen was awarded his first Nobel Prize in Physics, was the result of work done at the Bell Telephone Laboratories, and something must be said about the conditions experienced by scientists and engineers working there. For many years the Bell Telephone Company was a monopoly, and under US laws they were not allowed to make more than a limited amount of profit. What should be done with the extra money? They decided to invest it in fundamental research. This meant that scientists working at the Bell Laboratories were free to work on whatever problem was most interesting and promising. The result of this policy is that nine Nobel prizes have been awarded as the result of work completed at the Bell Laboratories:

- 1937: Clinton J. Davisson shared the Nobel Prize in Physics for demonstrating the wave nature of matter.
- 1956: John Bardeen, Walter H. Brattain, and William Shockley received the Nobel Prize in Physics for inventing the first transistors.
- 1977: Philip W. Anderson shared the Nobel Prize in Physics for developing an improved understanding of the electronic structure of glass and magnetic materials.

Figure 2.45: **John Bardeen (1908-1991).**

- 1978: Arno A. Penzias and Robert W. Wilson shared the Nobel Prize in Physics. Penzias and Wilson were cited for their discovering cosmic microwave background radiation, a nearly uniform glow that fills the Universe in the microwave band of the radio spectrum.
- 1997: Steven Chu shared the Nobel Prize in Physics for developing methods to cool and trap atoms with laser light.
- 1998: Horst Störmer, Robert Laughlin, and Daniel Tsui, were awarded the Nobel Prize in Physics for discovering and explaining the fractional quantum Hall effect.
- 2009: Willard S. Boyle, George E. Smith shared the Nobel Prize in Physics with Charles K. Kao. Boyle and Smith were cited for inventing charge-coupled device (CCD) semiconductor imaging sensors.
- 2014: Eric Betzig shared the Nobel Prize in Chemistry for his work in super-resolved fluorescence microscopy which he began pursuing while at Bell Labs.
- 2018: Arthur Ashkin shared the Nobel Prize in Physics for his work on "the optical tweezers and their application to biological systems"[35] which was developed at Bell Labs.

The invention of transistors

Microelectronics

The problem of unreliable vacuum tubes was solved in 1948 by John Bardeen, William Shockley and Walter Brattain of the Bell Telephone Laboratories. Application of quantum theory to solids had lead to an understanding of the electrical properties of crystals. Like atoms, crystals were found to have allowed and forbidden energy levels.

The allowed energy levels for an electron in a crystal were known to form bands, i.e., some energy ranges with many allowed states (allowed bands), and other energy ranges with none (forbidden bands). The lowest allowed bands were occupied by electrons, while higher bands were empty. The highest filled band was called the "valence band", and the lowest empty band was called the "conduction band".

According to quantum theory, whenever the valence band of a crystal is only partly filled, the crystal is a conductor of electricity; but if the valence band is completely filled with electrons, the crystal is an electrical insulator. (A completely filled band is analogous to a room so packed with people that none of them can move.)

In addition to conductors and insulators, quantum theory predicted the existence of "semiconductors" - crystals where the valence band is completely filled with electrons, but where the energy gap between the conduction band and the valence band is very small. For example, crystals of the elements silicon and germanium are semiconductors. For such a crystal, thermal energy is sometimes enough to lift an electron from the valence band to the conduction band.

Bardeen, Shockley and Brattain found ways to control the conductivity of germanium crystals by injecting electrons into the conduction band, or alternatively by removing electrons from the valence band. They could do this by "doping" the crystals with appropriate impurities, or by injecting electrons with a special electrode. The semiconducting crystals whose conductivity was controlled in this way could be used as electronic valves, in place of vacuum tubes.

By the 1960's, replacement of vacuum tubes by transistors in electronic computers had led not only to an enormous increase in reliability and a great reduction in cost, but also to an enormous increase in speed. It was found that the limiting factor in computer speed was the time needed for an electrical signal to propagate from one part of the central processing unit to another. Since electrical impulses propagate with the speed of light, this time is extremely small; but nevertheless, it is the limiting factor in the speed of electronic computers.

The Traitorous Eight

According to the Wikipedia article on Shockley,

"In 1956 Shockley moved from New Jersey to Mountain View, California to start Shockley Semiconductor Laboratory to live closer to his ailing mother in Palo Alto, California. The company, a division of Beckman Instruments, Inc., was the first establishment working on silicon semiconductor devices in what came to be known as Silicon Valley.

"His way [of leading the group] could generally be summed up as domineering and increasingly paranoid. In one well-known incident, he claimed that a secretary's cut thumb was the result of a malicious act and he demanded lie detector tests to find the culprit, when in reality, the secretary had simply grabbed at a door handle that happened to have an exposed tack on it for the purpose of hanging paper notes on. After he received the Nobel Prize in 1956 his demeanor changed, as evidenced in his increasingly autocratic, erratic and hard-to-please management style. In late 1957, eight of Shockley's researchers, who would

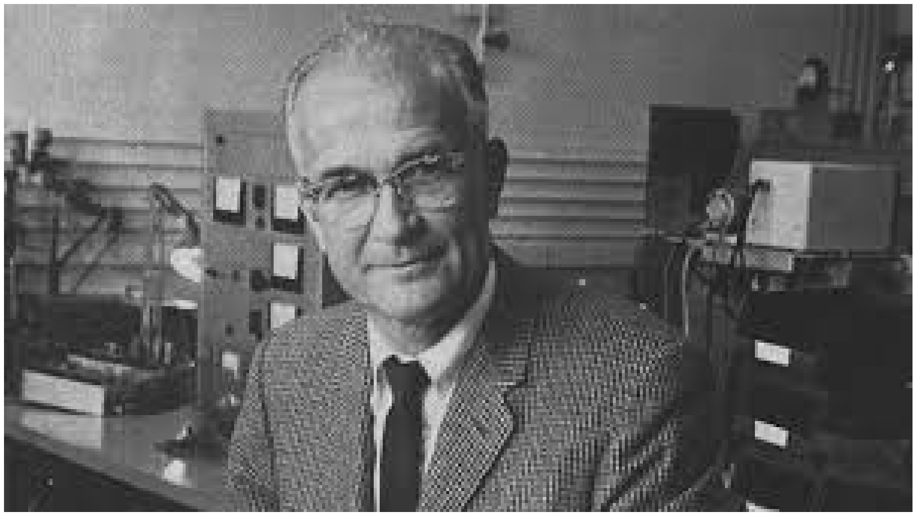

Figure 2.46: **William Shockley (1910-1989) shared the 1956 Nobel Prize in Physics with John Bardeen and Walter Brattain. He was so extremely difficult to work with that "the traitorous eight" resigned *en masse*.**

come to be known as the 'traitorous eight, resigned after Shockley decided not to continue research into silicon-based semiconductors. They went on to form Fairchild Semiconductor, a loss from which Shockley Semiconductor never recovered. Over the course of the next 20 years, more than 65 new enterprises would end up having employee connections back to Fairchild."

Integrated circuits

In order to reduce the propagation time, computer designers tried to make the central processing units very small; and the result was the development of integrated circuits and microelectronics. (Another motive for miniaturization of electronics came from the requirements of space exploration.)

Integrated circuits were developed in which single circuit elements were not manufactured separately. Instead, the whole circuit was made at one time. An integrated circuit is a sandwich-like structure, with conducting, resisting and insulating layers interspersed with layers of germanium or silicon, "doped " with appropriate impurities. At the start of the manufacturing process, an engineer makes a large drawing of each layer. For example, the drawing of a conducting layer would contain pathways which fill the role played by wires in a conventional circuit, while the remainder of the layer would consist of areas destined to be etched away by acid.

The next step is to reduce the size of the drawing and to multiply it photographically. The pattern of the layer is thus repeated many times, like the design on a piece of wallpaper. The multiplied and reduced drawing is then focused through a reversed microscope onto the surface to be etched.

Figure 2.47: **The Traitorous Eight: From left to right, Gordon Moore, C. Sheldon Roberts, Eugene Kleiner, Robert Noyce, Victor Grinich, Julius Blank, Jean Hoerni and Jay Last.**

Successive layers are built up by evaporating or depositing thin films of the appropriate substances onto the surface of a silicon or germanium wafer. If the layer being made is to be conducting, the surface would consist of an extremely thin layer of copper, covered with a photosensitive layer called a "photoresist". On those portions of the surface receiving light from the pattern, the photoresist becomes insoluble, while on those areas not receiving light, the photoresist can be washed away.

The surface is then etched with acid, which removes the copper from those areas not protected by photoresist. Each successive layer of a wafer is made in this way, and finally the wafer is cut into tiny "chips", each of which corresponds to one unit of the wallpaper-like pattern.

Although the area of a chip may be much smaller than a square centimeter, the chip can contain an extremely complex circuit. A typical programmable minicomputer or "microprocessor", manufactured during the 1970's, could have 30,000 circuit elements, all of which were contained on a single chip. By 1986, more than a million transistors were being placed on a single chip.

As a result of miniaturization, the speed of computers rose steadily. In 1960, the fastest computers could perform a hundred thousand elementary operations in a second. By 1970, the fastest computers took less than a second to perform a million such operations. In 1987, a computer called GF11 was designed to perform 11 billion floating-point operations (flops) per second.

GF11 (Gigaflop 11) is a scientific parallel-processing machine constructed by IBM. Approximately ten floating-point operations are needed for each machine instruction. Thus GF11 runs at the rate of approximately a thousand million instructions per second (1,100 MIPS). The high speed achieved by parallel-processing machines results from dividing a job into many sub-jobs on which a large number of processing units can work simultaneously.

Computer memories have also undergone a remarkable development. In 1987, the magnetic disc memories being produced could store 20 million bits of information per square inch; and even higher densities could be achieved by optical storage devices. (A "bit" is the unit of information. For example, the number 25, written in the binary system, is 11001. To specify this 5-digit binary number requires 5 bits of information. To specify an n-digit binary number requires n bits of information. Eight bits make a "byte".)

In the 1970's and 1980's, computer networks were set up linking machines in various parts of the world. It became possible (for example) for a scientist in Europe to perform a calculation interactively on a computer in the United States just as though the distant machine were in the same room; and two or more computers could be linked for performing large calculations. It also became possible to exchange programs, data, letters and manuscripts very rapidly through the computer networks.

Moore's law

In 1965, only four years after the first integrated circuits had been produced, Dr. Gordon E. Moore, one of the founders of Intel, made a famous prediction which has come to be known as "Moore's Law". He predicted that the number of transistors per integrated circuit would double every two years, and that this trend would continue through 1975. In fact, the general trend predicted by Moore has continued for a much longer time. Although the number of transistors per unit area has not continued to double every two years, the logic density (bits per unit area) has done so, and thus a modified version of Moore's law still holds today. How much longer the trend can continue remains to be seen. Physical limits to miniaturization of transistors of the present type will soon be reached; but there is hope that further miniaturization can be achieved through "quantum dot" technology, molecular switches, and autoassembly.

A typical programmable minicomputer or "microprocessor", manufactured in the 1970's, could have 30,000 circuit elements, all of which were contained on a single chip. By 1989, more than a million transistors were being placed on a single chip; and by 2000, the number reached 42,000,000.

As a result of miniaturization and parallelization, the speed of computers rose exponentially. In 1960, the fastest computers could perform a hundred thousand elementary operations in a second. By 1970, the fastest computers took less than a second to perform a million such operations. In 1987, a massively parallel computer, with 566 parallel processors, called GFll was designed to perform 11 billion floating-point operations per second (flops). By 2002 the fastest computer performed 40 at teraflops, making use of 5120 parallel CPU's.

Computer disk storage has also undergone a remarkable development. In 1987, the magnetic disk storage being produced could store 20 million bits of information per square inch; and even higher densities could be achieved by optical storage devices. Storage density has until followed a law similar to Moore's law.

In the 1970's and 1980's, computer networks were set up linking machines in various parts of the world. It became possible (for example) for a scientist in Europe to perform a calculation interactively on a computer in the United States just as though the distant machine were in the same room; and two or more computers could be linked for performing large calculations. It also became possible to exchange programs, data, letters and manuscripts very rapidly through the computer networks.

The exchange of large quantities of information through computer networks was made easier by the introduction of fiber optics cables. By 1986, 250,000 miles of such cables had been installed in the United States. If a ray of light, propagating in a medium with a large refractive index, strikes the surface of the medium at a grazing angle, then the ray undergoes total internal reflection. This phenomenon is utilized in fiber optics: A light signal can propagate through a long, hairlike glass fiber, following the bends of the fiber without losing intensity because of total internal reflection. However, before fiber optics could be used for information transmission over long distances, a technological breakthrough in glass manufacture was needed, since the clearest glass available in 1940 was opaque in lengths more than 10 m. Through studies of the microscopic properties of glasses, the problem of absorption was overcome. By 1987, devices were being manufactured commercially that were capable of transmitting information through fiber-optic cables at the rate of 1.7 billion bits per second.

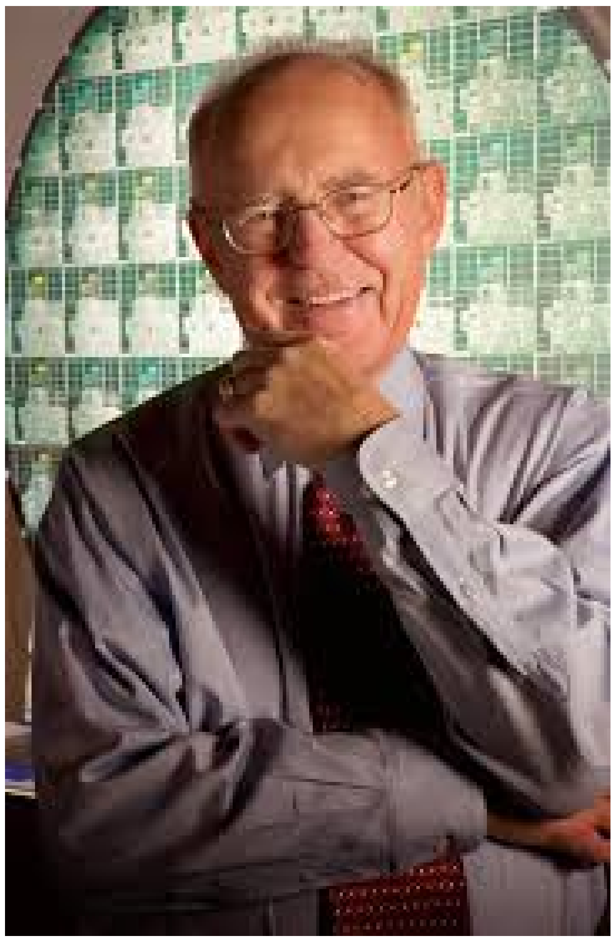

Figure 2.48: **Gordon E. Moore (born 1929), a founder of Intel and the author of Moore's Law. In 1965 he predicted that the number of components in integrated circuits would double every year for the next 10 years". In 1975 he predicted the this doubling would continue, but revised the doubling rate to "every two years. Astonishingly, Moore's Law has held much longer than he, or anyone else, anticipated.**

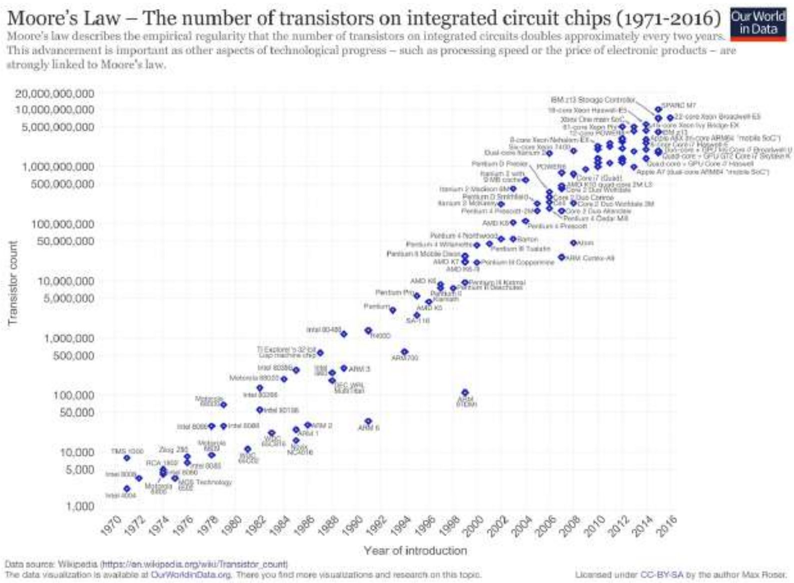

Figure 2.49: **Amazingly, Moore's Law has held much longer than he, or anyone else, anticipated. Perhaps quantum dot technologies can extend its validity even longer.**

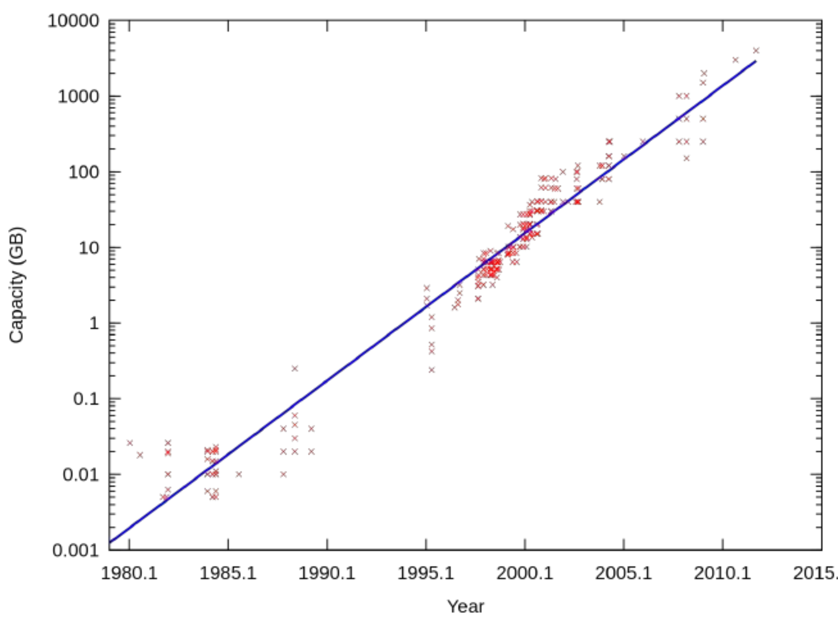

Figure 2.50: **A logarithmic plot of the increase in PC hard-drive capacity in gigabytes. An extrapolation of the rate of increase predicts that the individual capacity of a commercially available PC will reach 10,000 gigabytes by 2015, i.e. 10,000,000,000,000 bytes. (After Hankwang and Rentar, Wikimedia Commons)**

Self-reinforcing information accumulation

Humans have been living on the earth for roughly two million years (more or less, depending on where one draws the line between our human and prehuman ancestors, Table 6.1). During almost all of this,time, our ancestors lived by hunting and food-gathering. They were not at all numerous, and did not stand out conspicuously from other animals. Then, suddenly, during the brief space of ten thousand years, our species exploded in numbers from a few million to seven billion, populating all parts of the earth, and even setting foot on the moon. This population explosion, which is still going on, has been the result of dramatic cultural changes. Genetically we are almost identical with our hunter-gatherer ancestors, who lived ten thousand years ago, but cultural evolution has changed our way of life beyond recognition.

Beginning with the development of speech, human cultural evolution began to accelerate. It started to move faster with the agricultural revolution, and faster still with the invention of writing and printing. Finally, modern science has accelerated the rate of social and cultural change to a completely unprecedented speed.

The growth of modern science is accelerating because knowledge feeds on itself. A new idea or a new development may lead to several other innovations, which can in turn start an avalanche of change. For example, the quantum theory of atomic structure led to the invention of transistors, which made high-speed digital computers possible. Computers have not only produced further developments in quantum theory; they have also revolutionized many other fields.

The self-reinforcing accumulation of knowledge - the information explosion - which characterizes modern human society is reflected not only in an explosively-growing global population, but also in the number of scientific articles published, which doubles roughly every ten years. Another example is Moore's law - the doubling of the information density of integrated circuits every two years. Yet another example is the explosive growth of Internet traffic shown in Table 17.1.

The Internet itself is the culmination of a trend towards increasing societal information exchange - the formation of a collective human consciousness. This collective consciousness preserves the observations of millions of eyes, the experiments of millions of hands, the thoughts of millions of brains; and it does not die when the individual dies.

Automation

During the last three decades, the cost of computing has decreased exponentially by between twenty and thirty percent per year. Meanwhile, the computer industry has grown exponentially by twenty percent per year (faster than any other industry). The astonishing speed of this development has been matched by the speed with which computers have become part of the fabric of science, engineering, industry, commerce, communications, transport, publishing, education and daily life in the industrialized parts of the world.

The speed, power and accuracy of computers has revolutionized many branches of science. For example, before the era of computers, the determination of a simple molecular structure by the analysis of X-ray diffraction data often took years of laborious calculation; and complicated structures were completely out of reach. In 1949, however, Dorothy Crowfoot Hodgkin used an electronic computer to work out the structure of penicillin from X-ray data. This was the first application of a computer to a biochemical problem; and it was followed by the analysis of progressively larger and more complex structures.

Proteins, DNA, and finally even the detailed structures of viruses were studied through the application of computers in crystallography. The enormous amount of data needed for such studies was gathered automatically by computer-controlled diffractometers; and the final results were stored in magnetic-tape data banks, available to users through computer networks.

The application of quantum theory to chemical problems is another field of science which owes its development to computers. When Erwin Schrödinger wrote down his wave equation in 1926, it became possible, in principle, to calculate most of the physical and chemical properties of matter. However, the solutions to the Schrödinger equation for many-particle systems can only be found approximately; and before the advent of computers, even approximate solutions could not be found, except for the simplest systems.

When high-speed electronic digital computers became widely available in the 1960's, it suddenly became possible to obtain solutions to the Schrödinger equation for systems of chemical and even biochemical interest. Quantum chemistry (pioneered by such men as J.C. Slater, R.S. Mullikin, D.R. Hartree, V. Fock, J.H. Van Vleck, L. Pauling, E.B. Wilson, P.O. Löwdin, E. Clementi, C.J. Ballhausen and others) developed into a rapidly-growing field, as did solid state physics. Through the use of computers, it became possible to design new materials with desired chemical, mechanical, electrical or magnetic properties. Applying computers to the analysis of reactive scattering experiments, D. Herschbach, J. Polanyi and Y. Lee were able to achieve an understanding of the dynamics of chemical reactions.

The successes of quantum chemistry led Albert Szent-Györgyi, A. and B. Pullman, H. Scheraga and others to pioneer the fields of quantum biochemistry and molecular dynamics. Computer programs for drug design were developed, as well as molecular-dynamics programs which allowed the conformations of proteins to be calculated from a knowledge of their amino acid sequences. Studies in quantum biochemistry have yielded insights into the mechanisms of enzyme action, photosynthesis, active transport of ions across membranes, and other biochemical processes.

In medicine, computers began to be used for monitoring the vital signs of critically ill patients, for organizing the information flow within hospitals, for storing patients' records, for literature searches, and even for differential diagnosis of diseases.

The University of Pennsylvania has developed a diagnostic program called INTERNIST-1, with a knowledge of 577 diseases and their interrelations, as well as 4,100 signs, symptoms and patient characteristics. This program was shown to perform almost as well as an academic physician in diagnosing difficult cases. QMR (Quick Medical Reference), a microcomputer adaptation of INTERNIST-1, incorporates the diagnostic functions of the earlier program, and also offers an electronic textbook mode.

Beginning in the 1960's, computers played an increasingly important role in engineering and industry. For example, in the 1960's, Rolls Royce Ltd. began to use computers not only to design the optimal shape of turbine blades for aircraft engines, but also to control the precision milling machines which made the blades. In this type of computer-assisted design and manufacture, no drawings were required. Furthermore, it became possible for an industry requiring a part from a subcontractor to send the machine-control instructions for its fabrication through the computer network to the subcontractor, instead of sending drawings of the part.

In addition to computer-controlled machine tools, robots were also introduced. They were often used for hazardous or monotonous jobs, such as spray-painting automobiles; and they could be programmed by going through the job once manually in the programming mode. By 1987, the population of robots in the United States was between 5,000 and 7,000, while in Japan, the Industrial Robot Association reported a robot population of 80,000.

Chemical industries began to use sophisticated computer programs to control and to optimize the operations of their plants. In such control systems, sensors reported current temperatures, pressures, flow rates, etc. to the computer, which then employed a mathematical model of the plant to calculate the adjustments needed to achieve optimum operating conditions.

Not only industry, but also commerce, felt the effects of computerization during the postwar period. Commerce is an information-intensive activity; and in fact some of the crucial steps in the development of information-handling technology developed because of the demands of commerce: The first writing evolved from records of commercial transactions kept on clay tablets in the Middle East; and automatic business machines, using punched cards, paved the way for the development of the first programmable computers.

Computerization has affected wholesaling, warehousing, retailing, banking, stockmarket transactions, transportation of goods - in fact, all aspects of commerce. In wholesaling, electronic data is exchanged between companies by means of computer networks, allowing order-processing to be handled automatically; and similarly, electronic data on prices is transmitted to buyers.

The key to automatic order-processing in wholesaling was standardization. In the United States, the Food Marketing Institute, the Grocery Manufacturers of America, and several other trade organizations, established the Uniform Communications System (UCS) for the grocery industry. This system specifies a standard format for data on products, prices and orders.

Automatic warehouse systems were designed as early as 1958. In such systems, the goods to be stored are placed on pallets (portable platforms), which are stacked automatically in aisles of storage cubicles. A computer records the position of each item for later automatic retrieval.

In retailing, just as in wholesaling, standardization proved to be the key requirement for automation. Items sold in supermarkets in most industrialized countries are now labeled with a standard system of machine-readable thick and thin bars known as the Universal Product Code (UPC). The left-hand digits of the code specify the manufacturer or packer of the item, while the right-hand set of digits specify the nature of the item. A final digit is included as a check, to make sure that the others were read correctly. This last digit (called a modulo check digit) is the smallest number which yields a multiple of ten when added to the sum of the previous digits.

When a customer goes through a check-out line, the clerk passes the purchased items over a laser beam and photocell, thus reading the UPC code into a small embedded computer or microprocessor at the checkout counter, which adds the items to the customer's bill. The microprocessor also sends the information to a central computer and inventory data base. When stocks of an item become low, the central computer generates a replacement order. The financial book-keeping for the retailing operation is also carried out automatically by the central computer.

In many places, a customer passing through the checkout counter of a supermarket is able to pay for his or her purchases by means of a plastic card with a magnetic, machine-readable identification number. The amount of the purchase is then transmitted through a computer network and deducted automatically from the customer's bank account. If the customer pays by check, the supermarket clerk may use a special terminal to determine whether a check written by the customer has ever "bounced".

Most checks are identified by a set of numbers written in the Magnetic-Ink Character Recognition (MICR) system. In 1958, standards for the MICR system were established, and by 1963, 85 percent of all checks written in the United States were identified by MICR numbers. By 1968, almost all banks had adopted this system; and thus the administration of checking accounts was automated, as well as the complicated process by which a check, deposited anywhere in the world, returns to the payers bank.

Container ships were introduced in the late 1950's, and since that time, container systems have increased cargo-handling speeds in ports by at least an order of magnitude. Computer networks contributed greatly to the growth of the container system of transportation by keeping track of the position, ownership and contents of the containers.

In transportation, just as in wholesaling and retailing, standardization proved to be a necessary requirement for automation. Containers of a standard size and shape could be loaded and unloaded at ports by specialized tractors and cranes which required only a very small staff of operators. Standard formats for computerized manifests, control documents, and documents for billing and payment, were instituted by the Transportation Data Coordinating Committee, a non-profit organization supported by dues from shipping firms.

In the industrialized parts of the world, almost every type of work has been made more efficient by computerization and automation. Even artists, musicians, architects and authors find themselves making increasing use of computers: Advanced computing systems, using specialized graphics chips, speed the work of architects and film animators. The author's traditional typewriter has been replaced by a word-processor, the composer's piano by a music synthesizer.

In the Industrial Revolution of the 18th and 19th centuries, muscles were replaced by machines. Computerization represents a Second Industrial Revolution: Machines have begun to perform not only tasks which once required human muscles, but also tasks which formerly required human intelligence.

In industrial societies, the mechanization of agriculture has very much reduced the fraction of the population living on farms. For example, in the United States, between 1820 and 1980, the fraction of workers engaged in agriculture fell from 72 percent to 3.1 percent. There are signs that computerization and automation will similarly reduce the number of workers needed in industry and commerce.

Computerization is so recent that, at present, we can only see the beginnings of its impact; but when the Second Industrial Revolution is complete, how will it affect society? When our children finish their education, will they face technological unemployment?

The initial stages of the First Industrial Revolution produced much suffering, because labor was regarded as a commodity to be bought and sold according to the laws of supply and demand, with almost no consideration for the needs of the workers. Will we repeat this mistake? Or will society learn from its earlier experience, and use the technology of automation to achieve widely-shared human happiness?

The Nobel-laureate economist, Wassily W. Leontief, has made the following comment on the problem of technological unemployment:

"Adam and Eve enjoyed, before they were expelled from Paradise, a high standard of living without working. After their expulsion, they and their successors were condemned to eke out a miserable existence, working from dawn to dusk. The history of technological progress over the last 200 years is essentially the story of the human species working its way slowly and steadily back into Paradise. What would happen, however, if we suddenly found ourselves in it? With all goods and services provided without work, no one would be gainfully employed. Being unemployed means receiving no wages. As a result, until appropriate new income policies were formulated to fit the changed technological conditions, everyone would starve in Paradise."

To say the same thing in a slightly different way: consider what will happen when a factory which now employs a thousand workers introduces microprocessor-controlled industrial robots and reduces its work force to only fifty. What will the nine hundred and fifty redundant workers do? They will not be able to find jobs elsewhere in industry, commerce or agriculture, because all over the economic landscape, the scene will be the same.

There will still be much socially useful work to be done - for example, taking care of elderly people, beautifying the cities, starting youth centers, planting forests, cleaning up pollution, building schools in developing countries, and so on. These socially beneficial goals are not commercially "profitable". They are rather the sort of projects which governments sometimes support if they have the funds for it. However, the money needed to usefully employ the nine hundred and fifty workers will not be in the hands of the government. It will be in the hands of the factory owner who has just automated his production line.

In order to make the economic system function again, either the factory owner will have to be persuaded to support socially beneficial but commercially unprofitable projects, or else an appreciable fraction of his profits will have to be transferred to the government, which will then be able to constructively re-employ the redundant workers.

The future problems of automation and technological unemployment may force us to rethink some of our economic ideas. It is possible that helping young people to make a smooth transition from education to secure jobs will become one of the important responsibilities of governments, even in countries whose economies are based on free enterprise. If such a change does take place in the future, while at the same time socialistic countries are adopting a few of the better features of free enterprise, then one can hope that the world will become less sharply divided by contrasting economic systems.

Neural networks

Physiologists have begun to make use of insights derived from computer design in their efforts to understand the mechanism of the brain; and computer designers are beginning to construct computers modeled after neural networks. We may soon see the development of computers capable of learning complex ideas, generalization, value judgements, artistic creativity, and much else that was once thought to be uniquely characteristic of the human mind. Efforts to design such computers will undoubtedly give us a better understanding of the way in which the brain performs its astonishing functions.

Much of our understanding of the nervous systems of higher animals is due to the Spanish microscopist, Ramón y Cajal, and to the English physiologists, Alan Hodgkin and Andrew Huxley. Cajal's work, which has been confirmed and elaborated by modern electron microscopy, showed that the central nervous system is a network of nerve cells (neurons) and threadlike fibers growing from them. Each neuron has many input fibers (dendrites), and one output fiber (the axon), which may have several branches.

It is possible the computers of the future will have pattern-recognition and learning abilities derived from architecture inspired by our understanding of the synapse, by Young's model, or by other biological models. However, pattern recognition and learning can also be achieved by programming, using computers of conventional architecture. Programs already exist which allow computers to understand both handwriting and human speech; and a recent chess-playing program was able to learn by studying a large number of championship games. Having optimized its parameters by means of this learning experience, the chess-playing program was able to win against grand masters!

Like nuclear physics and genesplicing, artificial intelligence presents a challenge: Will society use its new powers wisely and humanely? The computer technology of the future can liberate us from dull and repetitive work, and allow us to use our energies creatively; or it can produce unemployment and misery, depending on how we organize our society. Which will we choose?

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Chapter 3

20TH CENTURY MEDICAL RESEARCHERS

3.1 Burnet, Jerne and the clonal theory of immunity

As everyone knows, recovery from an infectious disease involves a response of our immune systems. Recovery occurs after the immune system had had some time to respond, and a recovered patient generally has some immunity to the disease.

During the 20th century, there were conflicting ideas about how and why this process occurs. One of these theories was proposed by Linus Pauling, who thought that an antigen on the surface of a bacteria or virus provides a template, and that the immune system uses this template to produce the specific antibodies needed to combat the disease. However, experimental evidence accumulated showing Pauling's template theory to be wrong and supporting the clonal theory of immunity proposed by Sir Frank Macfarlane Burnet and Niels Kai Jerne.

According to the clonal theory of immunity, there are extremely many strains of lymphocytes, each of which produces a specific single antibody. Populations of all these many strains are always present in small numbers. When a patient becomes ill with an infection, the antigens of the ingesting bacteria or virus stimulate one specific strain of lymphocyte to reproduce itself in large numbers, i.e. to become a clone. This large population produces exactly the right antibodies needed to combat the disease, and the large population remains after recovery, conferring continued immunity.

In order for the immune system not to attack the cells of our own bodies, a learning process must take place, early in our lives, in which the difference between self and non-self is established, and the lymphocyte strains that attack self are suppressed. Jerne postulated (correctly) that this learning process takes place in the thymus gland, which is very large in infants, and much smaller in adults.

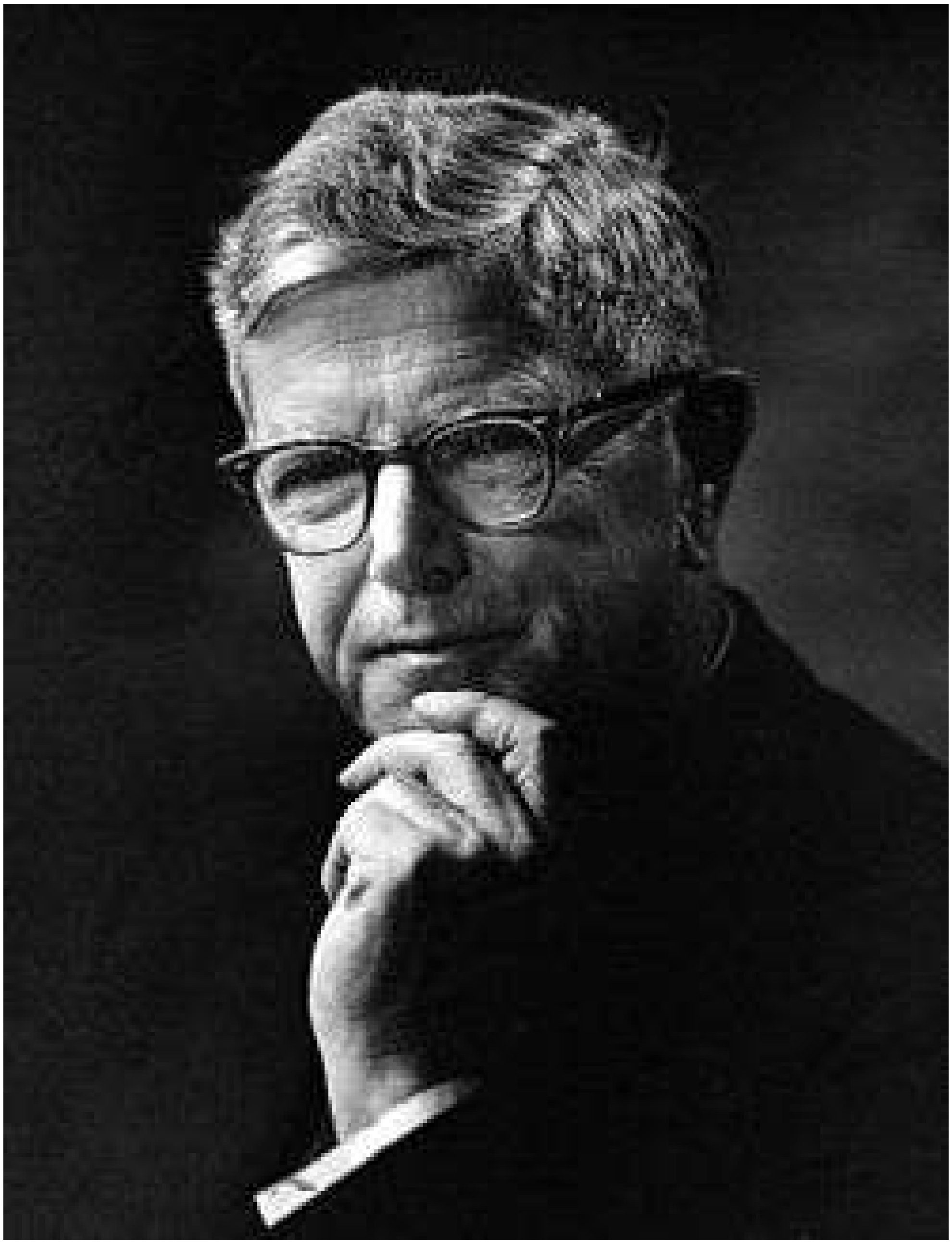

Figure 3.1: **Sir Frank Macfarlane Burnet (1899-1995). Both he and Niels Kai Jerne proposed the clonal theory of immunity.**

Figure 3.2: **The Danish immunologist Niels Kai Jerne (1911-1994). He shared the 1984 Nobel Prize for Physiology or Medicine with Georges Köhler and César Milstein "for theories concerning the specificity in development and control of the immune system and the discovery of the principle for production of monoclonal antibodies".**

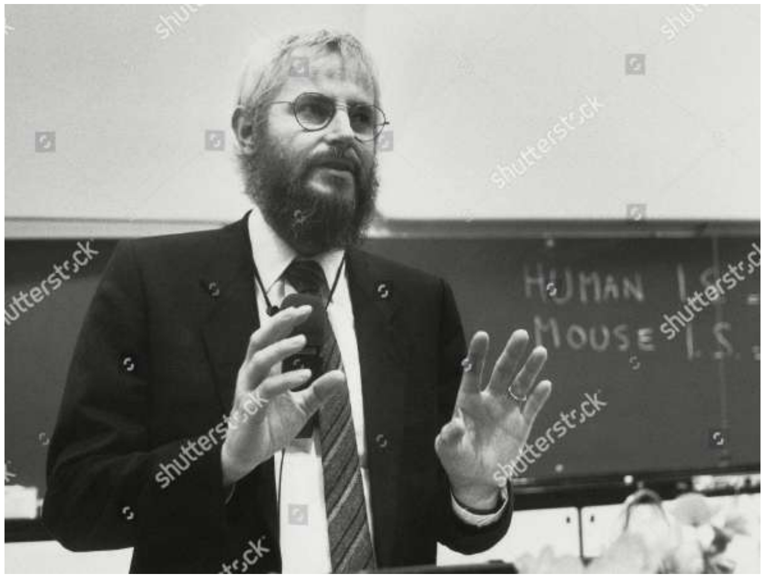

Figure 3.3: **Georges Köhler (1046-1995).**

Figure 3.4: **César Milstein (1927-2002).**

3.2 Köhler, Milstein and monoclonal antibodies

Once the clonal theory of immunity became established, the way seemed open to clone in vitro B lymphocytes of a predetermined specificity. However, such clone cannot be made to live forever because like all other cells, except cancer cells, they are subject to "programed cell death". To overcome this difficulty, Georges Köhler and César Milstein found a way to give the desired lymphocytes immortality by fusing them with lmyeloma cells, thus producing clones that could be cultured indefinitely.

The Wikipedia article on Monoclonal Antibodies states that "In the 1970s, the B-cell cancer multiple lmyeloma was known. It was understood that these cancerous B-cells all produce a single type of antibody (a paraprotein). This was used to study the structure of antibodies, but it was not yet possible to produce identical antibodies specific to a given antigen.

"In 1975, Georges Köhler and César Milstein succeeded in making fusions of myeloma cell lines with B cells to create hybridomas that could produce antibodies, specific to known antigens and that were immortalized. They and Niels Kaj Jerne shared the Nobel Prize in Physiology or Medicine in 1984 for the discovery.

"In 1988, Greg Winter and his team pioneered the techniques to humanize monoclonal antibodies, eliminating the reactions that many monoclonal antibodies caused in some patients.

"In 2018, James P. Allison and Tasuku Honjo received the Nobel Prize in Physiology or Medicine for their discovery of cancer therapy by inhibition of negative immune regulation, using monoclonal antibodies that prevent inhibitory linkages."

3.3 Fleming

Education

Alexander Fleming was born in Ayrshire, Scotland in 1881, where his parents had a farm. Following in his elder brother's footsteps, he studied medicine, enrolling at St. Mary's Hospital Medical School in London. After serving in the Royal Army Medical Corps during World War I, he returned to St. Mary's, and was elected Professor of Bacteriology in 1928.

Treating the wounds of soldiers

While treating wounded soldiers during the First World War, Fleming had noticed that the antiseptics commonly applied to wounds did more harm than good. These antiseptics killed bacteria on the surface of wounds, but below, untouched by the antiseptics, anaerobic bacteria continued the infection, and the body's natural defenses were damaged by the antiseptics. Fleming published these observations, but the practice of treating wounds with strong antiseptics nevertheless continued.

The discovery of lysozyme

After the war, continuing his work at St. Mary's Hospital, Fleming searched for effective antibacterial substances. The first that he discovered was the enzyme lysozyme, which he found in the nasal secretions of a patient with a heavy cold. Working with lysozyme, he was disappointed to find that it was effective only against relatively harmless bacteria. In fact the reason those bacteria are harmless is that our bodies are already heavily armed with lysozyme. It occurs in tears, saliva, skin, hair and nails as well as mucus. In nature, egg whites contain large amounts of lysozyme.

The discovery of penicillin

"One sometimes finds, what one is not looking for. When I woke up just after dawn on September 28, 1928, I certainly didn't plan to revolutionize all medicine by discovering the world's first antibiotic, or bacteria killer. But I suppose that was exactly what I did." Alexander Fleming

Fleming was a brilliant researcher, but his laboratory was often messy. When he left with his family for a vacation in August, 1928, a jumble of petri dishes with staphylococci cultures were piled in a corner of the laboratory. Returning, a month later, Fleming noticed a mold growing in one of the culture dishes. Around the mold, the staphylococci were dead. He showed the dish to his former assistant, Merlyn Pryce. who said: "That's how you discovered lysozyme".

The Wikipedia article on the history of penicillin states that "The Scottish physician Alexander Fleming was the first to suggest that a Penicillium mold must secrete an antibacterial substance, and the first to concentrate the active substance involved, which he named penicillin, in 1928. Penicillin was the first modern antibiotic. During the next twelve years Fleming grew, distributed, and studied the original mold, which was determined to be a rare variant of Penicillium notatum (now Penicillium chrysogenum)."

Fleming was not the first person to suggest that molds could be used to treat infections. In fact the use of molds for this purpose has been known since ancient times. But it was Fleming's work that initiated the modern mass production and use of antibiotics.

Honors and awards

- Fleming, Florey and Chain jointly received the Nobel Prize in Medicine in 1945. According to the rules of the Nobel committee a maximum of three people may share the prize. Fleming's Nobel Prize medal was acquired by the National Museums of Scotland in 1989 and is on display after the museum re-opened in 2011.
- Fleming was a member of the Pontifical Academy of Sciences.
- Fleming was elected a Fellow of the Royal Society (FRS) in 1943.
- Fleming was awarded the Hunterian Professorship by the Royal College of Surgeons of England.

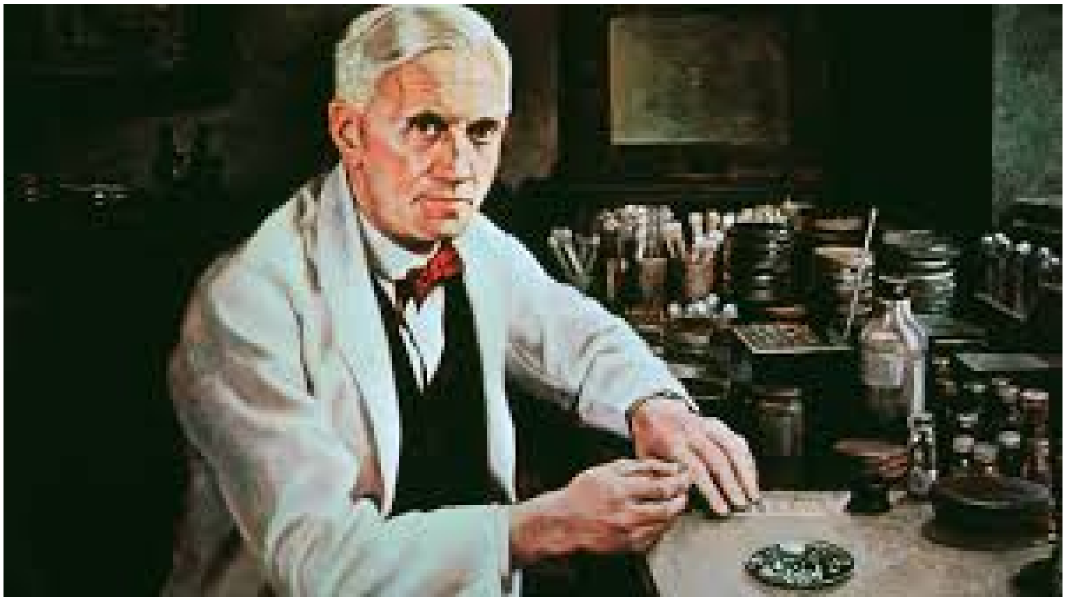

Figure 3.5: **Sir Alexander Fleming (1881-1955).**

Figure 3.6: **Fleming (center) receiving the Nobel prize from King Gustav V of Sweden (right) in 1945.**

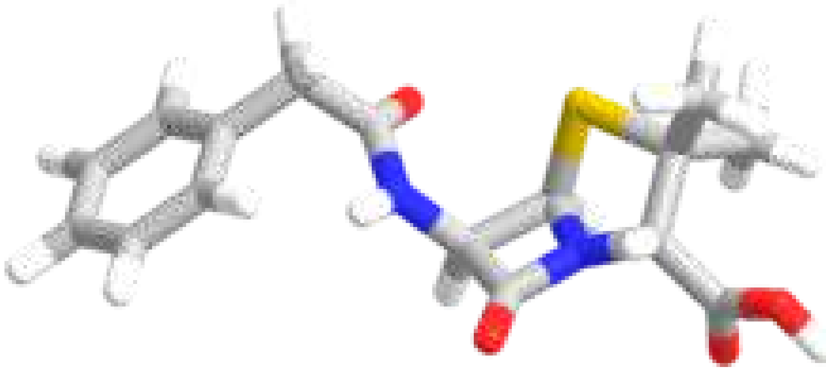

Figure 3.7: **3D-model of benzylpenicillin.**

Figure 3.8: **Faroe Islands postage stamp commemorating Fleming.**

- Fleming was knighted, as a Knight Bachelor, by king George VI in 1944.
- He was made a Knight Grand Cross of the Order of Alfonso X the Wise in 1948.
- In 1999, Time magazine named Fleming one of the 100 Most Important People of the 20th century, statimg: "It was a discovery that would change the course of history. The active ingredient in that mould, which Fleming named penicillin, turned out to be an infection-fighting agent of enormous potency. When it was finally recognized for what it was, the most efficacious life-saving drug in the world, penicillin would alter forever the treatment of bacterial infections. By the middle of the century, Fleming's discovery had spawned a huge pharmaceutical industry, churning out synthetic penicillin that would conquer some of mankind's most ancient scourges, including syphilis, gangrene and tuberculosis."
- The importance of his work was recognized by the placement of an International Historic Chemical Landmark plaque at the Alexander Fleming Laboratory Museum in London on November 19, 1999.
- When 2000 was approaching, at least three large Swedish magazines ranked penicillin as the most important discovery of the millennium.
- In 2002, Fleming was named in the BBC's list of the 100 Greatest Britons following a nationwide vote.
- A statue of Alexander Fleming stands outside the main bullring in Madrid, Plaza de Toros de Las Ventas. It was erected by subscription from grateful matadors, as penicillin greatly reduced the number of deaths in the bullring.
- Flemingovo námestÃ is a square named after Fleming in the university area of the Dejvice community in Prague.
- A secondary school is named after him in Sofia, Bulgaria.
- In Athens, a small square in the downtown district of Votanikos is named after Fleming and bears his bust. There are also a number of Streets in greater Athens and other towns in Greece named after either Fleming or his Greek second wife Amalia.
- In mid-2009, Fleming was commemorated on a new series of banknotes issued by the Clydesdale Bank; his image appears on the new issue of Â£5 notes.
- In 2009, Fleming was voted third greatest Scot in an opinion poll conducted by STV, behind only Scotland's national poet Robert Burns and national hero William Wallace.
- 91006 Fleming, an asteroid in the Asteroid Belt, is named after Fleming.
- Fleming station, on the Thessaloniki Metro system, takes its name from Fleming Street on which it is located, which in term is named after him.
- Sir Alexander Fleming College, a British school in Trujillo, northern Peru

Figure 3.9: **Sir Howard Florey (1898-1968), later Lord Florey.**

3.4 Florey and Chain

Oxford University takes up the challenge

Alexander Fleming had been unable to produce large quantities of penicillin and to make it stable, so he became discouraged about the practical possibilities of using on a large scale as an antibacterial agent. However, a group of researchers at Oxford University in the department of the Professor of Pathology, Howard Florey, took up the challenge. Many researchers were involved in the effort to produce penicillin on a large scale and to make it in a stable form. At times the whole department was involved in the work, but the contributions of Ernst Boris Chain, Norman Heatley and Edward Abraham were especially important, especially those of Chain. In 1945 Chain shared the Nobel Prize in Physiology or Medicine with Fleming and Florey.

Figure 3.10: **An Australian banknote with Florey's image.**

Figure 3.11: **Sir Ernst Boris Chain in 1945.**

Figure 3.12: **Ernst Chain in his laboratory.**

Figure 3.13: **Dr Ernst Chain undertakes an experiment in his office at the School of Pathology at Oxford University in 1944.**

3.5 Hodgkin, Huxley and Eckles

The flow of information between and within cells

Information is transferred between cells in several ways. Among bacteria, in addition to the chronologically vertical transfer of genetic information directly from a single parent to its two daughter cells on cell division, there are mechanisms for the sharing of genetic information in a chronologically horizontal way, between cells of the same generation. These horizontal genetic information transfers can be thought of as being analogous to sex, as will be seen more clearly from some examples.

In the most primitive mechanism of horizontal information transfer, a bacterium releases DNA into its surroundings, and the DNA is later absorbed by another bacterium, not necessarily of the same species. For example, a loop or plasmid of DNA conferring resistance to an antibiotic (an "R-factor") can be released by a resistant bacterium and later absorbed by a bacterium of another species, which then becomes resistant[1].

A second mechanism for horizontal information transfer involves infection of a bacterium by a virus. As the virus reproduces itself inside the bacterium, some of the host's DNA can chance to be incorporated in the new virus particles, which then carry the extra DNA to other bacteria.

Finally, there is a third mechanism (discovered by J. Lederberg) in which two bacteria come together and construct a conjugal bridge across which genetic information can flow.

Almost all multicellular animals and plants reproduce sexually. In the case of sexual reproduction the genetic information of both parents is thrown into a lottery by means of special cells, the gametes. Gametes of each parent contain only half the genetic information of the parent, and the exact composition of that half is determined by chance. Thus, when the gametes from two sexes fuse to form a new individual, the chances for variability are extremely large. This variability is highly valuable to multicellular organisms which reproduce sexually, not only because variability is the raw material of evolutionary adaption to changes in the environment, but also because the great variability of sexually-reproducing organisms makes them less likely to succumb to parasites. Infecting bacteria might otherwise deceive the immune systems of their hosts by developing cell-surface antigens which resemble those of the host, but when they infect sexually-reproducing organisms where each individual is unique, this is much less likely.

Within the cells of all organisms living today, there is a flow of information from polynucleotides (DNA and RNA) to proteins. As messenger RNA passes through a ribosome, like punched tape passing through a computer tapereader, the sequence of nucleotides in the mRNA is translated into the sequence of nucleic acids in the growing protein. The

[1] The fact that this can happen is a strong reason for using antibiotics with great caution in agriculture. Resistance to antibiotics can be transferred from the bacteria commonly found in farm animals to bacteria which are dangerous for humans. Microbiologists have repeatedly warned farmers, drug companies and politicians of this danger, but the warnings have usually been ignored. Unfortunately there are now several instances of antibiotic-resistant human pathogens that have been produced by indiscriminate use of antibiotics in agriculture.

molecular mechanism of the reading and writing in this process involves not only spatial complementarity, but also complementarity of charge distributions.

As a protein grows, one amino acid at a time, it begins to fold. The way in which it folds (the "tertiary conformation") is determined both by spatial complementarity and by complementarity of charge distributions: Those amino acids which have highly polar groups, i.e., where several atoms have large positive or negative excess charges - "hydrophilic" amino acids - tend to be placed on the outside of the growing protein, while amino acids lacking large excess charges - "hydrophobic" amino acids - tend to be on the inside, away from water. Hydrophilic amino acids form hydrogen bonds with water molecules. Whenever there is a large negative charge on an atom of an amino acid, it attracts a positively-charged hydrogen from water, while positively-charged hydrogens on nucleic acids are attracted to negatively charged oxygens of water. Meanwhile, in the interior of the growing protein, non-polar amino acids are attracted to each other by so-called van der Waals forces, which do not require large excess charges, but only close proximity.

When a protein is complete, it is ready to participate in the activities of the cell, perhaps as a structural element or perhaps as an enzyme. Enzymes catalyze the processes by which carbohydrates, and other molecules used by the cell, are synthesized. Often an enzyme has an "active site", where such a process takes place. Not only the spatial conformation of the active site but also its pattern of excess charges must be right if the catalysis is to be effective. An enzyme sometimes acts by binding two smaller molecules to its active site in a proper orientation to allow a reaction between them to take place. In other cases, substrate molecules are stressed and distorted by electrostatic forces as they are pulled into the active site, and the activation energy for a reaction is lowered.

Thus, information is transferred first from DNA and RNA to proteins, and then from proteins to (for example) carbohydrates. Sometimes the carbohydrates then become part of surface of a cell. The information which these surface carbohydrates ("cell surface antigens") contain may be transmitted to other cells. In this entire information transfer process, the "reading" and "writing" depend on steric complementarity and on complementarity of molecular charge distributions.

Not only do cells communicate by touching each other and recognizing each other's cell surface antigens - they also communicate by secreting and absorbing transmitter molecules. For example, the group behavior of slime mold cells is coordinated by the cyclic adenosine monophosphate molecules, which the cells secrete when distressed.

Within most multicellular organisms, cooperative behavior of cells is coordinated by molecules such as hormones - chemical messengers. These are recognized by "receptors", the mechanism of recognition once again depending on complementarity of charge distributions and shape. Receptors on the surfaces of cells are often membrane-bound proteins which reach from the exterior of the membrane to the interior. When an external transmitter molecule is bound to a receptor site on the outside part of the protein, it causes a conformational change which releases a bound molecule of a different type from a site on the inside part of the protein, thus carrying the signal to the cell's interior. In other cases the messenger molecule passes through the cell membrane.

In this way the individual cell in a society of cells (a multicellular organism) is told when to divide and when to stop dividing, and what its special role will be in the economy of the cell society (differentiation). For example, in humans, follicle-stimulating hormone, lutenizing hormone, prolactin, estrogen and progesterone are among the chemical messengers which cause the cell differentiation needed to create the secondary sexual characteristics of females.

Another role of chemical messengers in multicellular organisms is to maintain a reasonably constant internal environment in spite of drastic changes in the external environment of individual cells or of the organism as a whole (homeostasis). An example of such a homeostatic chemical messenger is the hormone insulin, which is found in humans and other mammals. The rate of its release by secretory cells in the pancreas is increased by high concentrations of glucose in the blood. Insulin carries the news of high glucose levels to target cells in the liver, where the glucose is converted to glycogen, and to other target cells in the muscles, where the glucose is burned.

Nervous systems

Hormones require a considerable amount of time to diffuse from the cells where they originate to their target cells; but animals often need to act very quickly, in fractions of seconds, to avoid danger or to obtain food. Because of the need for quick responses, a second system of communication has evolved - the system of neurons.

Neurons have a cell bodies, nuclei, mitochondria and other usual features of eukaryotic cells, but in addition they possess extremely long and thin tubelike extensions called axons and dendrites. The axons function as informational output channels, while the dendrites are inputs. These very long extensions of neurons connect them with other neurons which can be at distant sites, to which they are able to transmit electrical signals. The complex network of neurons within a multicellular organism, its nervous system, is divided into three parts. A sensory or input part brings in signals from the organism's interior or from its external environment. An effector or output part produces a response to the input signal, for example by initiating muscular contraction. Between the sensory and effector parts of the nervous system is a message-processing (internuncial) part, whose complexity is not great in the jellyfish or the leech. However, the complexity of the internuncial part of the nervous system increases dramatically as one goes upward in the evolutionary order of animals, and in humans it is truly astonishing.

The small button-like connections between neurons are called synapses. When an electrical signal propagating along an axon reaches a synapse, it releases a chemical transmitter substance into the tiny volume between the synapse and the next neuron (the post-synaptic cleft). Depending on the nature of the synapse, this chemical messenger may either cause the next neuron to "fire" (i.e., to produce an electrical pulse along its axon) or it may inhibit the firing of the neuron. Furthermore, the question of whether a neuron will or will not fire depends on the past history of its synapses. Because of this feature, the internuncial part of an animal's nervous system is able to learn. There many kinds of synapses and many kinds of neurotransmitters, and the response of synapses is sensitive to the concentration of various molecules in the blood, a fact which helps to give the nervous systems of higher animals extraordinary subtlety and complexity.

The first known neurotransmitter molecule, acetylcholine, was discovered jointly by Sir Henry Dale in England and by Otto Loewi in Germany. In 1921 Loewi was able to show that nerve endings transmit information to muscles by means of this substance. The idea for the critical experiment occurred to him in a dream at 3 am. Otto Loewi woke up and wrote down the idea; but in the morning he could not read what he had written. Luckily he had the same dream the following night. This time he took no chances. He got up, drank some coffee, and spent the whole night working in his laboratory. By morning he had shown that nerve cells separated from the muscle of a frog's heart secrete a chemical substance when stimulated, and that this substance is able to cause contractions of the heart of another frog. Sir Henry Dale later showed that Otto Loewi's transmitter molecule was identical to acetylcholine, which Dale had isolated from the ergot fungus in 1910. The two men shared a Nobel Prize in 1936. Since that time, a large variety of neurotransmitter molecules have been isolated. Among the excitatory neurotransmitters (in addition to acetylcholine) are noradrenalin, norepinephrine, serotonin, dopamine, and glutamate, while gamma-amino-butyric acid is an example of an inhibitory neurotransmitter.

In 1953, Stephen W. Kuffler, working at Johns Hopkins University, made a series of discoveries which yielded much insight into the mechanisms by which the internuncial part of mammalian nervous systems processes information. Kuffler's studies showed that some degree of abstraction of patterns already takes place in the retina of the mammalian eye, before signals are passed on through the optic nerve to the visual cortex of the brain. In the mammalian retina, about 100 million light-sensitive primary light-receptor cells are connected through bipolar neurons to approximately a million retinal neurons of another type, called ganglions. Kuffler's first discovery (made using microelectrodes) was that even in total darkness, the retinal ganglions continue to fire steadily at the rate of about thirty pulses per second. He also found that diffuse light illuminating the entire retina does not change this steady rate of firing.

Kuffler's next discovery was that each ganglion is connected to an array of about 100 primary receptor cells, arranged in an inner circle surrounded by an outer ring. Kuffler found the arrays to be of two types, which he called "on center arrays" and "off center arrays". In the "on center arrays", a tiny spot of light, illuminating only the inner circle, produces a burst of frequent firing of the associated ganglion, provided that cells in the outer ring of the array remain in darkness. However, if the cells in the outer ring are also illuminated, there is a cancellation, and there is no net effect. Exactly the opposite proved to be the case for the "off center arrays". As before, uniform illumination of both the inner circle and outer ring of these arrays produces a cancellation and hence no net effect on the steady background rate of ganglion firing. However, if the central circle by itself is illuminated by a tiny spot of light, the ganglion firing is inhibited, whereas if the outer ring alone is illuminated, the firing is enhanced. Thus Kuffler found that both types of arrays give no response to uniform illumination, and that both types of arrays measure, in different ways, the degree of contrast in the light falling on closely neighboring regions of the retina.

Kuffler's research was continued by his two associates, David H. Hubel and Torsten N.

Wessel, at the Harvard Medical School, to which Kuffler had moved. In the late 1950's, they found that when the signals sent through the optic nerves reach the visual cortex of the brain, a further abstraction of patterns takes place through the arrangement of connections between two successive layers of neurons. Hubbel and Wessel called the cells in these two pattern-abstracting layers "simple" and "complex". The retinal ganglions were found to be connected to the "simple" neurons in such a way that a "simple" cell responds to a line of contrasting illumination of the retina. For such a cell to respond, the line has to be at a particular position and has to have a particular direction. However, the "complex" cells in the next layer were found to be connected to the "simple" cells in such a way that they respond to a line in a particular direction, even when it is displaced parallel to itself[2].

In analyzing their results, Kuffler, Hubel and Wessel concluded that pattern abstraction in the mammalian retina and visual cortex takes place through the selective destruction of information. This conclusion agrees with what we know in general about abstractions: They are always simpler than the thing which they represent.

The giant squid axon

The mechanism by which electrical impulses propagate along nerve ax- ons was clarified by the English physiologists Alan Lloyd Hodgkin and Andrew Fielding Huxley (a grandson of Darwin's defender, Thomas Henry Huxley). In 1952, working with the giant axon of the squid (which can be as large as a millimeter in diameter), they demonstrated that the electrical impulse propagating along a nerve is in no way similar to an electrical current in a conducting wire, but is more closely analogous to a row of dominoes knocking each other down. The nerve fiber, they showed, is like a long thin tube, within which there is a fluid containing K^+, and Na^+ ions, as well as anions. Inside a resting nerve, the concentration of K^+ is higher than in the normal body fluids outside, and the concentration of Na^+ is lower. These abnormal concentrations are maintained by an "ion pump", which uses the Gibbs free energy of adenosine triphosphate (ATP) to bring potassium ions into the nerve and to expel sodium ions.

The membrane surrounding the neural axon is more permeable to potassium ions than to sodium, and the positively charged potassium ions tend to leak out of the resting nerve, producing a small difference in potential between the inside and outside. This "resting potential" helps to hold the molecules of the membrane in an orderly layer, so that the membrane's permeability to ions is low.

Hodgkin and Huxley showed that when a neuron fires, the whole situation changes dramatically. Triggered by the effects of excitatory neurotransmitter molecules, sodium ions begin to flow into the axon, destroying the electrical potential which maintained order

[2] Interestingly, at about the same time, the English physiologist J.Z. Young came to closely analogous conclusions regarding the mechanism of pattern abstraction in the visual cortex of the octopus brain. However, the similarity between the image-forming eye of the octopus and the image-forming vertebrate eye and the rough similarity between the mechanisms for pattern abstraction in the two cases must both be regarded as instances of convergent evolution, since the mollusc eye and the vertebrate eye have evolved independently.

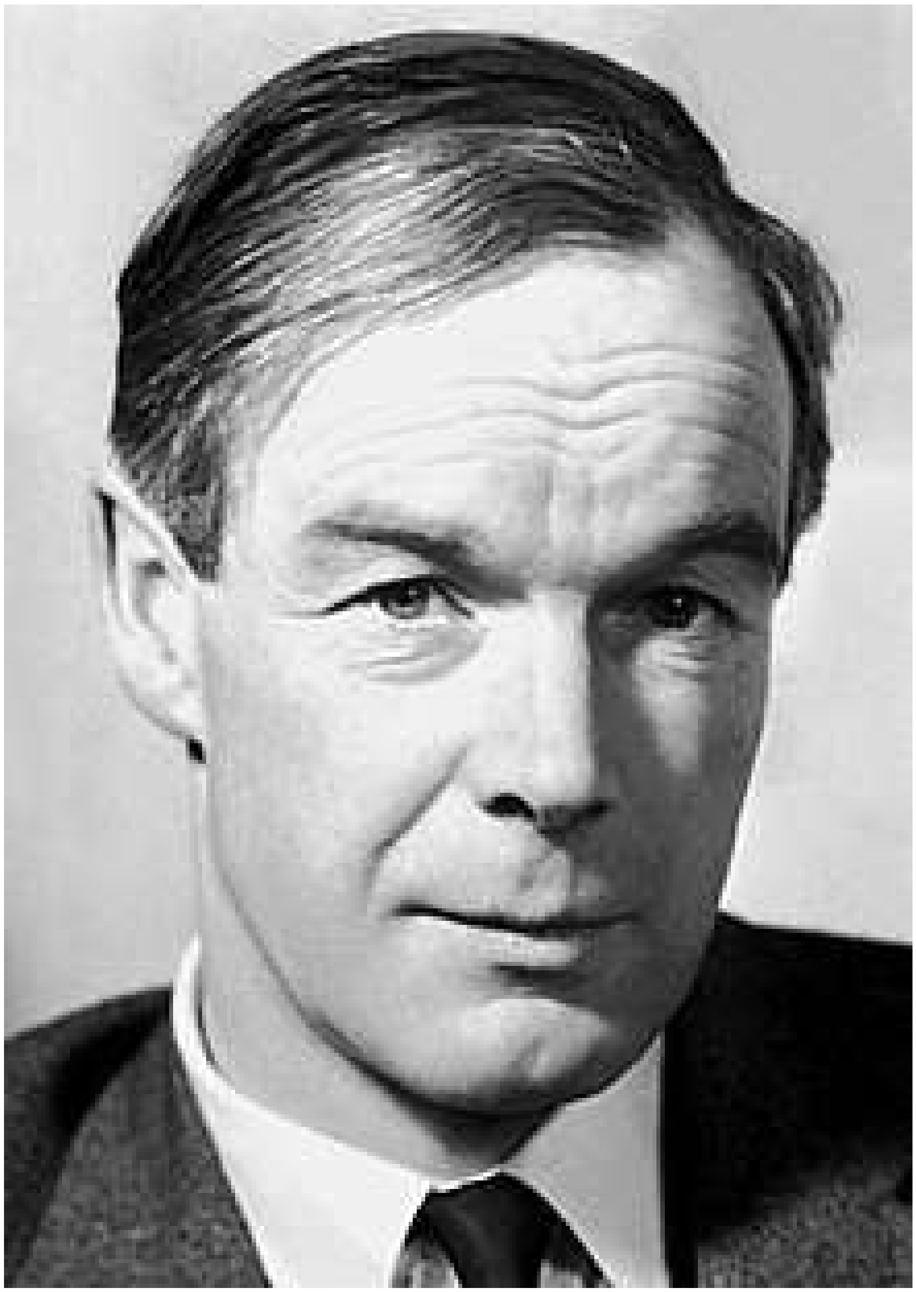

Figure 3.14: **Sir Alan Lloyd Hodgkin (1914-1998). He shared the 1963 Nobel Prize in Physiology or Medicine with Andrew Huxley and John Eccles.**

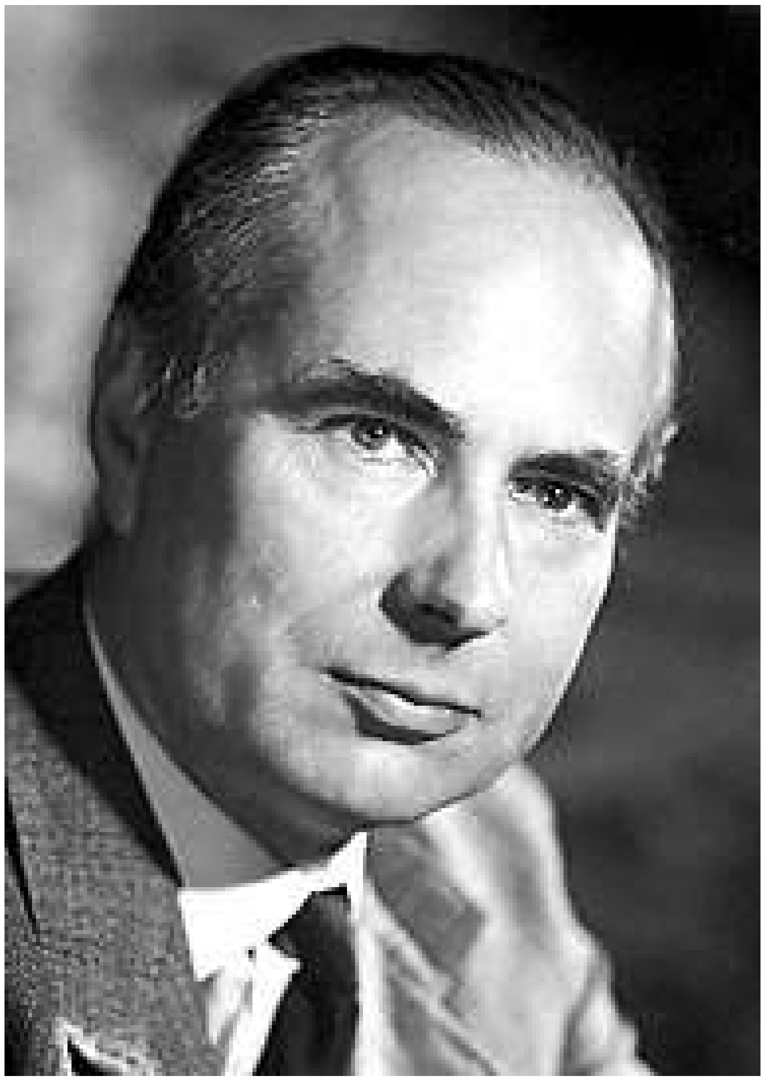

Figure 3.15: **Sir Andrew Fielding Huxley (1917-2012). He was a member of a famous family that included Thomas Henry Huxley ("Darwin's bulldog"), Aldous Huxley (author of *Brave New World*) and Sir Julian Huxley (a renowned evolutionary biologist, and the first director of UNESCO).**

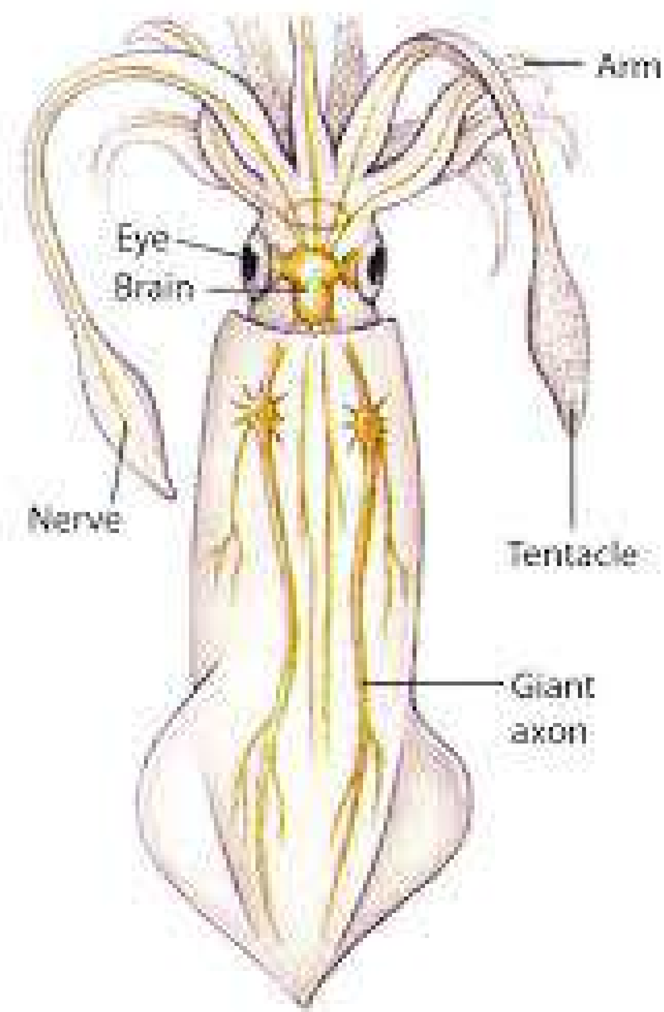

Figure 3.16: **The squid giant axon was large enough to allow Hodgkin and Huxley to perform their experiments demonstrating the mechanism of signal propagation in nerves. The squid giant axon was discovered by John Zachary Young (1907-1997) in the 1930's.**

Figure 3.17: **Hodgkin and Huxley working together.**

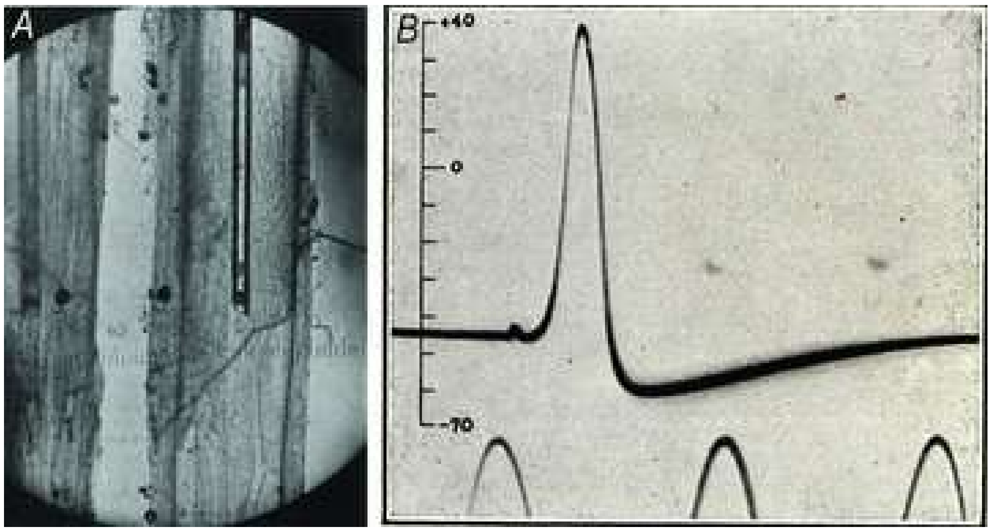

Figure 3.18: **Intracellular recording of the squid giant axon action potential.**

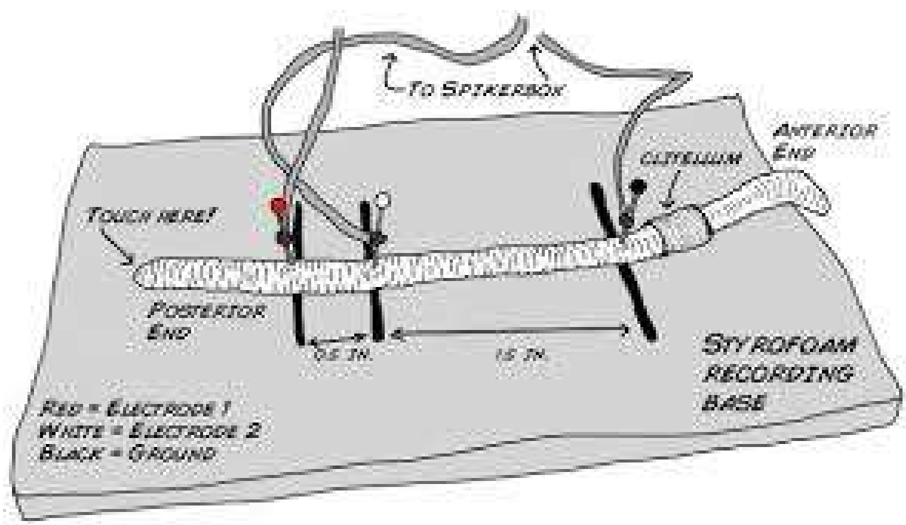

Figure 3.19: **A diagram of the Hodgkin-Huxley experiment with the giant squid axon.**

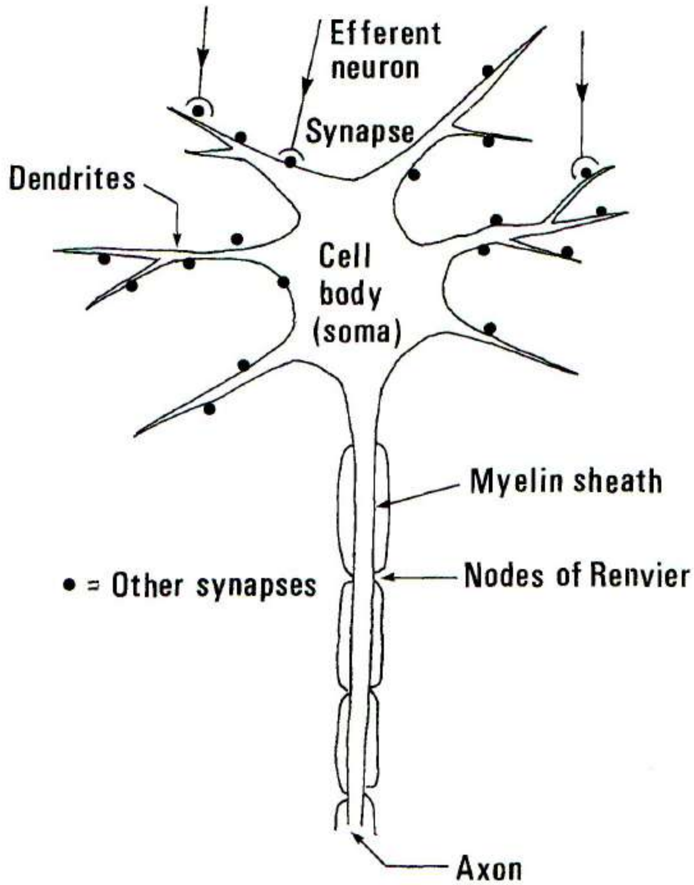

Figure 3.20: A schematic diagram of a neuron.

in the membrane. A wave of depolarization passes along the axon. Like a row of dominoes falling, the disturbance propagates from one section to the next: Sodium ions flow in, the order-maintaining electrical potential disappears, the next small section of the nerve membrane becomes permeable, and so on. Thus, Hodgkin and Huxley showed that when a neuron fires, a quick pulse-like electrical and chemical disturbance is transmitted along the axon.

Afterwards, the resting potential is restored by the sodium-potassium ion pump, later discovered by the Danish physiologist Jens Christian Skou. The pump consists of membrane-bound enzymes that use the energy of ATP to transport the ions across the electrochemical gradient.

Chemical synapses

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Neurotransmitters

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The idea for the critical experiment occurred to him in a dream at 3 am. Otto Loewi woke up and wrote down the idea; but in the morning he could not read what he had written. Luckily he had the same dream the following night. This time he took no chances. He got up, drank some coffee, and spent the whole night working in his laboratory. By morning he had shown that nerve cells separated from the muscle of a frog's heart secrete a chemical substance when stimulated, and that this substance is able to cause contractions of the heart of another frog.

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Some important neurotransmitters

- **Glutamate**: This is the most abundant neurotransmitter in humans, used by about half of the neurons in the human brain. It is the primary excitatory transmitter in the central nervous system. One of its functions is to help form memories.

- **GABA**: The name GABA is an acronym for Gamma-aminobutyric acid. GABA is the primary inhibitory transmitter in the vertebrate brain. It helps to control anxiety, and it is sometimes used medically to treat anxiety and the associated sleeplessness.

- **Glycine**: This neurotransmitter is a single amino acid. It is the main inhibitory neurotransmitter in the vertebrate spinal cord. Glycine is important in the central nervous system, especially in the spinal cord, brainstem, and retina.

- **Acetylcholine**: An ester (the organic analogue of a salt) formed from the reaction between choline and acetic acid, acetylcholine stimulates muscles, functions in the autonomic nervous system and sensory neurons, and is associated with REM sleep. Alzheimer's disease is associated with a significant drop in acetylcholine levels.

- **Norepinephrine**: Also known as noradrenaline, norepinephrine increases heart rate and blood pressure. It is part of the body's "fight or flight" system. Norepinephrine is also needed to form memories. Stress depletes stores of this neurotransmitter.

- **Dopamine**: Dopamine is also synthesized in plants and most animals. It is an inhibitory transmitter associated with the reward center of the brain. Low dopamine levels are associated with social anxiety and Parkinson's disease, while excess dopamine is related to schizophrenia. The brain includes several distinct dopamine pathways, one of which plays a major role in reward-motivated behavior. Most types of rewards increase the level of dopamine in the brain, and many addictive drugs increase dopamine neuronal activity.

- **Serotonin**: Biochemically derived from the amino acid tryptophanis, serotonin an inhibitory neurotransmitter involved in mood, emotion, and perception. Low serotonin levels can lead to depression, suicidal tendencies, anger management issues, difficulty sleeping, migraines, and an increased craving for carbohydrates. It's functions include the regulation of mood, appetite, and sleep. Serotonin also has some cognitive functions, including memory and learning.

- **Endorphins**: The name of this class of neurotransmitters means "a class of a morphine-like substance originating from within the body". are a class of molecules similar to opioids (e.g., morphine, heroin) in terms of structure and function. The word "endorphin" is short for "endogenous morphine." Endorphins are inhibitory transmitters associated with pleasure and pain relief. In other animals, these chemicals slow metabolism and permit hibernation. The treatment of pain by means of acupuncture functions by releasing endorphines.

Transmission of signals across synapses

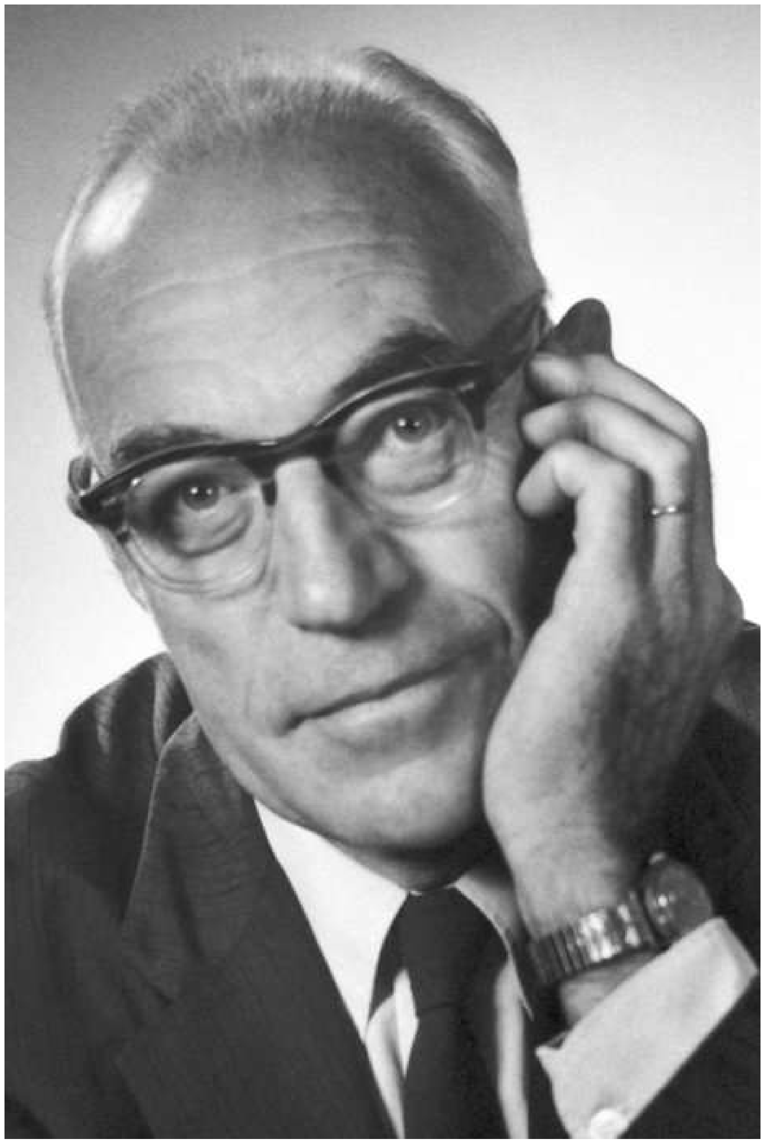

Figure 3.21: **Sir John Carew Eccles (1903-1997).**

Figure 3.22: **Jens Christian Skou (1908-2018). He received a Nobel Prize in Chemistry in in 1997 for his discovery of the K^+-Na^+ ion pump that uses energy from ATP to transport the ions across membranes against the electrochemical gradient. The photo shows him in 2008. He was born in Lemvig, Denmark.**

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Chapter 4

MOLECULAR BIOLOGISTS

4.1 Dorothy Crowfoot Hodgkin

X-ray crystallography

In England, J.D. Bernal and Dorothy Crowfoot Hodgkin pioneered the application of X-ray diffraction methods to the study of complex biological molecules. In 1949, Hodgkin determined the structure of penicillin; and in 1955, she followed this with the structure of vitamin B12. In 1960, Max Perutz and John C. Kendrew obtained the structures of the blood proteins myoglobin and hemoglobin. This was an impressive achievement for the Cambridge crystallographers, since the hemoglobin molecule contains roughly 12,000 atoms.

The structure obtained by Perutz and Kendrew showed that hemoglobin is a long chain of amino acids, folded into a globular shape, like a small, crumpled ball of yarn. They found that the amino acids with an affinity for water were on the outside of the globular molecule; while the amino acids for which contact with water was energetically unfavorable were hidden on the inside. Perutz and Kendrew deduced that the conformation of the protein - the way in which the chain of amino acids folded into a 3-dimensional structure - was determined by the sequence of amino acids in the chain.

In 1966, D.C. Phillips and his co-workers at the Royal Institution in London found the crystallographic structure of the enzyme lysozyme (an egg-white protein which breaks down the cell walls of certain bacteria). Again, the structure showed a long chain of amino acids, folded into a roughly globular shape. The amino acids with hydrophilic groups were on the outside, in contact with water, while those with hydrophobic groups were on the inside. The structure of lysozyme exhibited clearly an active site, where sugar molecules of bacterial cell walls were drawn into a mouth-like opening and stressed by electrostatic forces, so that bonds between the sugars could easily be broken.

Figure 4.1: **Dorothy Crowfoot Hodgkin (1910-1994). She and her mentor J.D Bernal were great pioneers in the application of X-ray crystallography to determination of the structure of biological molecules, such as proteins. She was awarded the Nobel Prize in Chemistry in 1964.**

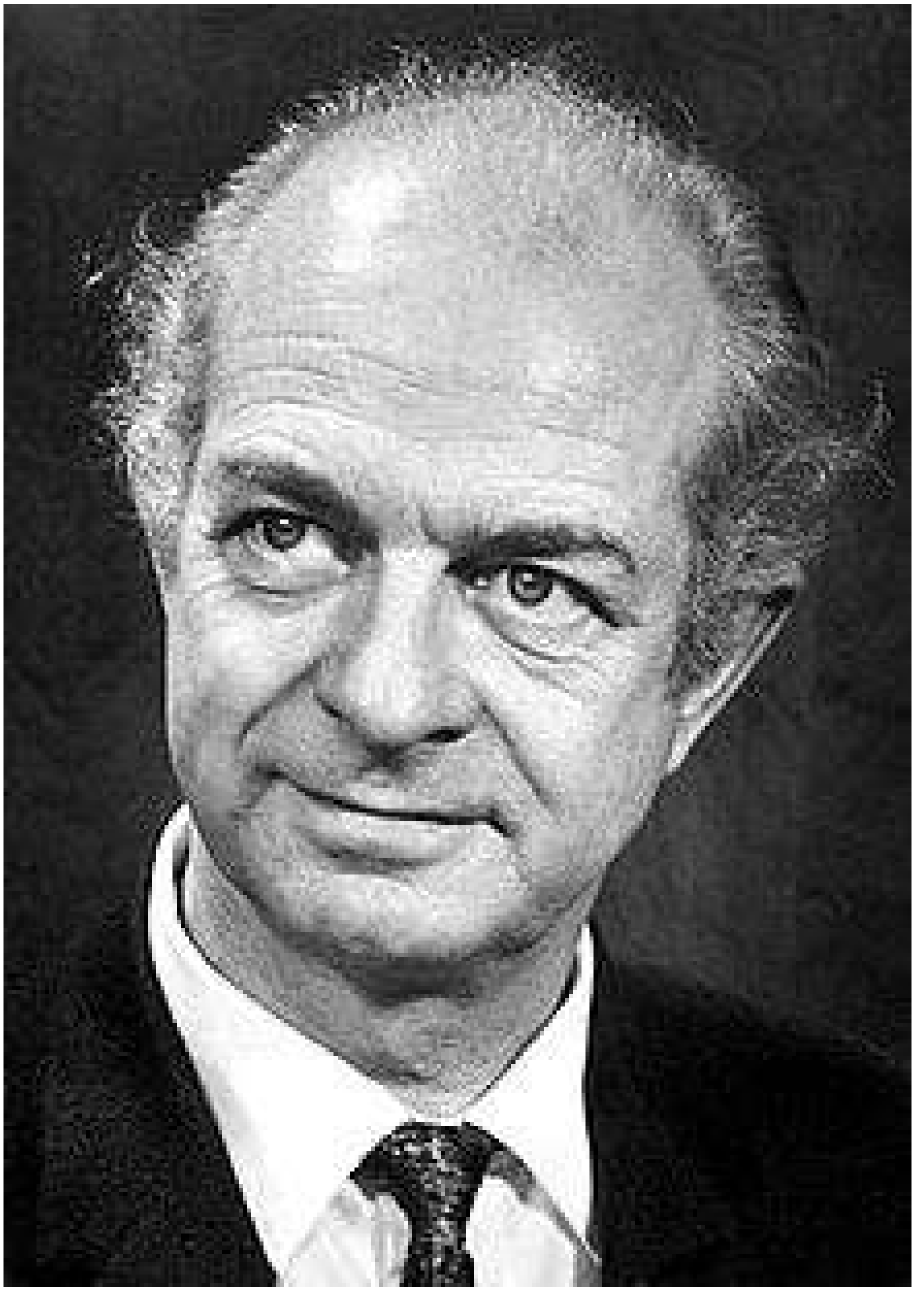

Figure 4.2: **Linus Pauling (1901-1994). The New Scientist called him one of the 20 most important scientists in history. He was awarded the Nobel Prize in Chemistry in 1954 and the Nobel Peace Prize in 1962.**

Figure 4.3: **Frederick Sanger (1918-2013) was one of the only two people in history have won two Nobel Prizes in the same field, in his case Chemistry. He won the first on 1958 for his work on the structure of proteins, and the second in 1980 for his method for determining the base sequences of nucleic acids.**

4.2 Frederic Sanger

Meanwhile, at Cambridge University, Frederick Sanger developed methods for finding the exact sequence of amino acids in a protein chain. In 1945, he discovered a compound (2,4-dinitrofluorobenzene) which attaches itself preferentially to one end of a chain of amino acids. Sanger then broke down the chain into individual amino acids, and determined which of them was connected to his reagent. By applying this procedure many times to fragments of larger chains, Sanger was able to deduce the sequence of amino acids in complex proteins. In 1953, he published the sequence of insulin. This led, in 1964, to the synthesis of insulin.

4.3 Linus Pauling

Linus Pauling also contributed importantly to our understanding of the structure of proteins. Wikipedia says of his work: "Pauling was one of the founders of the fields of quantum chemistry and molecular biology. His contributions to the theory of the chemical bond include the concept of orbital hybridisation and the first accurate scale of electronegativities of the elements. Pauling also worked on the structures of biological molecules, and showed the importance of the alpha helix and beta sheet in protein secondary structure. Pauling's approach combined methods and results from X-ray crystallography, molecular model building, and quantum chemistry. His discoveries inspired the work of James Watson, Francis Crick, and Rosalind Franklin on the structure of DNA, which in turn made it possible for geneticists to crack the DNA code of all organisms."

The biological role and structure of proteins which began to emerge was as follows: A mammalian cell produces roughly 10,000 different proteins. All enzymes are proteins; and the majority of proteins are enzymes - that is, they catalyze reactions involving other biological molecules. All proteins are built from chainlike polymers, whose monomeric sub-units are the following twenty amino acids: glycine, aniline, valine, isoleucine, leucine, serine, threonine, proline, aspartic acid, glutamic acid, lysine, arginine, asparagine, glutamine, cysteine, methionine, tryptophan, phenylalanine, tyrosine and histidine. These individual amino acid monomers may be connected together into a polymer (called a polypeptide) in any order - hence the great number of possibilities. In such a polypeptide, the backbone is a chain of carbon and nitrogen atoms showing the pattern ...-C-C-N-C-C-N-C-C-N-...and so on. The -C-C-N- repeating unit is common to all amino acids. Their individuality is derived from differences in the side groups which are attached to the universal -C-C-N- group.

Some proteins, like hemoglobin, contain metal atoms, which may be oxidized or reduced as the protein performs its biological function. Other proteins, like lysozyme, contain no metal atoms, but instead owe their biological activity to an active site on the surface of the protein molecule. In 1909, the English physician, Archibald Garrod, had proposed a one-gene-one-protein hypothesis. He believed that hereditary diseases are due to the absence of specific enzymes. According to Garrod's hypothesis, damage suffered by a gene results in the faulty synthesis of the corresponding enzyme, and loss of the enzyme ultimately results in the symptoms of the hereditary disease.

In the 1940's, Garrod's hypothesis was confirmed by experiments on the mold, Neurospora, performed at Stanford University by George Beadle and Edward Tatum. They demonstrated that mutant strains of the mold would grow normally, provided that specific extra nutrients were added to their diets. The need for these dietary supplements could in every case be traced to the lack of a specific enzyme in the mutant strains. Linus Pauling later extended these ideas to human genetics by showing that the hereditary disease, sickle-cell anemia, is due to a defect in the biosynthesis of hemoglobin.

4.4 Erwin Schrödinger

What is Life? That was the title of a small book published by the physicist Erwin Schrödinger in 1944. Schrödinger (1887-1961) was born and educated in Austria. In 1926 he shared the Nobel Prize in Physics[1] for his contributions to quantum theory (wave mechanics). Schrödinger's famous wave equation is as fundamental to modern physics as Newton's equations of motion are to classical physics.

When the Nazis entered Austria in 1938, Schrödinger opposed them, at the risk of his life. To escape arrest, he crossed the Alps on foot, arriving in Italy with no possessions except his knapsack and the clothes which he was wearing. He traveled to England; and in 1940 he obtained a position in Ireland as Senior Professor at the Dublin Institute for Advanced Studies. There he gave a series of public lectures upon which his small book is based.

In his book, *What is Life?*, Schrödinger developed the idea that a gene is a very large information-containing molecule which might be compared to an aperiodic crystal. He also examined in detail the hypothesis (due to Max Delbrück) that X-ray induced mutations of the type studied by Hermann Muller can be thought of as photo-induced transitions from one isomeric conformation of the genetic molecule to another. Schrödinger's book has great historic importance, because Francis Crick (whose education was in physics) was one of the many people who became interested in biology as a result of reading it. Besides discussing what a gene might be in a way which excited the curiosity and enthusiasm of Crick, Schrödinger devoted a chapter to the relationship between entropy and life.

"What is that precious something contained in our food which keeps us from death? That is easily answered," Schrödinger wrote, "Every process, event, happening - call it what you will; in a word, everything that is going on in Nature means an increase of the entropy of the part of the world where it is going on. Thus a living organism continually increases its entropy - or, as you may say, produces positive entropy, which is death. It can only keep aloof from it, i.e. alive, by continually drawing from its environment negative entropy - which is something very positive as we shall immediately see. What an organism feeds upon is negative entropy. Or, to put it less paradoxically, the essential thing in

[1] with P.A.M. Dirac

metabolism is that the organism succeeds in freeing itself from all the entropy it cannot help producing while alive..."[2]

"Entropy, taken with a negative sign, is itself a measure of order. Thus the device by which an organism maintains itself stationary at a fairly high level of orderliness (= fairly low level of entropy) really consists in continually sucking orderliness from its environment. This conclusion is less paradoxical than it appears at first sight. Rather it could be blamed for triviality. Indeed, in the case of higher animals we know the kind of orderliness they feed upon well enough, viz. the extremely well-ordered state of matter state in more or less complicated organic compounds which serve them as foodstuffs. After utilizing it, they return it in a very much degraded form - not entirely degraded, however, for plants can still make use of it. (These, of course, have their most powerful source of 'negative entropy' in the sunlight.)" At the end of the chapter, Schrödinger added a note in which he said that if he had been writing for physicists, he would have made use of the concept of free energy; but he judged that this concept might be difficult or confusing for a general audience.

All living organisms draw a supply of thermodynamic information from their environment, and they use it to "keep aloof" from the disorder which constantly threatens them. In the case of animals, the information-containing free energy comes in the form of food. In the case of green plants, it comes primarily from sunlight. The thermodynamic information thus gained by living organisms is used by them to create configurations of matter which are so complex and orderly that the chance that they could have arisen in a random way is infinitesimally small.

John von Neumann invented a thought experiment which illustrates the role which free energy plays in creating statistically unlikely configurations of matter. Von Neumann imagined a robot or automaton, made of wires, electrical motors, batteries, etc., constructed in such a way that when floating on a lake stocked with its component parts, it will reproduce itself. The important point about von Neumann's automaton is that it requires a source of free energy (i.e., a source of energy from which work can be obtained) in order to function. We can imagine that the free energy comes from electric batteries which the automaton finds in its environment. (These are analogous to the food eaten by animals.) Alternatively we can imagine that the automaton is equipped with photocells, so that it can use sunlight as a source of free energy, but it is impossible to imagine the automaton reproducing itself without some energy source from which work can be obtained to drive its reproductive machinery. If it could be constructed, would von Neumann's automaton be alive? Few people would say yes. But if such a self-reproducing automaton could be constructed, it would have some of the properties which we associate with living organisms.

The autocatalysts which are believed to have participated in molecular evolution had some of the properties of life. They used "food" (i.e., energy-rich molecules in their environments) to reproduce themselves, and they evolved, following the principle of natural selection. The autocatalysts were certainly precursors of life, approaching the borderline

[2] The Hungarian-American biochemist Albert Szent-Györgyi, who won a Nobel prize for isolating vitamin C, and who was a pioneer of Bioenergetics, expressed the same idea in the following words: "We need energy to fight against entropy".

Figure 4.4: **The great Austrian physicist Erwin Schrödinger (1887-1961) was one of the principle founders of quantum theory. He fled from Austria over the mountains to Italy after the Nazis entered his country, and finally found refuge at the Institute for Advanced Studies in Ireland. It was there that he wrote his important book, "What is Life?". Reading Schrödinger's book, Francis Crick was inspired to look for the structure of DNA.**

between non-life and life.

Is a virus alive? We know, for example, that the tobacco mosaic virus can be taken to pieces. The proteins and RNA of which it is composed can be separated, purified, and stored in bottles on a laboratory shelf. At a much later date, the bottles containing the separate components of the virus can be taken down from the shelf and incubated together, with the result that the components assemble themselves in the correct way, guided by steric and electrostatic complementarity. New virus particles are formed by this process of autoassembly, and when placed on a tobacco leaf, the new particles are capable of reproducing themselves. In principle, the stage where the virus proteins and RNA are purified and placed in bottles could be taken one step further: The amino acid sequences of the proteins and the base sequence of the RNA could be determined and written down.

Later, using this information, the parts of the virus could be synthesized from amino acids and nucleotides. Would we then be creating life? Another question also presents itself: At a certain stage in the process just described, the virus seems to exist only in the form of information - the base sequence of the RNA and the amino acid sequence of the proteins. Can this information be thought of as the idea of the virus in the Platonic sense? (Pythagoras would have called it the "soul" of the virus.) Is a computer virus alive? Certainly it is not so much alive as a tobacco mosaic virus. But a computer virus can use thermodynamic information (supplied by an electric current) to reproduce itself, and it has a complicated structure, containing much cybernetic information.

Under certain circumstances, many bacteria form spores, which do not metabolize, and which are able to exist without nourishment for very long periods - in fact for millions of years. When placed in a medium containing nutrients, the spores can grow into actively reproducing bacteria. There are examples of bacterial spores existing in a dormant state for many millions of years, after which they have been revived into living bacteria. Is a dormant bacterial spore alive?

Clearly there are many borderline cases between non-life and life; and Aristotle seems to have been right when he said, "Nature proceeds little by little from lifeless things to animal life, so that it is impossible to determine either the exact line of demarcation, or on which side of the line an intermediate form should lie." However, one theme seems to characterize life: It is able to convert the thermodynamic information contained in food or in sunlight into complex and statistically unlikely configurations of matter. A flood of information-containing free energy reaches the earth's biosphere in the form of sunlight. Passing through the metabolic pathways of living organisms, this information keeps the organisms far away from thermodynamic equilibrium ("which is death"). As the thermodynamic information flows through the biosphere, much of it is degraded into heat, but part is converted into cybernetic information and preserved in the intricate structures which are characteristic of life. The principle of natural selection ensures that as this happens, the configurations of matter in living organisms constantly increase in complexity, refinement and statistical improbability. This is the process which we call evolution, or in the case of human society, progress.

4.5 Sir Francis Crick and James Dewey Watson

Until 1944, most scientists had guessed that the genetic message was carried by the proteins of the chromosome. In 1944, however, O.T. Avery and his co-workers at the laboratory of the Rockefeller Institute in New York performed a critical experiment, which proved that the material which carries genetic information is not protein, but deoxyribonucleic acid (DNA) - a giant chainlike molecule which had been isolated from cell nuclei by the Swiss chemist, Friedrich Miescher.

Avery had been studying two different strains of pneumococci, the bacteria which cause pneumonia. One of these strains, the S-type, had a smooth coat, while the other strain, the R-type, lacked an enzyme needed for the manufacture of a smooth carbohydrate coat. Hence, R-type pneumococci had a rough appearance under the microscope. Avery and his co-workers were able to show that an extract from heat-killed S-type pneumococci could convert the living R-type species permanently into S-type; and they also showed that this extract consisted of pure DNA.

In 1947, the Austrian-American biochemist, Erwin Chargaff, began to study the long, chainlike DNA molecules. It had already been shown by Levine and Todd that chains of DNA are built up of four bases: adenine (A), thymine (T), guanine (G) and cytosine (C), held together by a sugar-phosphate backbone. Chargaff discovered that in DNA from the nuclei of living cells, the amount of A always equals the amount of T; and the amount of G always equals the amount of C.

When Chargaff made this discovery, neither he nor anyone else understood its meaning. However, in 1953, the mystery was completely solved by Rosalind Franklin and Maurice Wilkins at Kings College, London, together with James Watson and Francis Crick at Cambridge University. By means of X-ray diffraction techniques, Wilkins and Franklin obtained crystallographic information about the structure of DNA. Using this information, together with Linus Pauling's model-building methods, Crick and Watson proposed a detailed structure for the giant DNA molecule.

The discovery of the molecular structure of DNA was an event of enormous importance for genetics, and for biology in general. The structure was a revelation! The giant, helical DNA molecule was like a twisted ladder: Two long, twisted sugar-phosphate backbones formed the outside of the ladder, while the rungs were formed by the base pairs, A, T, G and C. The base adenine (A) could only be paired with thymine (T), while guanine (G) fit only with cytosine (C). Each base pair was weakly joined in the center by hydrogen bonds - in other words, there was a weak point in the center of each rung of the ladder - but the bases were strongly attached to the sugar-phosphate backbone. In their 1953 paper, Crick and Watson wrote:

"It has not escaped our notice that the specific pairing we have postulated suggests a possible copying mechanism for genetic material". Indeed, a sudden blaze of understanding illuminated the inner workings of heredity, and of life itself.

If the weak hydrogen bonds in the center of each rung were broken, the ladderlike DNA macromolecule could split down the center and divide into two single strands. Each single strand would then become a template for the formation of a new double-stranded molecule.

Figure 4.5: **Sir Francis Crick (1916-2004). Besides being half of the team that determined the correct structure of DNA, he made many other extremely important contributions to molecular biology and neuroscience. He contributed importantly to the solution of the genetic code, and is known for his "central dogma": Information flows from DNA to RNA, and never backward. RNA codes the synthesis of proteins, and enzymes, which are proteins, catalyze the synthesis of smaller molecules.**

Figure 4.6: **James Dewey Watson (born in 1928) Crick's partner in solving the DNA structure. After serving for 35 years as Director and later President of the Cold Springs Harbor Laboratory and greatly expanding it facilities, he joined the US National Institutes of Health, where he has been the driving force behind the Human Genome Project.**

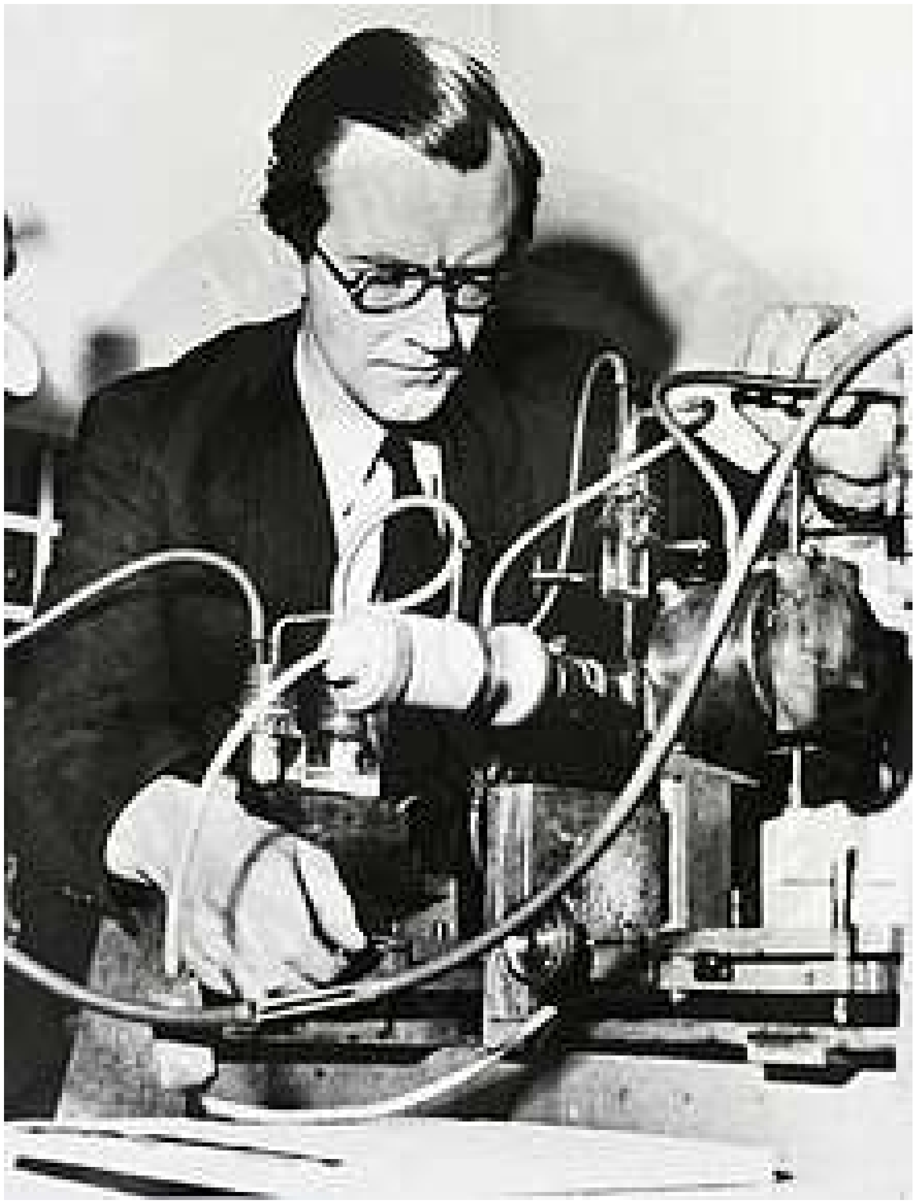

Figure 4.7: **Maurice Wilkins (1916-2004). He applied to DNA the X-ray diffraction methods pioneered by Dorothy Hodgkin. It was his work, and that of Rosalind Franklin, together with Linus Pauling's model-building methods, that enabled Crick and Watson to correctly solve the structure of DNA. He shared the 1962 Nobel Prize in Physiology or Medicine with them.**

Figure 4.8: **Rosalind Franklin (1920-1958). It was one of her high-quality diffraction photographs, taken in Maurice Wilkins' laboratory, that proved to be critical for the DNA structure. She might have shared the Nobel Prize with Wilkins, Crick and Watson, but before this could be considered by the committee, she died of overian cancer.**

Figure 4.9: **Oswald Theodore Avery (1877-1955). Together with his team at the Rockefeller University Hospital in New York City, he proved experimentally that DNA is the molecule that carries genetic information between generations.**

Figure 4.10: **The Austro-Hungarian biochemist Erwin Chargaff (1905-2002) found experimentally that in DNA from the nuclei of living cells, the amount of adenine always equals the amount of thiamine; and the amount of guanine always equals the amount of cytosine, but at the time of his discovery, neither he nor anyone else, understood the meaning of this rule.**

Because of the specific pairing of the bases in the Watson-Crick model of DNA, the two strands had to be complementary. T had to be paired with A, and G with C. Therefore, if the sequence of bases on one strand was (for example) TTTGCTAAAGGTGAACCA... , then the other strand necessarily had to have the sequence AAACGATTTCCACTTGGT... The Watson-Crick model of DNA made it seem certain that all the genetic information needed for producing a new individual is coded into the long, thin, double-stranded DNA molecule of the cell nucleus, written in a four-letter language whose letters are the bases, adenine, thymine, guanine and cytosine.

The solution of the DNA structure in 1953 initiated a new kind of biology - molecular biology. This new discipline made use of recently-discovered physical techniques - X-ray diffraction, electron microscopy, electrophoresis, chromatography, ultracentrifugation, radioactive tracer techniques, autoradiography, electron spin resonance, nuclear magnetic resonance and ultraviolet spectroscopy. In the 1960's and 1970's, molecular biology became the most exciting and rapidly-growing branch of science.

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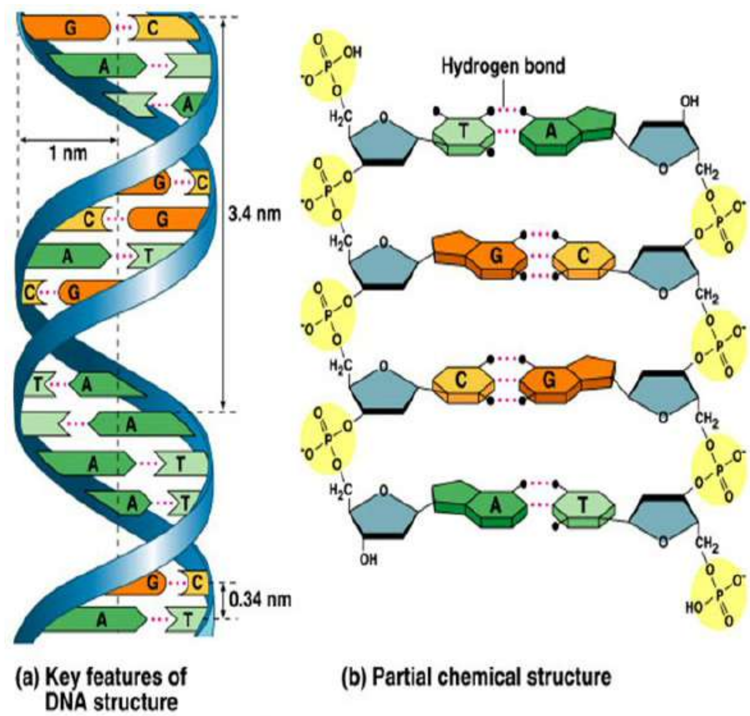

Figure 4.11: **Once the structure of DNA was known, it became clear that transgenerational information is transmitted in a chemical language based on a code with four letters, G, T, C and A.**

Since DNA was known to carry the genetic message, coded into the sequence of the four nucleotide bases, A, T, G and C, and since proteins were known to be composed of specific sequences of the twenty amino acids, it was logical to suppose that the amino acid sequence in a protein was determined by the base sequence of DNA. The information somehow had to be read from the DNA and used in the biosynthesis of the protein.

It was known that, in addition to DNA, cells also contain a similar, but not quite identical, polynucleotide called ribonucleic acid (RNA). The sugar-phosphate backbone of RNA was known to differ slightly from that of DNA; and in RNA, the nucleotide thymine (T) was replaced by a chemically similar nucleotide, uracil (U). Furthermore, while DNA was found only in cell nuclei, RNA was found both in cell nuclei and in the cytoplasm of cells, where protein synthesis takes place. Evidence accumulated indicating that genetic information is first transcribed from DNA to RNA, and afterwards translated from RNA into the amino acid sequence of proteins.

At first, it was thought that RNA might act as a direct template, to which successive amino acids were attached. However, the appropriate chemical complementarity could not be found; and therefore, in 1955, Francis Crick proposed that amino acids are first bound to an adaptor molecule, which is afterward bound to RNA.

In 1956, George Emil Palade of the Rockefeller Institute used electron microscopy to study subcellular particles rich in RNA (ribosomes). Ribosomes were found to consist of two subunits - a smaller subunit, with a molecular weight one million times the weight of a hydrogen atom, and a larger subunit with twice this weight.

It was shown by means of radioactive tracers that a newly synthesized protein molecule is attached temporarily to a ribosome, but neither of the two subunits of the ribosome seemed to act as a template for protein synthesis. Instead, Palade and his coworkers found that genetic information is carried from DNA to the ribosome by a messenger RNA molecule (mRNA). Electron microscopy revealed that mRNA passes through the ribosome like a punched computer tape passing through a tape-reader. It was found that the adapter molecules, whose existence Crick had postulated, were smaller molecules of RNA; and these were given the name "transfer RNA" (tRNA). It was shown that, as an mRNA molecule passes through a ribosome, amino acids attached to complementary tRNA adaptor molecules are added to the growing protein chain.

The relationship between DNA, RNA, the proteins and the smaller molecules of a cell was thus seen to be hierarchical: The cell's DNA controlled its proteins (through the agency of RNA); and the proteins controlled the synthesis and metabolism of the smaller molecules.

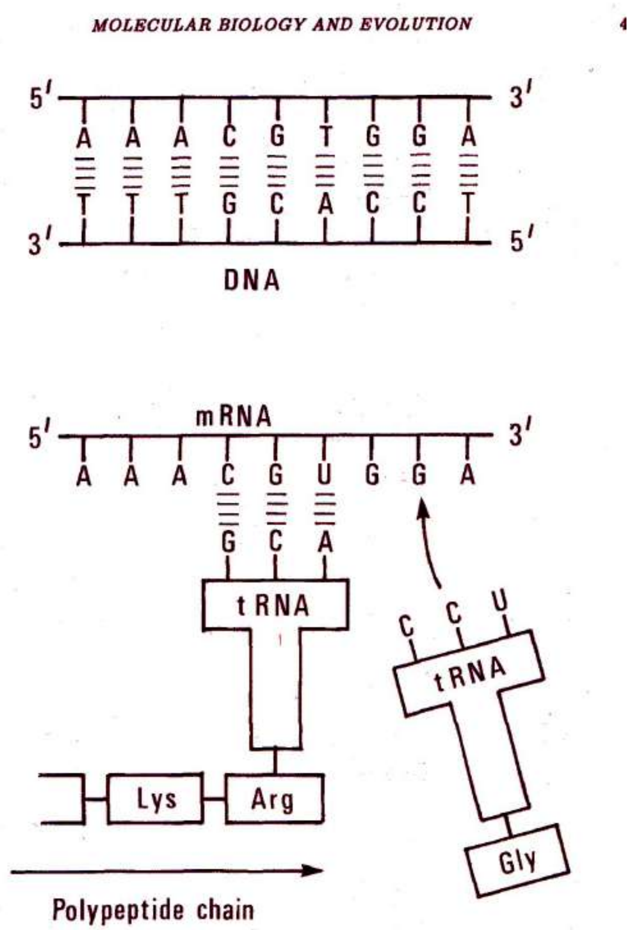

Figure 4.12: **Information coded on DNA molecules in the cell nucleus is transcribed to mRNA molecules. The messenger RNA molecules in turn provide information for the amino acid sequence in protein synthesis.**

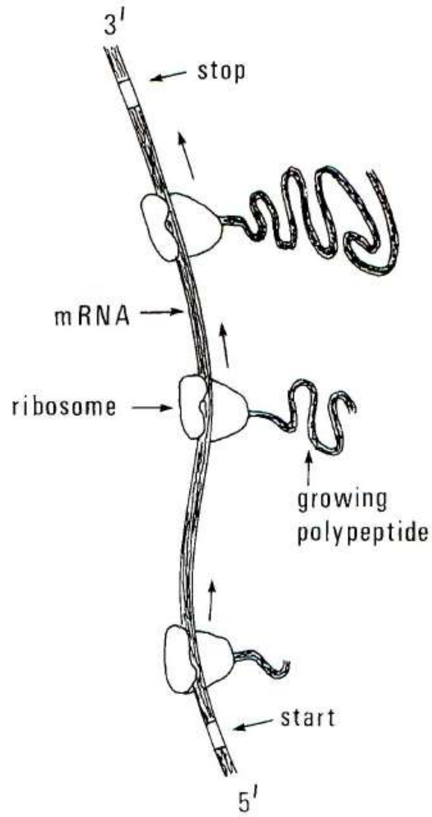

Figure 4.13: **mRNA passes through the ribosome like a punched computer tape passing through a tape-reader.**

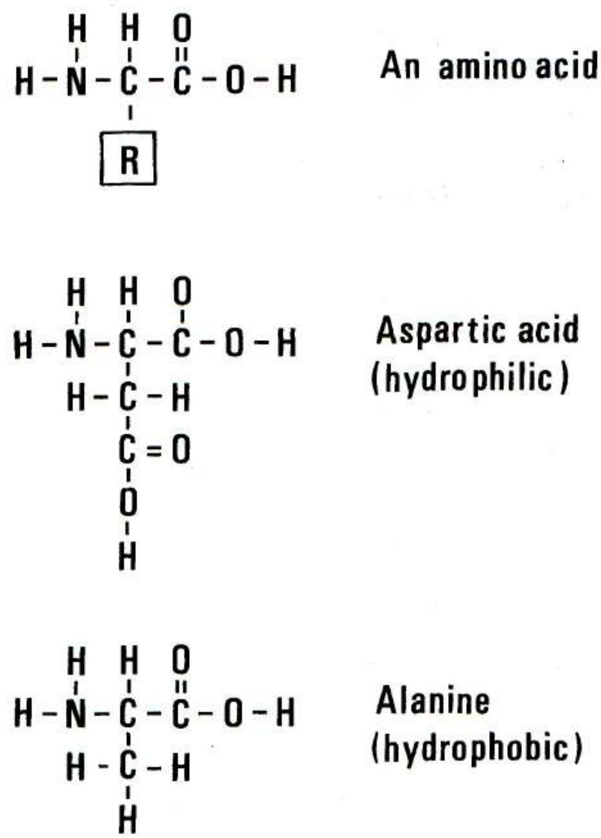

Figure 4.14: **This figure shows aspartic acid, whose residue (R) is hydrophilic, contrasted with alanine, whose residue is hydrophobic. A protein chain is formed from its constituent amino acids by removal of water so that a direct chain of the form -N-C-C-N-C-C-N-C-C-... is produced. The chain then folds in such a way that the hydrophilic residues are outermost while the hydrophobic residues are on the inside.**

4.6 The genetic code

In 1955, Severo Ochoa, at New York University, isolated a bacterial enzyme (RNA polymerase) which was able join the nucleotides A, G, U and C so that they became an RNA strand. One year later, this feat was repeated for DNA by Arthur Kornberg.

With the help of Ochoa's enzyme, it was possible to make synthetic RNA molecules containing only a single nucleotide - for example, one could join uracil molecules into the ribonucleic acid chain, ...U-U-U-U-U-U-... In 1961, Marshall Nirenberg and Heinrich Matthaei used synthetic poly-U as messenger RNA in protein synthesis; and they found that only polyphenylalanine was synthesized. In the same year, Sydney Brenner and Francis Crick reported a series of experiments on mutant strains of the bacteriophage, T4. The experiments of Brenner and Crick showed that whenever a mutation added or deleted either one or two base pairs, the proteins produced by the mutants were highly abnormal and non-functional. However, when the mutation added or subtracted three base pairs, the proteins often were functional. Brenner and Crick concluded that the genetic language has three-letter words (codons). With four different "letters", A, T, G and C, this gives sixty-four possible codons - more than enough to specify the twenty different amino acids.

In the light of the phage experiments of Brenner and Crick, Nirenberg and Matthaei concluded that the genetic code for phenylalanine is UUU in RNA and TTT in DNA. The remaining words in the genetic code were worked out by H. Gobind Khorana of the University of Wisconsin, who used other mRNA sequences (such as GUGUGU..., AAGAAGAAG... and GUUGUUGUU...) in protein synthesis. By 1966, the complete genetic code, specifying amino acids in terms of three-base sequences, was known. The code was found to be the same for all species studied, no matter how widely separated they were in form; and this showed that all life on earth belongs to the same family, as postulated by Darwin.

Table 4.1: **The genetic code**

TTT=Phe	TCT=Ser	TAT=Tyr	TGT=Cys
TTC=Phe	TCC=Ser	TAC=Tyr	TGC=Cys
TTA=Leu	TCA=Ser	TAA=Ter	TGA=Ter
TTG=Leu	TGC=Ser	TAG=Ter	TGG=Trp
CTT=Leu	CCT=Pro	CAT=His	CGT=Arg
CTC=Leu	CCC=Pro	CAC=His	CGC=Arg
CTA=Leu	CCA=Pro	CAA=Gln	CGA=Arg
CTG=Leu	CGC=Pro	CAG=Gln	CGG=Arg
ATT=Ile	ACT=Thr	AAT=Asn	AGT=Ser
ATC=Ile	ACC=Thr	AAC=Asn	AGC=Ser
ATA=Ile	ACA=Thr	AAA=Lys	AGA=Arg
ATG=Met	AGC=Thr	AAG=Lys	AGG=Arg
GTT=Val	GCT=Ala	GAT=Asp	GGT=Gly
GTC=Val	GCC=Ala	GAC=Asp	GGC=Gly
GTA=Val	GCA=Ala	GAA=Glu	GGA=Gly
GTG=Val	GGC=Ala	GAG=Glu	GGG=Gly

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Chapter 5

SOME 20TH CENTURY NOVELISTS

5.1 H.G. Wells

Scientist, prophet and social reformer

Herbert George Wells (1866-1946) was born into a very poor family in Kent, England. A defining moment in his life came when he was 8 years old. He had broken his leg, and his father brought him books from the local library to help him to pass the time that he was forced to spend in bed. Wells became an avid reader, and started his long process of self-education. He also began to see himself as a future writer.

Since his parents could not afford to support their children, they were apprenticed in trades. H.G. Wells spent three miserable years. from 1880 to 1883, as a draper's apprentice.

In 1883, when Wells was 17 years old, he was able to obtain a position as a student-teacher at Midhurst Grammar School. This allowed him to continue his self-education in earnest.

The following year, Wells won a scholarship to what would later become the Royal College of Science, which is now part of the Imperial College of Science and Technology. There he studied biology under Thomas Henry Huxley.[1]

Wells remained at the Royal College of Science until 1887, when he was 21. He entered the Royal College's Debating Society, and at this time he also began to attend lectures of the newly-formed Fabian Society, which took place at the home of William Morris. In this way, Wells began his lifelong commitment to social reform.

In 1893, when Wells was 27, he published his first book, a two-volume textbook on biology.

After leaving the Royal College of Science, where he had been supported by a scholarship, Wells had no source of income. Luckily, his Aunt Mary, his father's sister, invited

[1]Imperial College now has a Wells Society, commemorating his stay there, where one can hear lectures by distinguished pioneers in science, such as Grey Walter and J.Z. Young.

him to stay in her home, so at least he had a place to love. While there, Wells became interested in his cousin Isabel, whom he later married. To earn money during this period, Wells began writing short humorous articles for magazines, such as the Pall Mall Gazette. Many of these have been collected, but many others are now lost.

Women

Wells' marriage to his cousin Isabel lasted only until 1894. The couple separated because Wells had fallen in love with one of his students, Amy Catherine Robbins, with whom he moved into a rented house in Surrey. They were later married, and they had two sons.

The time in Surrey with Amy was a very productive one for Wells. During this period he wrote *The War of the Worlds* and *The Time Machine*, completed *The Island of Doctor Moreau*, wrote and published *The Wonderful Visit* and *The Wheels of Chance*, and began writing two other early books, *When the Sleeper Wakes* and *Love and Mr Lewisham.*

Wikipedia states that

"Wells had affairs with a significant number of women. In December 1909, he had a daughter, Anna-Jane, with the writer Amber Reeves, whose parents, William and Maud Pember Reeves, he had met through the Fabian Society. Amber had married the barrister G. R. Blanco White in July of that year, as co-arranged by Wells. After Beatrice Webb voiced disapproval of Wells' 'sordid intrigue' with Amber, he responded by lampooning Beatrice Webb and her husband Sidney Webb in his 1911 novel The New Machiavelli as 'Altiora and Oscar Bailey', a pair of short-sighted, bourgeois manipulators. Between 1910 and 1913, novelist Elizabeth von Arnim was one of his mistresses. In 1914, he had a son, Anthony West (1914-1987), by the novelist and feminist Rebecca West, 26 years his junior. In 1920-21, and intermittently until his death, he had a love affair with the American birth control activist Margaret Sanger.

"Between 1924 and 1933 he partnered with the 22-year younger Dutch adventurer and writer Odette Keun, with whom he lived in Lou Pidou, a house they built together in Grasse, France. Wells dedicated his longest book to her (The World of William Clissold, 1926). When visiting Maxim Gorky in Russia 1920, he had slept with Gorky's mistress Moura Budberg, then still Countess Benckendorf and 27 years his junior. In 1933, when she left Gorky and emigrated to London, their relationship renewed and she cared for him through his final illness. Wells asked her to marry him repeatedly, but Budberg strongly rejected his proposals."

Figure 5.1: **H.G. Wells (1866-1946).**

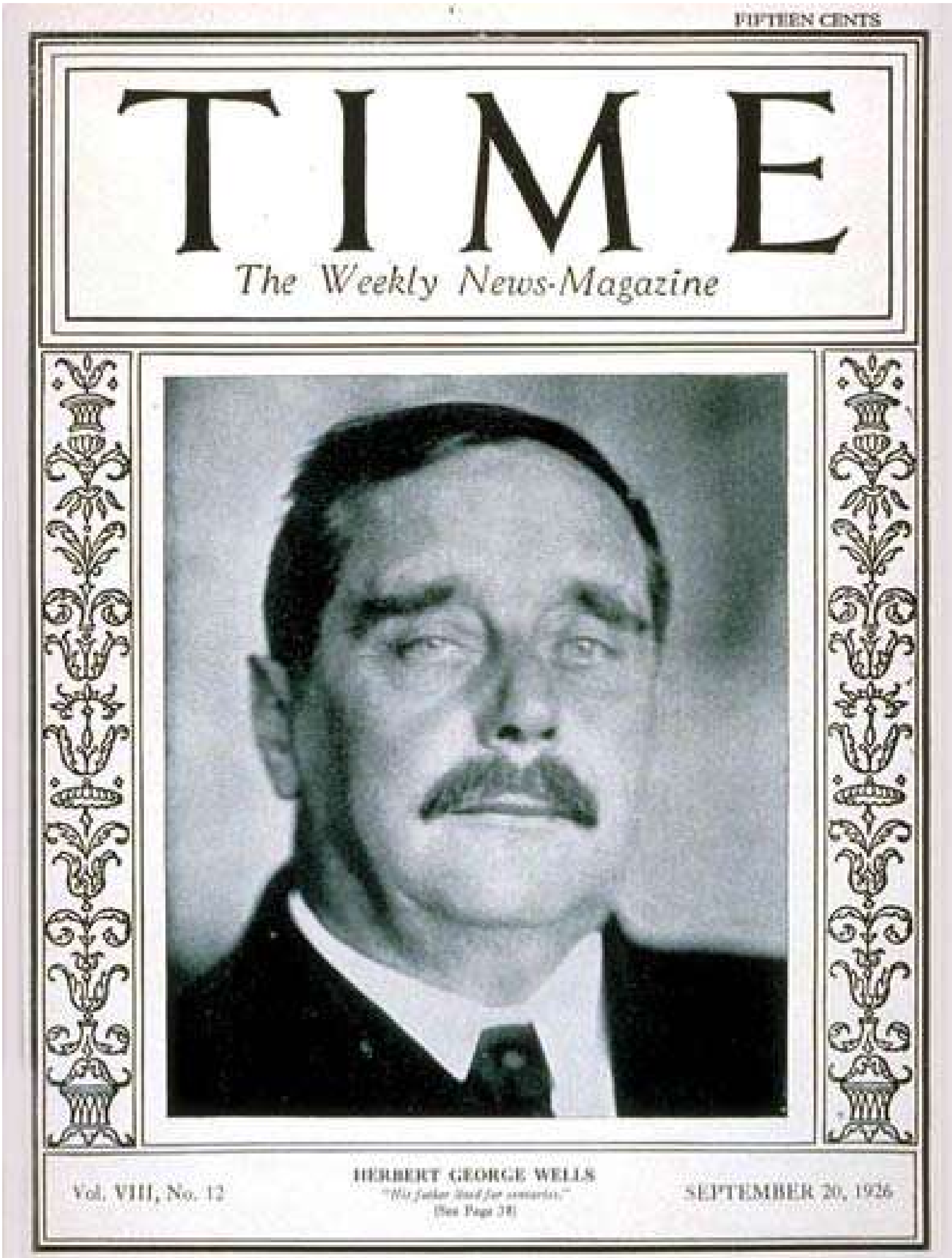

Figure 5.2: **H. G. Wells, one day before his 60th birthday, on the front cover of *Time* magazine, 20 September 1926.**

Figure 5.3: **Churchill avidly read Wells. An October 1906 Churchill speech was partly inspired by Wells' ideas of a supportive state as a "Utopia". Two days earlier, Churchill had written Wells: "I owe you a great debt.".**

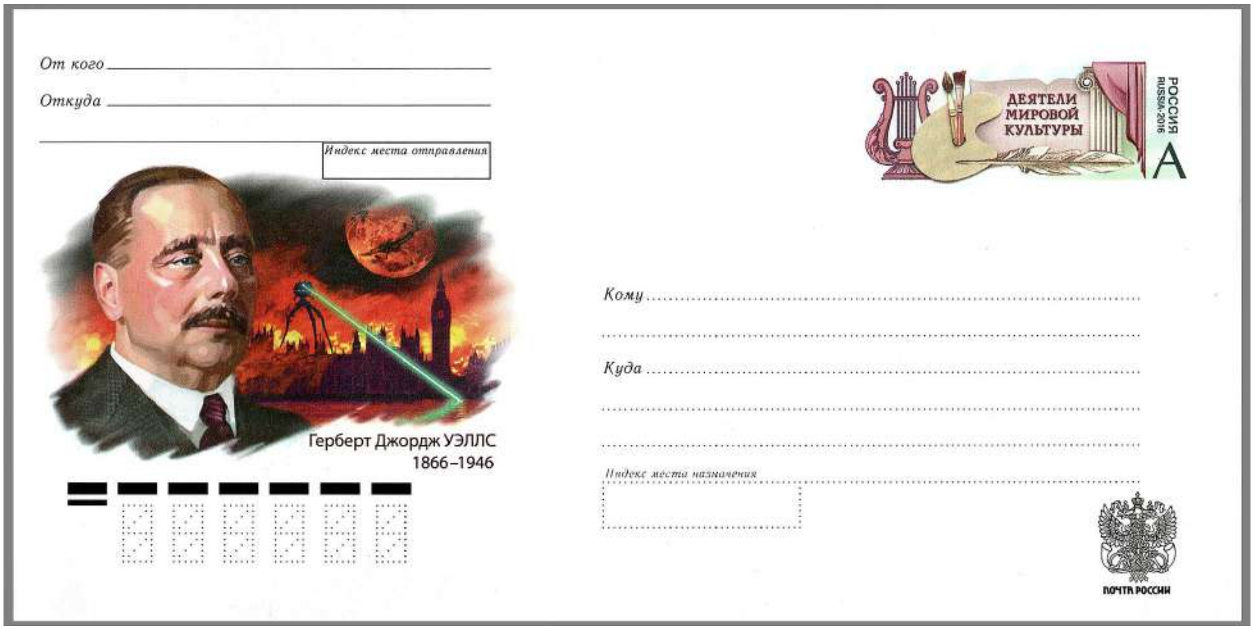

Figure 5.4: **2016 illustrated postal envelope with an image from *The War of the Worlds*, Russian Post, commemorating the 150th anniversary of the author's birth.**

The Shakespeare of science fiction

"During his own lifetime, however, he was most prominent as a forward-looking, even prophetic social critic who devoted his literary talents to the development of a progressive vision on a global scale. A futurist, he wrote a number of utopian works and foresaw the advent of aircraft, tanks, space travel, nuclear weapons, satellite television and something resembling the World Wide Web. His science fiction imagined time travel, alien invasion, invisibility, and biological engineering. Brian Aldiss referred to Wells as the "Shakespeare of science fiction". His most notable science fiction works include *The Time Machine* (1895), *The Island of Doctor Moreau* (1896), *The Invisible Man* (1897),*The War of the Worlds* (1898) and *The War in the Air* (1907). He was nominated for the Nobel Prize in Literature four times.

Wells' enormous literary output

Novels

- The Time Machine (1895). Fragments from the serial form in The New Review which were generally excluded in the book version can be found in the anthology edited by Philmus, 1975, as can the untitled version published in seven instalments in the National Observer 17 March - 23 June 1984.[2]
- The Wonderful Visit (1895)

- The Island of Doctor Moreau (1896)
- The Wheels of Chance (1896)
- The Invisible Man (1897)
- The War of the Worlds (1898)
- When the Sleeper Wakes (1899)
- Love and Mr Lewisham (1900)
- The First Men in the Moon (1901)
- The Sea Lady (1902)
- The Food of the Gods and How It Came to Earth (1904)
- Kipps (1905)
- A Modern Utopia (1905)
- In the Days of the Comet (1906)
- The War in the Air (1908)
- Tono-Bungay (1909)
- Ann Veronica (1909)
- The History of Mr Polly (1910)
- The Sleeper Awakes (1910) - revised edition of When the Sleeper Wakes (1899)
- The New Machiavelli (1911)
- Marriage (1912)
- The Passionate Friends (1913)
- The Wife of Sir Isaac Harman (1914)
- The World Set Free (1914)
- Bealby: A Holiday (1915)
- Boon (1915) (as Reginald Bliss)
- The Research Magnificent (1915)
- Mr Britling Sees It Through (1916)
- The Soul of a Bishop (1917)
- Joan and Peter: The Story of an Education (1918)
- The Undying Fire (1919)
- The Secret Places of the Heart (1922)
- Men Like Gods (1923)
- The Dream (1924)
- Christina Alberta's Father (1925)
- The World of William Clissold (1926)
- Meanwhile (1927)
- Mr. Blettsworthy on Rampole Island (1928)
- The Autocracy of Mr. Parham (1930)
- The Bulpington of Blup (1932)
- The Shape of Things to Come (1933)
- The Croquet Player (1936)
- Brynhild (1937)
- Star Begotten (1937)
- The Camford Visitation (1937), novella

- Apropos of Dolores (1938)
- The Brothers (1938)
- The Holy Terror (1939)
- Babes in the Darkling Wood (1940)
- All Aboard for Ararat (1940)
- You Can't Be Too Careful (1941)

Short stories

- "A Tale of the Twentieth Century" (Science Schools Journal, no. 6, May 1887) - signed S.B. for Septimus Browne[2]
- "A Talk with Gryllotalpa" (Science Schools Journal, no. 3, February 1887) - published under the pseudonym Septimus Browne[2]
- "A Vision of the Past" (Science Schools Journal, no. 7, June 1887) - signed S.S. for "Sosthenes Smith" [2][3]
- "The Chronic Argonauts" (a.k.a. "Chronic Argonaut", a.k.a. "The Chronic Argonaughts") (Science Schools Journal, nos. 17-19, April-June 1888), novelette - the earliest version of The Time Machine.[4]
- "The Devotee of Art" (Science Schools Journal, nos. 24-25, Nov.-Dec. 1888)
- "Æpyornis Island" (Pall Mall Budget, 13 December 1894)
- "A Deal in Ostriches" (Pall Mall Gazette, 20 December 1894)
- "A Family Elopement" (The St. James's Gazette, 3 March 1894)
- "A Misunderstood Artist" (Pall Mall Gazette, 29 October 1894)
- "How Gabriel Became Thompson" (Truth, 26 July 1894)
- "In the Avu Observatory" (Pall Mall Budget, 9 August 1894)
- "In the Modern Vein" (a.k.a. "In the Modern Vein: An Unsympathetic Love Story", a.k.a. "A Bardlet's Romance") (Truth, 8 March 1894)
- "The Diamond Maker" (Pall Mall Budget, 16 August 1894)
- "The Flowering of the Strange Orchid" (a.k.a. "The Strange Orchid") (Pall Mall Budget, 2 August 1894)
- "The Hammerpond Park Burglary" (Pall Mall Budget, 5 July 1894)
- "The Jilting of Jane" (Pall Mall Budget, 12 July 1894)
- "The Lord of the Dynamos" (Pall Mall Budget, 6 September 1894)
- "The Man With a Nose" (Pall Mall Gazette, 6 Feb. 1894)
- "The Stolen Bacillus" (Pall Mall Budget, 21 June 1894)
- "The Thing in No. 7" (Pall Mall Budget, 25 October 1894)
- "The Thumbmark" (Pall Mall Budget, 28 June 1894)
- "The Treasure in the Forest" (Pall Mall Budget, 23 August 1894)
- "The Triumphs of a Taxidermist" (Pall Mall Gazette, 3-15 March 1894)
- "Through a Window" (a.k.a. "At a Window") (Black and White, 25 August 1894)
- "A Catastrophe" (New Budget, 4 April 1895)
- "How Pingwill Was Routed" (New Budget, 27 June 1895)
- "Le Mari Terrible" (New Budget, 23 May 1895)

- "Our Little Neighbour" (New Budget, 4 April 1895)
- "Pollock and the Porroh Man" (New Budget, 23 May 1895)
- "The Argonauts of the Air" (The Phil May's Annual, December 1895)
- "The Cone" (Unicorn, 18 September 1895)
- "The Flying Man" (Pall Mall Gazette, 4 January 1895)
- "The Moth" (a.k.a. "A Moth - Genus Novo") (Pall Mall Gazette, 28 March 1895)
- "The Reconciliation" (a.k.a. "The Bulla") (The Weekly Sun Literary Supplement, 1 December 1895)
- "The Remarkable Case of Davidson's Eyes" (a.k.a. "The Story of Davidson's Eyes") (Pall Mall Budget, 28 March 1895)
- "The Sad Story of a Dramatic Critic" (a.k.a. "The Obliterated Man") (New Budget, 15 August 1895)
- "The Temptation of Harringay" (The St. James's Gazette, 9 February 1895)
- "Wayde's Essence" (New Budget, 18 April 1895)
- "A Slip Under the Microscope" (The Yellow Book, January 1896)
- "In the Abyss" (Pearson's Magazine, 1 August 1896)
- "The Apple" (The Idler, October 1896)
- "The Plattner Story" (The New Review, April 1896)
- "The Purple Pileus" (Black and White, December 1896)
- "The Rajah's Treasure" (Pearson's Magazine, July 1896)
- "The Red Room" (a.k.a. "The Ghost of Fear") (The Idler, March 1896)
- "The Sea Raiders" (a.k.a. "The Sea-Raiders") (The Weekly Sun Literary Supplement, 6 December 1896)
- "The Story of the Late Mr. Elvesham" (The Idler, May 1896)
- "Under the Knife" (a.k.a. "Slip Under the Knife") (The New Review, January 1896)
- "A Perfect Gentleman on Wheels" (Woman at Home, April 1897)
- "A Story of the Stone Age" (a.k.a. "Stories of the Stone Age") (The Idler, May-September 1897), novella
- "Mr Marshall's Doppelganger" (Gentlewoman, 18 September 1897)
- "The Crystal Egg" (The New Review, May 1897)
- "The Lost Inheritance" (The Plattner Story and Others., May 1897)
- "The Presence by the Fire" (Penny Illustrated Paper, 14 August 1897)
- "The Star" (The Graphic, December 1897)
- "Jimmy Goggles the God" (The Graphic, December 1898)
- "Miss Winchelsea's Heart" (The Queen, October 1898)
- "Mr. Ledbetter's Vacation" (a.k.a. "Mr Ledbetter's Vacation") (The Strand Magazine, October 1898)
- "The Man Who Could Work Miracles" (a.k.a. "The Man Who Could Work Miracles: A Pantoum in Prose", a.k.a. "Man Who Could Work Miracles") (Illustrated London News, July 1898)
- "The Stolen Body" (The Strand Magazine, November 1898)
- "The Stolen Body" was reprinted in Weird Tales in November 1925
- "Walcote" (Science Schools Journal, nos. 25-26, Dec. 1898 - Jan. 1899)

- ”A Story of the Days to Come” (Pall Mall Magazine, June-October 1899), novella
- ”A Vision of Judgment” (a.k.a. ”A Vision of Judgement”) (The Butterfly, September 1899)
- ”Mr. Brisher’s Treasure” (a.k.a. ”Mr Brisher’s Treasure”) (The Strand Magazine, April 1899)
- ”A Dream of Armageddon” (Black and White Budget, 25 May 1901)
- ”Filmer” (The Graphic, December 1901)
- ”The New Accelerator” (The Strand Magazine, December 1901)
- ”The Inexperienced Ghost” (a.k.a. ”The Story of the Inexperienced Ghost”) (The Strand Magazine, March 1902)
- ”The Loyalty of Esau Common” (The Contemporary Review, February 1902)
- ”Mr. Skelmersdale in Fairyland” (a.k.a. ”Mr Skelmersdale in Fairyland”) (London Magazine, February 1903)
- ”The Land Ironclads” (The Strand Magazine, December 1903)
- ”The Magic Shop” (The Strand Magazine, June 1903)
- ”The Truth About Pyecraft” (The Strand Magazine, April 1903)
- ”The Valley of Spiders” (The Strand Magazine, March 1903)
- ”The Country of the Blind” (The Strand Magazine, April 1904; revised, 1939), novelette
- ”The Empire of the Ants” (a.k.a. ”Empire of the Ants”) (The Strand Magazine, December 1905)
- ”The Door in the Wall” (1906)
- ”The Beautiful Suit” (a.k.a. ”A Moonlight Fable”) (Collier’s Weekly, April 1909)
- ”Little Mother Up the MÃ¶rderberg” (The Strand Magazine, April 1910), Little Mother series 2
- ”My First Aeroplane” (The Strand Magazine, January 1910), Little Mother series 1
- ”The Story of the Last Trump” (Boon, 1915)
- ”The Wild Asses of the Devil” (Boon, 1915)
- ”Peter Learns Arithmetic” (1918)
- ”The Invasion from Mars” (1920)
- ”The Grisly Folk” (Storyteller Magazine, April 1921), essay
- ”Into the Abyss” (1923)
- ”The Pearl of Love” (The Strand Magazine, January 1925)
- ”The Adventures of Tommy” (1928)
- ”A Woman’s Heart” (1931)
- ”The Queer Story of Brownlow’s Newspaper” (The Strand Magazine, February 1932)
- ”Answer to Prayer” (The New Statesman, 10 April 1937)
- ”Depouillement - the Door in the Wall” (1953, published posthumously)
- ”The Desert Daisy” (1957, published posthumously)
- ”The Haunted Ceiling” (2016, published posthumously)[

Collections and uncollected short stories

- Select Conversations with an Uncle (Now Extinct) and Two Other Reminiscences (1895), collection of 14 short stories:
- "Of Conversation and The Anatomy of Fashion", "The Theory of The Perpetual Discomfort of Humanity", "The Use of Ideals", "The Art of Being Photographed", "Bagshot's Mural Decorations", "On Social Music", "The Joys of Being Engaged", "La Belle Dame Sans Merci", "On a Tricycle", "An Unsuspected Masterpiece", "The Great Change", "The Pains of Marriage", "A Misunderstood Artist", "The Man with a Nose"
- The Stolen Bacillus and Other Incidents (1895),[6] collection of 15 short stories:
- "The Stolen Bacillus", "The Flowering of the Strange Orchid", "In the Avu Observatory", "The Triumphs of a Taxidermist", "A Deal in Ostriches", "Through a Window", "The Temptation of Harringay", "The Flying Man", "The Diamond Maker", " Æpyornis Island", "The Remarkable Case of Davidson's Eyes", "The Lord of the Dynamos", "The Hammerpond Park Burglary", "The Moth", "The Treasure in the Forest"
- The Plattner Story and Others (1897),[7] collection of 17 short stories:
- "The Plattner Story", "The Argonauts of the Air", "The Story of the Late Mr. Elvesham", "In the Abyss", "The Apple", "Under the Knife", "The Sea Raiders", "Pollock and the Porroh Man", "The Red Room", "The Cone", "The Purple Pileus", "The Jilting of Jane", "In the Modern Vein", "A Catastrophe", "The Lost Inheritance", "The Sad Story of a Dramatic Critic", "A Slip Under the Microscope"
- Thirty Strange Stories (1897),[8] collection of 30 short stories:
- " Æpyornis Island", "In the Abyss", "The Lord of the Dynamos", "The Moth", "The Plattner Story", "Pollock and the Porroh Man", "The Remarkable Case of Davidson's Eyes", "The Story of the Late Mr. Elvesham", "The Argonauts of the Air", "In the Avu Observatory", "The Stolen Bacillus", "The Triumphs of a Taxidermist", "The Apple", "The Red Room", "The Cone", "The Purple Pileus", "The Jilting of Jane", "A Catastrophe", "The Lost Inheritance", "The Sad Story of a Dramatic Critic", "A Slip Under the Microscope", "The Treasure in the Forest", "A Deal in Ostriches", "The Sea-Raiders", "In the Modern Vein: An Unsympathetic Love Story", "The Reconciliation", "Le Mari Terrible", "The Rajah's Treasure", "The Strange Orchid", "Slip Under the Knife"
- Tales of Space and Time (1899),[9] collection of 3 short stories and 2 novellas:
- "The Crystal Egg", "The Star", "A Story of the Stone Age" (novella), "A Story of the Days to Come" (novella), "The Man Who Could Work Miracles"
- Twelve Stories and a Dream (1903),[10] collection of 13 short stories:
- "Filmer", "The Magic Shop", "The Valley of Spiders", "The Truth About Pyecraft", "Mr. Skelmersdale in Fairyland", "The Inexperienced Ghost", "Jimmy Goggles the God", "The New Accelerator", "Mr. Ledbetter's Vacation", "The Stolen Body", "Mr. Brisher's Treasure", "Miss Winchelsea's Heart", "A Dream of Armageddon"
- The Country of the Blind and Other Stories, or The Country of the Blind, and Other Stories (1911), collection of 32 short stories and 1 novelette:

- "The Jilting of Jane", "The Cone", "The Stolen Bacillus", "The Flowering of the Strange Orchid", "In the Avu Observatory", " Æpyornis Island", "The Remarkable Case of Davidson's Eyes", "The Lord of the Dynamos", "The Moth", "The Treasure in the Forest", "The Story of the Late Mr. Elvesham", "Under the Knife", "The Sea Raiders", "The Obliterated Man", "The Plattner Story", "The Red Room", "The Purple Pileus", "A Slip Under the Microscope", "The Crystal Egg", "The Star", "The Man Who Could Work Miracles", "A Vision of Judgment", "Jimmy Goggles the God", "Miss Winchelsea's Heart", "A Dream of Armageddon", "The Valley of Spiders", "The New Accelerator", "The Truth About Pyecraft", "The Magic Shop", "The Empire of the Ants", "The Door in the Wall", "The Country of the Blind" (novelette), "The Beautiful Suit"
- The Door in the Wall and Other Stories (1911), collection of 7 short stories and 1 novelette:
- "The Door in the Wall", "The Star", "A Dream of Armageddon", "The Cone", "A Moonlight Fable", "The Diamond Maker", "The Lord of the Dynamos", "The Country of the Blind" (novelette)
- Tales of the Unexpected (1922), collection of 15 short stories:
- "The Remarkable Case of Davidson's Eyes", "The Moth", "The Story of the Late Mr. Elvesham", "Under the Knife", "The Plattner Story", "The Crystal Egg", "The Man Who Could Work Miracles", "A Dream of Armageddon", "The New Accelerator", "The Door in the Wall", "The Apple", "The Temptation of Harringay", "Mr. Skelmersdale in Fairyland", "The Inexperienced Ghost", "The Stolen Body"
- Tales of Wonder (1923), collection of 16 short stories and 1 novelette:
- "Into the Abyss", "Pollock and the Porroh Man", "The Triumphs of a Taxidermist", "In the Avu Observatory", "The Flowering of the Strange Orchid", " Æpyornis Island", "The Sea Raiders", "The Red Room", "The Purple Pileus", "The Star", "A Vision of Judgment", "The Valley of Spiders", "The Truth of Pyecraft, "The Magic Shop", "The Empire of the Ants", "The Country of the Blind" (novelette), "The Beautiful Suit"
- The Country of the Blind (1923), collection of 2 short stories and 1 novelette:
- "The Country of the Blind" (novelette), "The Truth About Pyecraft", "The Beautiful Suit"
- Tales of Life and Adventure (1923), collection of 21 short stories:
- "The Argonauts of the Air", "In the Modern Vein: An Unsympathetic Love Story", "A Catastrophe", "The Lost Inheritance", "A Deal in Ostriches", "Through a Window", "The Flying Man", "The Diamond Maker", "The Hammerpond Park Burglary", "The Jilting of Jane", "The Cone", "The Stolen Bacillus", "The Lord of the Dynamos", "The Treasure in the Forest", "The Obliterated Man", "A Slip Under the Microscope", "Jimmy Goggles the God", "Miss Winchelsea's Heart", "Filmer", "Mr. Ledbetter's Vacation", "Mr. Brisher's Treasure"
- The Empire of the Ants and Other Stories (1925), collection of 3 short stories:
- "The Empire of the Ants", "The Remarkable Case of Davidson's Eyes", "The Cone"
- The Obliterated Man and Other Stories (1925), collection of 4 short stories:

- "The Obliterated Man", "The Plattner Story", "The Red Room", "A Vision of Judgment"
- The Stolen Bacillus and Other Stories (1925), collection of 5 short stories:
- "The Jilting of Jane", " Æpyornis Island", "In the Avu Observatory", "The Flowering of the Strange Orchid", "The Stolen Bacillus"
- The Country of the Blind and Other Stories (1926), collection of 8 short stories, 2 novelettes and 1 essay:
- "The Country of the Blind" (novelette), "The Door in the Wall", "The Beautiful Suit", "The Empire of the Ants", "The Land Ironclads" (novelette), "The Grisly Folk" (essay), "Little Mother Up the MÃ¶rderberg" (Little Mother series 2), "My First Aeroplane" (Little Mother series 1), "A Vision of Judgment", "The Story of the Last Trump", "The Pearl of Love"
- The Short Stories of H. G. Wells, or The Famous Short Stories of H. G. Wells, or The Complete Short Stories of H. G. Wells (1927), collection of 1 novel, 57 short stories, 4 novelettes/novellas and 1 essay:
- The Time Machine (novel), "The Empire of the Ants", "A Vision of Judgement", "The Land Ironclads" (novelette), "The Beautiful Suit", "The Door in the Wall", "The Pearl of Love", "The Country of the Blind" (novelette), "The Stolen Bacillus", "The Flowering of the Strange Orchid", "In the Avu Observatory", "The Triumphs of a Taxidermist", "A Deal in Ostriches", "Through a Window", "The Temptation of Harringay", "The Flying Man", "The Diamond Maker", " Æpyornis Island", "The Remarkable Case of Davidson's Eyes", "The Lord of the Dynamos", "The Hammerpond Park Burglary", "The Moth", "The Treasure in the Forest", "The Plattner Story", "The Argonauts of the Air", "The Story of the Late Mr. Elvesham", "In the Abyss", "The Apple", "Under the Knife", "The Sea-Raiders", "Pollock and the Porroh Man", "The Red Room", "The Cone", "The Purple Pileus", "The Jilting of Jane", "In the Modern Vein: An Unsympathetic Love Story", "A Catastrophe", "The Lost Inheritance", "The Sad Story of a Dramatic Critic", "A Slip Under the Microscope", "The Reconciliation", "My First Aeroplane" (Little Mother series 1), "Little Mother Up the MÃ¶rderberg" (Little Mother series 2), "The Story of the Last Trump", "The Grisly Folk" (essay), "The Crystal Egg", "The Star", "A Story of the Stone Age" (novella), "A Story of the Days to Come" (novella), "The Man Who Could Work Miracles", "Filmer", "The Magic Shop", "The Valley of Spiders", "The Truth About Pyecraft", "Mr. Skelmersdale in Fairyland", "The Inexperienced Ghost", "Jimmy Goggles the God", "The New Accelerator", "Mr. Ledbetter's Vacation", "The Stolen Body", "Mr. Brisher's Treasure", "Miss Winchelsea's Heart", "A Dream of Armageddon"
- The Treasure in the Forest and Other Stories (1929), collection
- The Valley of Spiders (1930), collection
- Selections from the Early Prose Works of H. G. Wells (1931), collection of 4 extracts from novels, 1 short story and 1 novelette:
- "The Martians Come to Earth" (extract from The War of the Worlds), "The Giant Rats" (extract from The Food of the Gods), "The Invisible Man Explains" (extract

from The Invisible Man), "There and Back Again" (extract from The Time Machine), "The New Accelerator", "The Land Ironclads" (novelette)
- The Man Who Could Work Miracles (1931), collection of 3 short stories:
- "The Man Who Could Work Miracles", "The Door in the Wall", "The Sea Raiders"
- The Stolen Body and Other Tales of the Unexpected (1931), collection of 13 short stories:
- "The Stolen Body", "The Remarkable Case of Davidson's Eyes", "The Moth", "The Story of the Late Mr. Elvesham", "Under the Knife", "The Plattner Story", "The Crystal Egg", "The Man Who Could Work Miracles", "A Dream of Armageddon", "The New Accelerator", "The Door in the Wall", "The Apple", "The Inexperienced Ghost"
- The Treasure in the Forest and Other Stories (1931), collection of 3 short stories:
- "The Treasure in the Forest", "The Late Mr. Elvesham", "Under the Knife"
- A Slip Under the Microscope (1931), collection of 2 short stories:
- "The Crystal Egg", "A Slip Under the Microscope"
- A Woman's Heart and Other Stories (1931), collection of 2 short stories:
- "A Woman's Heart", "A Dream of Armageddon"
- The Valley of Spiders and Other Stories (1931), collection of 3 short stories:
- "The Valley of Spiders", "The New Accelerator", "The Moth"
- The Favorite Short Stories of H. G. Wells, or The Famous Short Stories of H. G. Wells (1937), collection of 1 novel, 28 short stories and 2 novelettes:
- "A Deal in Ostriches", "A Vision of Judgement", "In the Abyss", "In the Avu Observatory", "Pollock and the Porroh Man", "The Apple", "The Argonauts of the Air", "The Beautiful Suit", "The Country of the Blind" (novelette), "The Diamond Maker", "The Door in the Wall", "The Empire of the Ants", "The Flowering of the Strange Orchid", "The Flying Man", "The Hammerpond Park Burglary", "The Land Ironclads" (novelette), "The Lord of the Dynamos", "The Moth", "The Pearl of Love", "The Plattner Story", "The Remarkable Case of Davidson's Eyes", "The Sea-Raiders", "The Stolen Bacillus", "The Story of the Late Mr. Elvesham", "The Temptation of Harringay", The Time Machine (novel), "The Treasure in the Forest", "The Triumphs of a Taxidermist", "Through a Window", "Under the Knife", " Æpyornis Island"
- Short Stories: First Series (1940), collection of 13 short stories:
- "The Truth About Pyecraft", "The Man Who Could Work Miracles", "The Star", "The New Accelerator", "The Story of the Late Mr. Elvesham", "The Door in the Wall", "The Magic Shop", "The Plattner Story", "The Flowering of the Strange Orchid", "The Red Room", "The Temptation of Harringay", "The Inexperienced Ghost", "The Beautiful Suit"
- Short Stories: Second Series (1940), collection
- Two Film Stories: Things to Come / The Man Who Could Work Miracles (1940), collection of 1 screenplay from novel and 1 short story:
- Things to Come (screenplay from The Shape of Things to Come), "Man Who Could Work Miracles"

- The Truth About Pyecraft and Other Short Stories (1943), collection
- The Man Who Could Work Miracles (1943), collection of 3 short stories:
- "The Man Who Could Work Miracles", "The Hammerpond Park Burglary", "The Apple"
- The Truth About Pyecraft and Other Stories (1944), collection
- The Time Machine: An Invention and Other Stories (1946), collection of 1 novel and 14 short stories:
- The Time Machine (novel), "The Stolen Bacillus", "A Deal in Ostriches", "Through a Window", "The Flying Man", "The Diamond Maker", "The Lord of the Dynamos", "The Hammerpond Park Burglary", "The Argonauts of the Air", "The Cone", "A Catastrophe", "A Slip Under the Microscope", "Filmer", "Jimmy Goggles the God", "The Man Who Could Work Miracles: A Pantoum in Prose"
- The Country of the Blind and Other Stories (1947), collection of 3 short stories and 1 novelette:
- "The Country of the Blind" (novelette), "The Door in the Wall", "The Truth About Pyecraft", "A Deal in Ostriches"
- 28 Science Fiction Stories of H. G. Wells (1952), collection of 2 novels, 22 short stories and 4 novelettes/novellas:
- Men Like Gods (novel), "The Empire of the Ants", "The Land Ironclads" (novelette), "The Country of the Blind" (novelette), "The Stolen Bacillus", "The Flowering of the Strange Orchid", "In the Avu Observatory", "A Story of the Stone Age" (novella), " Æpyornis Island", "The Remarkable Case of Davidson's Eyes", "The Plattner Story", "The Argonauts of the Air", "The Story of the Late Mr. Elvesham", "In the Abyss", Star Begotten (novel), "Under the Knife", "The Sea Raiders", "The Crystal Egg", "The Star", "The Man Who Could Work Miracles", "Filmer", "A Story of the Days to Come" (novella), "The Magic Shop", "The Valley of Spiders", "The Truth About Pyecraft", "The New Accelerator", "The Stolen Body", "A Dream of Armageddon"
- Seven Stories (1953), collection of 7 short stories:
- "Depouillement - the Door in the Wall", "The Moth", "The Apple", "The Purple Pileus", "The New Accelerator", "The Inexperienced Ghost", "The Man Who Could Work Miracles"
- Two Tales (1956), collection of 2 short stories:
- "The Truth About Pyecraft", "The Man Who Could Work Miracles"
- Selected Short Stories (1958), collection of 1 novel, 17 short stories, 2 novelettes and 1 essay:
- The Time Machine (novel), "The Land Ironclads" (novelette), "The Door in the Wall", "The Country of the Blind" (novelette), "The Stolen Bacillus", "The Diamond Maker", "Aepyornis Island", "The Remarkable Case of Davidson's Eyes", "The Lord of the Dynamos", "The Plattner Story", "The Argonauts of the Air", "In the Abyss", "Under the Knife", "The Sea Raiders", "The Cone", "The Purple Pileus", "The Grisly Folk" (essay), "The Man Who Could Work Miracles", "The Truth About Pyecraft", "Jimmy Goggles the God", "The New Accelerator"
- Best Stories of H. G. Wells (1960), collection of 14 short stories and 2 novelettes/novellas:

- "The Lord of the Dynamos", "The Plattner Story", "The Argonauts of the Air", "The Story of the Late Mr. Elvesham", "The Crystal Egg", "The Star", "The Man Who Could Work Miracles", "The Sea-Raiders", "The Magic Shop", "The Valley of Spiders", "The Truth About Pyecraft", "The Land Ironclads" (novelette), "Mr. Skelmersdale in Fairyland", "The New Accelerator", "A Dream of Armageddon", "A Story of the Days to Come" (novella)
- The Time Machine and Other Stories (1963), collection of 1 novel, 2 short stories and 1 novelette:
- The Time Machine (novel), "The Empire of the Ants", "The Country of the Blind" (novelette), "The Man Who Could Work Miracles"
- The Valley of Spiders (1964), collection of 13 short stories:
- "Pollock and the Porroh Man", "In the Avu Observatory", "The Flowering of the Strange Orchid", "The Red Room", "The Valley of Spiders", "The Empire of the Ants", "The Moth", "The Story of the Late Mr. Elvesham", "The Temptation of Harringay", "The Inexperienced Ghost", "The Stolen Body", "The Crystal Egg", "The Door in the Wall"
- The Cone (1965), collection of 12 short stories:
- "The Cone", "Jimmy Goggles the God", "The Beautiful Suit", "Under the Knife", "The Lord of the Dynamos", "Through a Window", "The Star", "A Dream of Armageddon", "The Treasure in the Forest", "The Apple", " Æpyornis Island", "Mr. Skelmersdale in Fairyland"
- The Inexperienced Ghost and Nine Other Stories (1965), collection of 9 short stories and 1 novelette:
- "The Inexperienced Ghost", "The Magic Shop", "The Country of the Blind" (novelette), "The Apple", "The Stolen Body", "A Slip Under the Microscope", "The Purple Pileus", "Pollock and the Porroh Man", "The Man Who Could Work Miracles", "The Flowering of the Strange Orchid"
- Best Science Fiction Stories of H. G. Wells, or The Best Science Fiction Stories of H. G. Wells (1966), collection of 1 novel and 17 short stories:
- " Æpyornis Island", "The Crystal Egg", "In the Abyss", "The Lord of the Dynamos", "The Man Who Could Work Miracles", "The New Accelerator", "The Plattner Story", "The Remarkable Case of Davidson's Eyes", "The Star", "A Dream of Armageddon", "Filmer", "In the Avu Observatory", "The Diamond Maker", "The Apple", "The Purple Pileus", "The Sea-Raiders", "The Strange Orchid", The Invisible Man (novel)
- Early Writings in Science and Science Fiction (1975), collection of 1 novel, 1 extract from novel, 2 short stories and 24 essays:
- "A Talk with Gryllotalpa", "The Rediscovery of the Unique" (essay), "Flat Earth Again" (essay), "The Limits of Individual Plasticity" (essay), "On Comparative Theology" (essay), The Time Machine (novel), "The Time Machine" (extract from The Time Machine), "The "Cyclic" Delusion" (essay), "The Visibility of Change in the Moon" (essay), "The Possible Individuality of Atoms" (essay), "The Biological Problem of To-day" (essay), "The Rate of Change in Species" (essay), "The Duration of

Life" (essay), "Death" (essay), "Concerning Skeletons" (essay), "Another Basis for Life" (essay), "A Vision of the Past", "Zoological Retrogression" (essay), "On Extinction" (essay), "Life in the Abyss" (essay), "Intelligence on Mars" (essay), "Ancient Experiments in Co-Operation" (essay), "Province of Pain" (essay), "The Sun God and the Holy Stars" (essay), "Bye-Products in Evolution" (essay), "Bio-Optimism" (essay), "Human Evolution, an Artificial Process" (essay), "Morals and Civilisation" (essay)

- The Time Machine (1975), collection of 1 novel and 1 short story:
- The Time Machine (novel), "The Man Who Could Work Miracles"
- Empire of the Ants and 8 Other Science Fiction Stories (1977), collection of 9 short stories:
- "The Crystal Egg", "The Man Who Could Work Miracles", "The Plattner Story", "A Dream of Armageddon", "Aepyornis Island", "In the Abyss", "The Sea Raiders", "Filmer", "Empire of the Ants"
- The Empire of the Ants (and Other Stories) (1977), collection of 4 short stories and 1 novelette:
- "The Empire of the Ants", "The Country of the Blind" (novelette), "The Crystal Egg", "The Man Who Could Work Miracles", "The Magic Shop"
- The Man with the Nose and Other Uncollected Stories of H. G. Wells (1984), collection The Country of the Blind and Other Science-Fiction Stories (1997), collection of 5 short stories and 1 novelette:
- "The Country of the Blind" (revised novelette), "The Star", "The New Accelerator", "The Remarkable Case of Davidson's Eyes", "Under the Knife", "The Queer Story of Brownlow's Newspaper"
- The Inexperienced Ghost (1998), collection of 2 short stories:
- "The Inexperienced Ghost", "The Temptation of Harringay"
- The Red Room and Other Stories (1998), collection
- Selected Stories of H. G. Wells (2004), collection of 24 short stories and 2 novelettes:
- "A Slip Under the Microscope", "The Remarkable Case of Davidson's Eyes", "The Plattner Story", "Under the Knife", "The Crystal Egg", "The New Accelerator", "The Stolen Body", "The Argonauts of the Air", "In the Abyss", "The Star", "The Land Ironclads" (novelette), "A Dream of Armageddon", "The Lord of the Dynamos", "The Valley of Spiders", "The Story of the Late Mr. Elvesham", "The Man Who Could Work Miracles", "The Magic Shop", "Mr. Skelmersdale in Fairyland", "The Door in the Wall", "The Presence by the Fire", "A Vision of Judgment", "The Story of the Last Trump", "The Wild Asses of the Devil", "Answer to Prayer", "The Queer Story of Brownlow's Newspaper", "The Country of the Blind" (revised novelette)
- The Country of the Blind (2005), collection of 2 short stories and 1 novelette:
- "The Country of the Blind" (novelette), "The Remarkable Case of Davidson's Eyes", "The Stolen Bacillus"
- The Stolen Bacillus (2005), collection

- The Man Who Could Work Miracles, or A Dream of Armageddon: The Complete Supernatural Tales (2006), collection of 30 short stories and 1 novelette:
- "The Devotee of Art", "Walcote", "The Flowering of the Strange Orchid", "The Lord of the Dynamos", "The Temptation of Harringay", "The Moth", "Pollock and the Porroh Man", "Under the Knife", "The Plattner Story", "The Red Room", "The Story of the Late Mr. Elvesham", "The Apple", "The Crystal Egg", "The Presence by the Fire", "The Man Who Could Work Miracles", "The Stolen Body", "A Vision of Judgment", "A Dream of Armageddon", "The New Accelerator", "The Inexperienced Ghost", "Mr Skelmersdale in Fairyland", "The Truth About Pyecraft", "The Magic Shop", "The Country of the Blind" (novelette), "The Door in the Wall", "The Beautiful Suit", "The Wild Asses of the Devil", "The Story of the Last Trump", "The Pearl of Love", "The Queer Story of Brownlow's Newspaper", "Answer to Prayer"
- The Country of the Blind and Other Selected Stories (2007), collection of 21 short stories and 2 novelettes/novellas:
- "The Lord of the Dynamos", "The Remarkable Case of Davidson's Eyes", "The Moth", "A Catastrophe", "The Cone", "The Argonauts of the Air", "Under the Knife", "A Slip Under the Microscope", "The Plattner Story", "The Story of the Late Mr Elvesham", "In the Abyss", "The Sea Raiders", "The Crystal Egg", "A Story of the Stone Age" (novella), "The Star", "The Man Who Could Work Miracles", "A Dream of Armageddon", "The New Accelerator", "The Truth About Pyecraft", "The Country of the Blind" (novelette), "The Empire of the Ants", "The Door in the Wall", "The Wild Asses of the Devil"
- Man Who Could Work Miracles and Things to Come (2010), collection of 1 novel and 1 short story:
- "The Man Who Could Work Miracles", Things to Come (novel)
- H. G. Wells: Tales of the Weird and Supernatural (2010), collection of 19 short stories:
- "The Man Who Could Work Miracles", "Pollock and the Porroh Man", "The Stolen Body", "The Story of the Late Mr. Elvesham", "A Dream of Armageddon", "The Magic Shop", "A Vision of Judgement", "The Door in the Wall", "The Temptation of Harringay", "The Apple", "The Red Room", "The Story of the Last Trump", "Mr. Skelmersdale in Fairyland", "Under the Knife", "The Story of the Inexperienced Ghost", "A Moth - Genus Novo", "The Wild Asses of the Devil", "The Presence by the Fire", "Mr. Marshall's Doppelganger"
- The Door in the Wall (2011), collection of 3 short stories:
- "The Door in the Wall", "The Sea Raiders", "The Moth"
- Complete Short Story Omnibus (2011), collection of 78 short stories, 5 novelettes/novellas and 1 essay:
- "The Stolen Bacillus", "The Flowering of the Strange Orchid", "In the Avu Observatory", "The Triumphs of a Taxidermist", "A Deal in Ostriches", "Through a Window", "The Temptation of Harringay", "The Flying Man", "The Diamond Maker", "Aepyornis Island", "The Remarkable Case of Davidson's Eyes", "The Lord

of the Dynamos", "The Hammerpond Park Burglary", "The Moth", "The Treasure in the Forest", "The Plattner Story", "The Argonauts of the Air", "The Story of the Late Mr Elvesham", "In the Abyss", "The Apple", "Under the Knife", "The Sea Raiders" (variant of The Sea-Raiders), "Pollock and the Porroh Man", "The Red Room", "The Cone", "The Purple Pileus", "The Jilting of Jane", "In the Modern Vein: An Unsympathetic Love Story", "A Catastrophe", "The Lost Inheritance", "The Sad Story of a Dramatic Critic", "A Slip Under the Microscope", "The Crystal Egg", "The Star", "A Story of the Stone Age" (novella), "A Story of the Days to Come" (novella), "The Man Who Could Work Miracles", "Filmer", "The Magic Shop", "The Valley of Spiders", "The Truth About Pyecraft", "Mr Skelmersdale in Fairyland", "The Inexperienced Ghost", "Jimmy Goggles the God", "The New Accelerator", "Mr Ledbetter's Vacation", "The Stolen Body", "Mr Brisher's Treasure", "Miss Winchelsea's Heart", "A Dream of Armageddon", "The Door in the Wall", "The Empire of the Ants", "A Vision of Judgment", "The Land Ironclads" (novelette), "The Beautiful Suit", "The Pearl of Love", "The Country of the Blind" (novelette), "The Reconciliation", "My First Aeroplane" (Little Mother series 1), "Little Mother Up the MÃ¶rderberg" (Little Mother series 2), "The Story of the Last Trump", "The Grisly Folk" (essay), "A Tale of the Twentieth Century: For Advanced Thinkers", "Walcote", "The Devotee of Art", "The Man with a Nose", "A Perfect Gentleman on Wheels", "Wayde's Essence", "A Misunderstood Artist", "Le Mari Terrible", "The Rajah's Treasure", "The Presence by the Fire", "Mr Marshall's Doppelganger", "The Thing in No. 7", "The Thumbmark", "A Family Elopement", "Our Little Neighbour", "How Gabriel Became Thompson", "How Pingwill Was Routed", "The Loyalty of Esau Common: A Fragment", "The Wild Asses of the Devil", "Answer to Prayer", "The Queer Story of Brownlow's Newspaper", "The Country of the Blind" (revised novelette)

- The War of the Worlds (2013), collection of 1 novel, 1 short story and 1 essay:
- "The Crystal Egg", The War of the Worlds (novel), "The Things That Live on Mars" (essay)
- A Slip Under the Microscope (2015), collection of 2 short stories:
- "The Door in the Wall", "A Slip Under the Microscope"
- The Crystal Egg and Other Stories (2017), collection of 30 short stories, 3 novelettes/novellas and 1 essay:
- "The Crystal Egg", "The Cone", "The Country of the Blind" (novelette), "The Man Who Could Work Miracles", "A Story of the Stone Age" (novella), "The Star", "The Red Room", "In the Abyss", "The Plattner Story", "The New Accelerator", "A Slip Under the Microscope", "The Stolen Bacillus", "The Remarkable Case of Davidson's Eyes", "The Lord of the Dynamos", "The Grisly Folk" (essay), "The Door in the Wall", "The Diamond Maker", "Under the Knife", "The Sea-Raiders", "The Purple Pileus", "The Truth About Pyecraft", "Jimmy Goggles the God", "The Flowering of the Strange Orchid", "The Argonauts of the Air", "Miss Winchelsea's Heart", "A Vision of Judgement", "The Land Ironclads" (novelette), "The Flying Man", "In

the Avu Observatory", "The Triumphs of a Taxidermist", "A Deal in Ostriches", "Through a Window", "The Temptation of Harringay", "The Beautiful Suit"
- The Island of Doctor Moreau & Other Works (2017), collection
- A Novel Journal: H. G. Wells (2017), collection
- The Amazing Stories Collection (2018), collection
- H. G. Wells Short Stories (2018), collection

Uncollected short stories:

- "The Chronic Argonauts" (a.k.a. "Chronic Argonaut", a.k.a. "The Chronic Argonaughts") (Science Schools Journal, nos. 17-19, April-June 1888), novelette
- "Peter Learns Arithmetic" (1918)
- "The Invasion from Mars" (1920)
- "The Adventures of Tommy" (1928)
- "The Desert Daisy" (1957, published posthumously)
- "The Haunted Ceiling" (2016, published posthumously)

Film stories

- The King Who Was a King: The Book of a Film (1929 - scenario for a film which was never made)
- Things to Come (1935 - adaptation of The Shape of Things to Come and The Work, Wealth and Happiness of Mankind)
- Man Who Could Work Miracles (1936)
- The New Faust (in Nash's Pall Mall Magazine, December 1936 - unmade adaptation of "The Story of the Late Mr. Elvesham")
- Film Stories (1940 - collection of Things to Come and Man Who Could Work Miracles)

Collections of articles

- The War That Will End War (1914)
- An Englishman Looks at the World (1914); US title: Social Forces in England and America
- The Elements of Reconstruction (1916) . published under the pseudonym D. P.
- Russia in the Shadows (1920)
- A Year of Prophesying (1925)
- The Way the World is Going (1928)
- The New America: The New World (1935)

Biographies

- Experiment in Autobiography (1934)
- Frank Swinnerton (1920) - with Arnold Bennett, Grant Overton
- The Story of a Great Schoolmaster: Being a Plain Account of the Life and Ideas of Sanderson of Oundle (1924) - a biography of Frederick William Sanderson

Essays

- Certain Personal Matters (1897)
- The Peace of the World (1915)
- In the Fourth Year (1918)
- Washington and the Hope of Peace (a.k.a. "Washington and the Riddle of Peace") (1922)
- World Brain (1938)
- Travels of a Republican Radical in Search of Hot Water (1939)

History

- What is Coming? (1916)
- War and the Future (a.k.a. Italy, France and Britain at War) (1917)
- The Idea of a League of Nations (1919) - with Viscount Edward Grey, Lionel Curtis, William Archer, H. Wickham Steed, A. E. Zimmern, J. A. Spender, Viscount Bryce and Gilbert Murray
- The Way to the League of Nations (1919) - with Viscount Edward Grey, Lionel Curtis, William Archer, H. Wickham Steed, A. E. Zimmern, J. A. Spender, Viscount Bryce and Gilbert Murray
- The New Teaching of History: with a reply to some recent criticisms of the Outline of History (H. G. Wells) (1921)
- A Short History of the World (1922) (New and Rev Ed. 1946)
- A Short History of Mankind (1925)
- Mr. Belloc Objects to "The Outline of History" (1926)
- The Common Sense of War and Peace (1940)
- The Pocket History of the World (1941)
- Crux Ansata: An Indictment of the Roman Catholic Church (1943)

Polatics

- This Misery of Boots (1907)
- Will Socialism Destroy the Home? (1907)
- New Worlds for Old (1908)
- The Great State (1912)
- The War and Socialism (1915)

- The Outline of History series:
- The Outline of History (1920)
- The Science of Life (1930) - with Julian S. Huxley and G. P. Wells
- The Work, Wealth and Happiness of Mankind (1931)
- The Salvaging of Civilization (1921)
- Socialism and the Scientific Motive (1923)
- Wells' Social Anticipations (1927)
- The Open Conspiracy (a.k.a. What Are We To Do With Our Lives?) (1928)
- The New Russia (1931)
- What Should be Done-Now: A Memorandum on the World Situation, John Day (1932)
- After Democracy (1932)
- Marxism vs Liberalism (1934) - with J. V. Stalin
- The New World Order (1939)
- The Rights of Man (1940)
- Guide to the New World (1941)
- Modern Russian and English Revolutionaries (1942) - with Lev Uspensky
- Phoenix: A Summary of the Inescapable Conditions of World Reorganization (1942)

Science

- Text-Book of Biology (1893)
- Honours Physiography (1893) - with R. A. Gregory
- Anticipations of the Reactions of Mechanical and Scientific Progress upon Human Life and Thought (1901)
- Mankind in the Making (1903)

Sociology

- Great Thoughts From H. G. Wells (1912)
- Thoughts From H. G. Wells (1912)
- Divorce as I See It (1930)
- The Anatomy of Frustration (1936)
- The Fate of Homo Sapiens (a.k.a. The Fate of Man) (1939)
- The Outlook for Homo Sapiens (1942)
- The Conquest of Time (1942)
- '42 to '44: A Contemporary Memoir (1944)
- Reshaping Man's Heritage (1944) - with J. B. S. Haldane, Julian S. Huxley
- The Happy Turning (1945)
- Mind at the End of Its Tether (1945)

Others

- The Future in America (1906), travels
- First and Last Things (1908), philosophy
- Floor Games (1911), guide
- Little Wars (1913), guide
- God the Invisible King (1917), religion
- Introduction to Nocturne (1917)
- Points of View (1930)
- Selections From the Early Prose Works of H. G. Wells (1931)
- H.G. Wells: Early Writings in Science and Science Fiction (1975)

Articles

- "Zoological Retrogression" (1891)
- "The Rediscovery of the Unique" (1891)
- "Ancient Experiments in Co-Operation" (1892)
- "On Extinction" (1893)
- "The Man of the Year Million" (1893)
- "The Sun God and the Holy Stars" (1894)
- "Province of Pain" (1894)
- "Life in the Abyss" (1894)
- "Another Basis for Life" (1894)
- "The Rate of Change in Species" (1894)
- "The Biological Problem of To-day" (1894)
- "The 'Cyclic' Delusion" (1894)
- "The Flat Earth Again" Pall Mall Gazette (2 April 1894)[2]
- "Bio-Optimism" (1895)
- "Bye-Products in Evolution" (1895)
- "Death" (1895)
- "The Duration of Life" (1895)
- "The Visibility of Change in the Moon" (1895)
- "The Limits of Individual Plasticity" Saturday Review (18 January 1895) later incorporated in The Island Of Dr Moreau[2]
- "Human Evolution, an Artificial Process" (1896)
- "Intelligence on Mars" (1896)
- "Concerning Skeletons" (1896)
- "The Possible Individuality of Atoms" (1896)
- "Morals and Civilisation" (1897)
- "On Comparative Theology" (1898)
- "The Discovery of the Future" (1902)
- "The English House of the Future" (1903; several other authors)
- "Skepticism of the Instrument" (1903)

- "The So-Called Science of Sociology" (1906)[11]
- "The Things that Live on Mars" (illustrated by William Robinson Leigh) (1908)
- "The Grisly Folk" (1921)
- "Mr. Wells and Mr. Vowles" (1926)[12]
- "The Red Dust a Fact!" (1927)
- "Democracy Under Revision" (1927)
- "Wells Speaks Some Plain Words to us," New York Times, 16 October 1927
- "Common Sense of World Peace" (1929)
- "Foretelling the Future" (1938)

5.2 F. Scott Fitzgerald

Scott and Zelda

Francis Scott Key Fitzgerald (1896-1940) came from a middle-class family. He began writing at an early age. His first short story, *The Mystery of the Raymond Mortgage*, was published in his school magazine when he was only 13.

In 1917, while he was a student at Princeton University, more preoccupied with writing than with his studies, F. Scott Fitzgerald fell deeply in love with the young socialite Ginevra King. only to be told by her father. "Poor boys shouldn't think of marrying rich girls."

Depressed to the point of suicidal thoughts, Fitzgerald dropped out of Princeton and joined the army, hoping to be killed in battle in the war, which was still raging. Instead he was assigned to a post near Montgomery Alabama. Here he met Zelda Sayre at a country club dance. She was the beautiful, spoiled, attention-seeking daughter of a prominent southern family. She enjoyed flouting conventions, causing scandals, and being the center of gossip.

A romance developed between Scott and Zelda. He proposed marriage, but she initially refused, because of his poor financial prospects. Later, however, when his first novel, *This Side of Paradise* became a cultural sensation, she accepted. They went to New York together, and were married there.

Wikipedia states that **"Scott and Zelda quickly became celebrities of New York, as much for their wild behavior as for the success of *This Side of Paradise*. They were ordered to leave both the Biltmore Hotel and the Commodore Hotel for their drunkenness. Zelda once jumped into the fountain at Union Square. When Dorothy Parker first met them, Zelda and Scott were sitting atop a taxi. Parker said, 'They did both look as though they had just stepped out of the sun; their youth was striking. Everyone wanted to meet him.' Their social life was fueled with alcohol. Publicly, this meant little more than napping when they arrived at parties, but privately it increasingly led to bitter fights. To their delight, in the pages of the New York newspapers Zelda and Scott had become icons of youth and success - enfants terribles of the Jazz Age."**

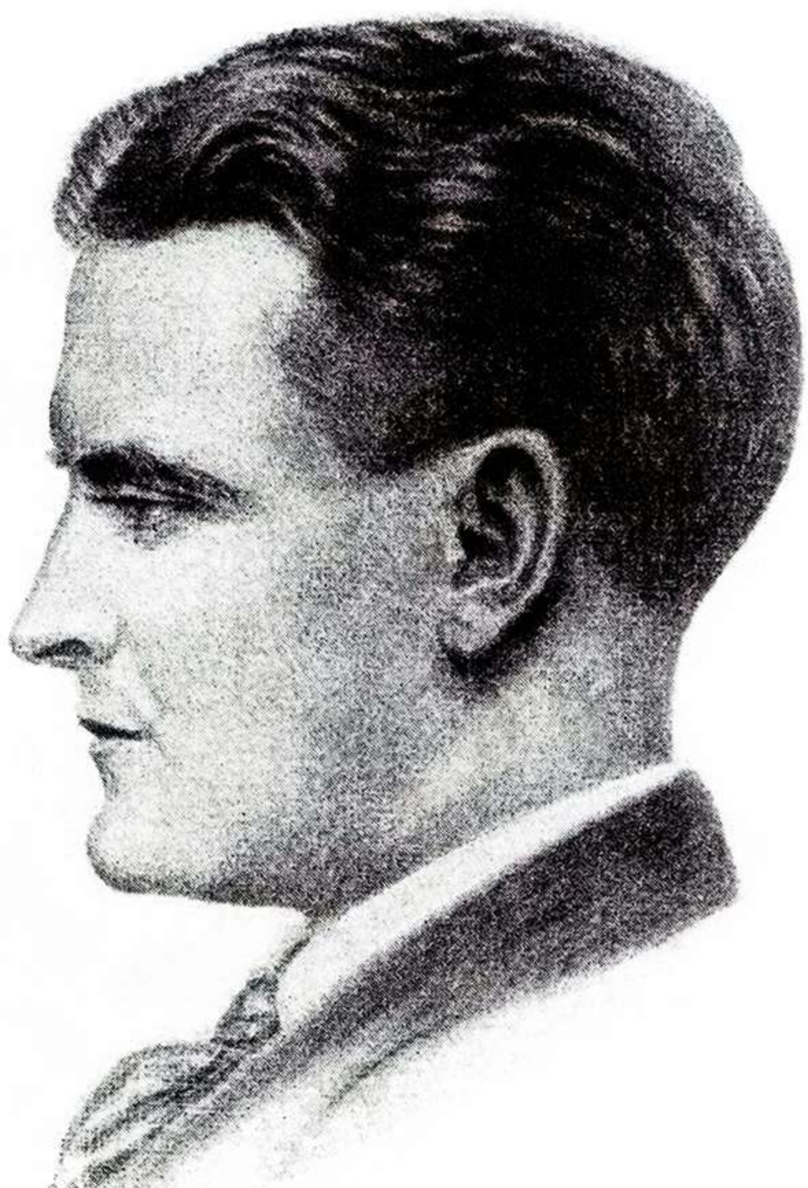

Figure 5.5: **A 1921 magazine study of Fitzgerald.**

Figure 5.6: **A sketch of Zelda by artist Gordan Bryant published in *Metropolitan Magazine.***

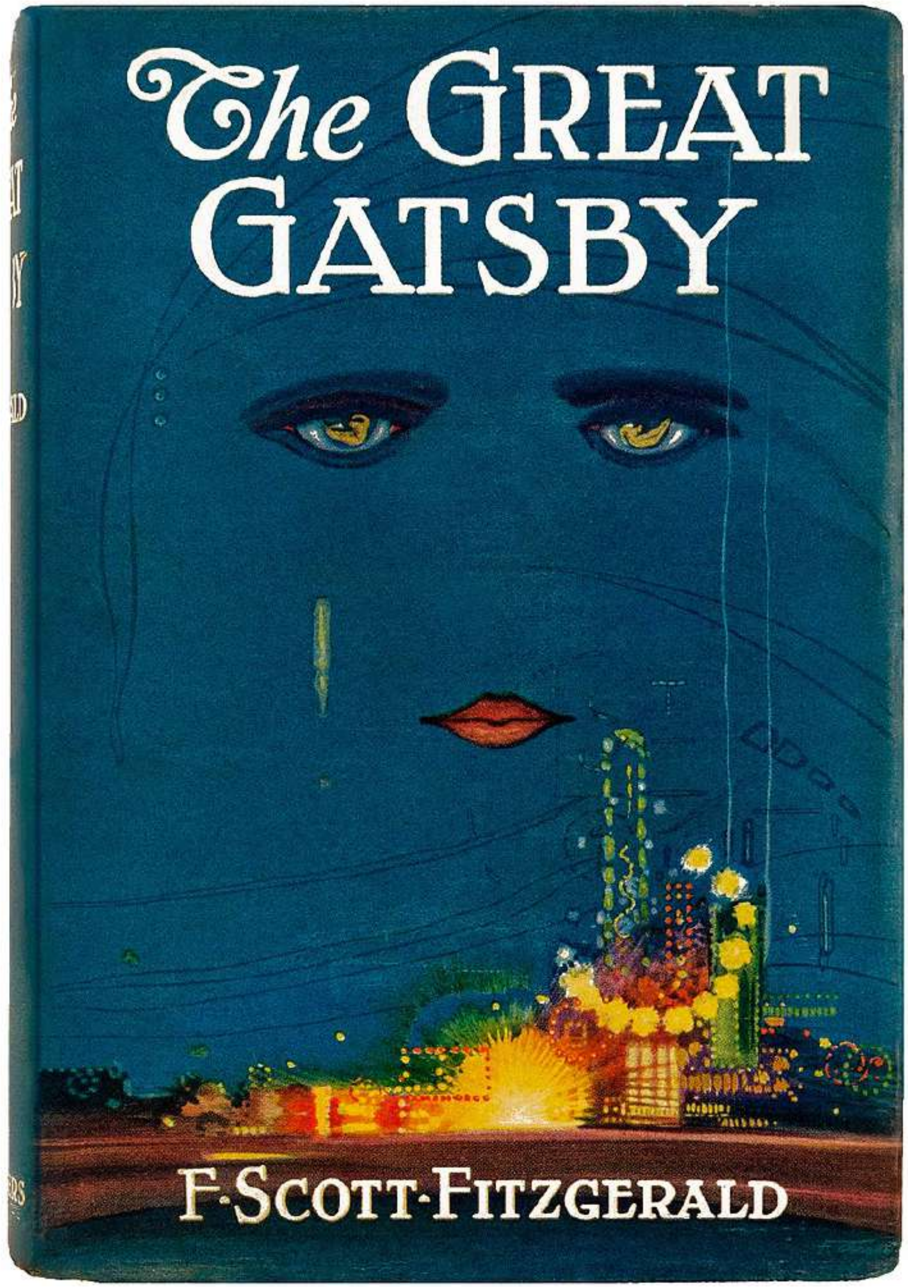

Figure 5.7: **In Europe, Fitzgerald wrote and published *The Great Gatsby* (1925), now viewed by many as his magnum opus. The cover, by Barcelona artist Francis Cugat, shows the eyes and mouth of a Jazz Age flapper. A tear falls from one of her eyes. If we look carefully, we can see in each of her eyes a reclining nude. The scene at the bottom suggests Coney Island, to represent the hedonistic lifestyle of the era. Although it was initially not a commercial success, by early 2020, *The Great Gatsby* had sold almost 30 million copies worldwide, and the book continues to sell an additional 500,000 copies every year.**

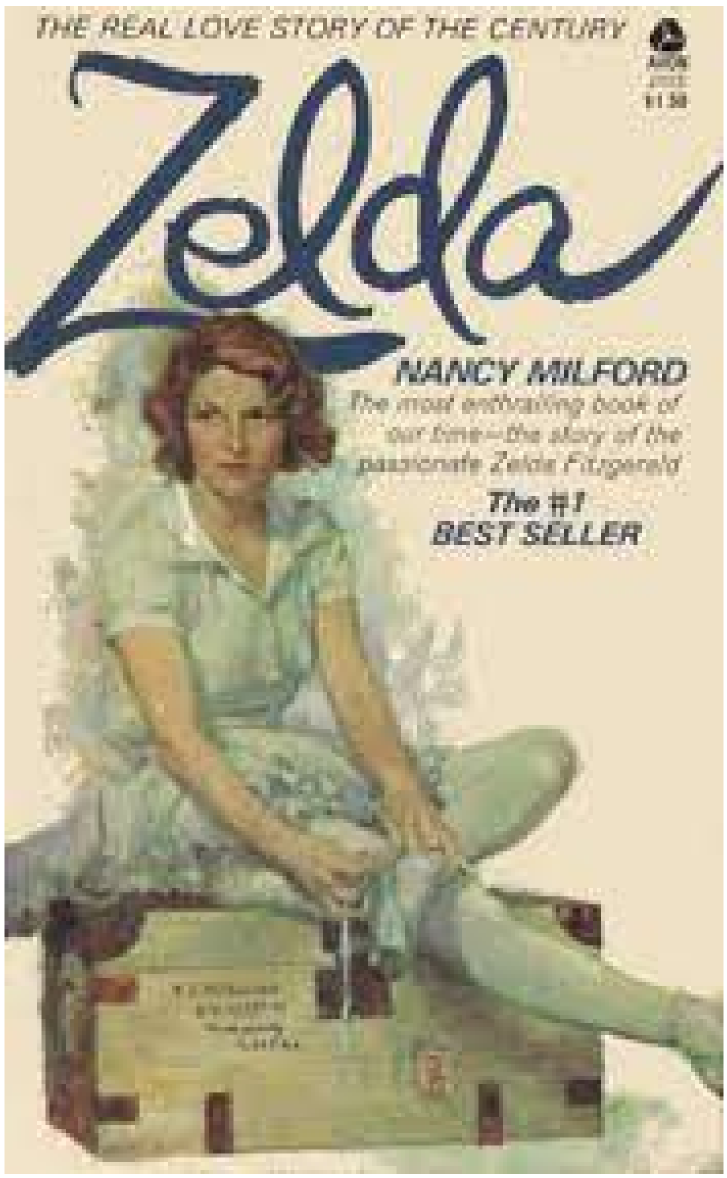

Figure 5.8: **Nancy Mitford's famous and shocking biography.**

Scott and Zelda in Europe

While in Europe, Scott worked on his novel *The Great Gatsby*. The Fitzgeralds lived both in Italy and in France. In Paris, Scott formed a close friendship with Ernest Hemingway, who was then a relatively unknown writer. He also met Gertrude Stein, James Joyce Ezra Pound and many other writers of their circle.

Hollywood

Wikipedia states that **"although he found movie work degrading, Fitzgerald accepted a lucrative exclusive deal with Metro-Goldwyn-Mayer in 1937 that necessitated his moving to Hollywood, where he earned his highest annual income up to that point: $29,757.87 (equivalent to $535,711 in 2020). During his two years in California, Fitzgerald rented a room at the Garden of Allah bungalow complex on Sunset Boulevard. In an effort to abstain from alcohol, Fitzgerald drank large amounts of Coca-Cola and ate many sweets. Estranged from Zelda, he began a relationship with nationally syndicated gossip columnist Sheilah Graham, his final companion before his death."**

Alcohol and insanity

In 1934, H.L. Menken, a literary critic and friend of the Fitzgeralds, wrote in his diary, "the case of F. Scott Fitzgerald has become distressing. He is boozing in a wild manner and has become a nuisance. His wife, Zelda, who has been insane for years, is now confined at the Sheppard-Pratt Hospital, and he is living in Park Avenue with his little daughter, Scottie."

Scott died in 1940 from heart failure, while Zelda perished in 1948 in a fire at the mental hospital in which she was a patient.

F. Scott Fitzgerald's literary work

Novels

- This Side of Paradise, New York: Scribners, 1920
- The Beautiful and Damned, New York: Scribners, 1922
- The Great Gatsby, New York: Scribners, 1925
- Tender Is the Night, New York: Scribners, 1934
- The Last Tycoon, New York: Scribners, 1941

Short Stories

- The Mystery of the Raymond Mortgage, St. Paul Academy Now and Then (October 1909)
- Reade, Substitute Right Half, St. Paul Academy Now and Then (February 1910)

- A Debt of Honor, St. Paul Academy Now and Then (March 1910)
- The Room with the Green Blinds, St. Paul Academy Now and Then (June 1911)
- A Luckless Santa Claus, Newman News (Christmas 1912)
- Pain and the Scientist, Newman News (1913)
- The Trail of the Duke, Newman News (June 1913)
- Shadow Laurels, Nassau Literary Magazine (April 1915)
- The Ordeal, Nassau Literary Magazine (June 1915)
- The Débutante, Nassau Literary Magazine (January 1917)
- The Spire and the Gargoyle, Nassau Literary Magazine (February 1917)
- Tarquin of Cheapside, Nassau Literary Magazine (April 1917) The Smart Set (February 1921)
- Babes in the Woods, Nassau Literary Magazine (May 1917)
- Sentiment - And the Use of Rouge, Nassau Literary Magazine (June 1917)
- The Pierian Springs and the Last Straw, Nassau Literary Magazine (October 1917)
- Porcelain and Pink, The Smart Set (January 1920)
- Head and Shoulders, The Saturday Evening Post (21 February 1920)
- Benediction, The Smart Set (February 1920)
- Dalyrimple Goes Wrong, The Smart Set (February 1920)
- Myra Meets His Family, The Saturday Evening Post (20 March 1920)
- Mister Icky, The Smart Set (March 1920)
- The Camel's Back, The Saturday Evening Post (24 April 1920)
- Bernice Bobs Her Hair, The Saturday Evening Post (1 May 1920)
- The Ice Palace, The Saturday Evening Post (22 May 1920)
- The Offshore Pirate, The Saturday Evening Post (29 May 1920)
- The Cut-Glass Bowl, Scribner's Magazine (May 1920)
- The Four Fists, Scribner's Magazine (June 1920)
- The Smilers, The Smart Set (June 1920)
- May Day, The Smart Set (July 1920)
- The Jelly-Bean, Metropolitan Magazine (October 1920)
- The Lees of Happiness, Chicago Sunday Tribune (12 December 1920)
- Jemina, Vanity Fair (January 1921)
- O Russet Witch!, Metropolitan Magazine (February 1921)
- The Popular Girl, The Saturday Evening Post (11 and 18 February 1922)
- Two for a Cent, Metropolitan Magazine (April 1922)
- The Curious Case of Benjamin Button, Collier's (27 May 1922)
- The Diamond as Big as the Ritz, The Smart Set (June 1922)
- Winter Dreams, Metropolitan Magazine (December 1922)
- Dice, Brassknuckles & Guitar, Hearst's International Cosmopolitan (May 1923)
- Hot & Cold Blood, Hearst's International Cosmopolitan (August 1923)
- Gretchen's Forty Winks, The Saturday Evening Post (15 March 1924)
- Diamond Dick and the First Law of Woman, Hearst's International Cosmopolitan (April 1924)
- The Third Casket, The Saturday Evening Post (31 May 1924)

- Absolution, The American Mercury (June 1924)
- The Sensible Thing, Liberty (5 July 1924)
- The Unspeakable Egg, The Saturday Evening Post (12 July 1924)
- John Jackson's Arcady, The Saturday Evening Post' (26 July 1924)
- The Baby Party, Hearst's International Cosmopolitan (February 1925)
- The Pusher-in-the-Face, Woman's Home Companion (February 1925)
- Love in the Night, The Saturday Evening Post (14 March 1925)
- One of My Oldest Friends, Woman's Home Companion (September 1925)
- The Adjuster, The Redbook Magazine (September 1925)
- A Penny Spent, The Saturday Evening Post (10 October 1925)
- Not in the Guidebook, Woman's Home Companion (November 1925)
- The Rich Boy, The Redbook Magazine (January and February 1926)
- Presumption, The Saturday Evening Post (9 January 1926)
- The Adolescent Marriage, The Saturday Evening Post (6 March 1926)
- The Dance, The Redbook Magazine (June 1926)
- Rags Martin-Jones and the Pr-nce of W-les, McCall's (July 1926)
- Your Way and Mine, Woman's Home Companion (May 1927)
- Jacob's Ladder, The Saturday Evening Post (20 August 1927)
- The Love Boat, The Saturday Evening Post (8 October 1927)
- A Short Trip Home, The Saturday Evening Post (17 December 1927)
- The Bowl, The Saturday Evening Post (21 January 1928)
- Magnetism, The Saturday Evening Post (3 March 1928)
- The Scandal Detectives, The Saturday Evening Post (28 April 1928)
- A Night at the Fair, The Saturday Evening Post (21 July 1928)
- The Freshest Boy, The Saturday Evening Post (28 July 1928)
- He Thinks He's Wonderful, The Saturday Evening Post (29 September 1928)
- The Captured Shadow, The Saturday Evening Post (29 December 1928)
- Outside the Cabinet-Maker's, The Century Magazine (December 1928)
- The Perfect Life, The Saturday Evening Post (5 January 1929)
- The Last of the Belles, The Saturday Evening Post (2 March 1929)
- Forging Ahead, The Saturday Evening Post (30 March 1929)
- Basil and Cleopatra, The Saturday Evening Post (27 April 1929)
- The Rough Crossing, The Saturday Evening Post (8 June 1929)
- Majesty, The Saturday Evening Post (13 July 1929)
- At Your Age, The Saturday Evening Post (17 August 1929)
- The Swimmers, The Saturday Evening Post (19 October 1929)
- Two Wrongs, The Saturday Evening Post (18 January 1930)
- First Blood, The Saturday Evening Post (5 April 1930)
- A Nice Quiet Place, The Saturday Evening Post (31 May 1930)
- The Bridal Party, The Saturday Evening Post(August 9, 1930)
- A Woman with a Past, The Saturday Evening Post (6 September 1930)
- One Trip Abroad, The Saturday Evening Post (11 October 1930)
- A Snobbish Story, The Saturday Evening Post (29 November 1930)

- The Hotel Child, The Saturday Evening Post (31 January 1931)
- Babylon Revisited, The Saturday Evening Post, (21 February 1931)
- Indecision, The Saturday Evening Post (16 May 1931)
- A New Leaf, The Saturday Evening Post (4 July 1931)
- Emotional Bankruptcy, The Saturday Evening Post (15 August 1931)
- Between Three and Four, The Saturday Evening Post (5 September 1931)
- A Change of Class, The Saturday Evening Post (26 September 1931)
- A Freeze-Out, The Saturday Evening Post (19 December 1931)
- Diagnosis, The Saturday Evening Post (20 February 1932)
- Six of One, Redbook (February 1932)
- Flight and Pursuit, The Saturday Evening Post (14 May 1932)
- Family in the Wind, The Saturday Evening Post (4 June 1932)
- The Rubber Check, The Saturday Evening Post (6 August 1932)
- What a Handsome Pair!, The Saturday Evening Post (27 August 1932)
- Crazy Sunday, The American Mercury (October 1932)
- One Interne, The Saturday Evening Post (5 November 1932)
- On Schedule, The Saturday Evening Post (18 March 1933)
- More Than Just a House, The Saturday Evening Post (24 June 1933)
- I Got Shoes, The Saturday Evening Post (Sep 1933)
- No Flowers, The Saturday Evening Post (July 1934)
- New Types, The Saturday Evening Post (Sep 1934)
- In the Darkest Hour, Redbook (Oct 1934)
- Her Last Case, The Saturday Evening Post (Nov 1934)
- The Fiend, Esquire (January 1935)
- The Night of Chancellorsville, Esquire (February 1935)
- Shaggy's Morning, Esquire (May 1935)
- The Count of Darkness, Redbook (June 1935)
- The Intimate Strangers, McCall's (June 1935)
- Zone of Accident, The Saturday Evening Post (July 1935)
- The Kingdom in the Dark, Redbook (Aug 1935)
- Fate in Her Hands, American Magazine (April 1936)
- Image on the Heart, McCall's (April 1936)
- Too Cute for Words, The Saturday Evening Post (April 1936)
- Three Acts of Music, Esquire (May 1936)
- Inside the House, The Saturday Evening Post (June 1936)
- Author's House, Esquire (July 1936)
- An Author's Mother, Esquire (September 1936)
- I Didn't Get Over, Esquire (October 1936)
- An Alcoholic Case, Esquire (February 1937)
- Trouble, he Saturday Evening Post (March 1937)
- The Long Way Out, Esquire (September 1937)
- The Guest in Room Nineteen, Esquire (Oct 1937)
- In the Holidays, Esquire (Dec 1937)

- Financing Finnegan, Esquire (January 1938)
- Design in Plaster, Esquire (November 1939)
- The Lost Decade, Esquire (December 1939)
- Strange Sanctuary, Liberty (Dec 1939)
- Pat Hobby's Christmas Wish, Esquire (January 1940)
- A Man in the Way, Esquire (February 1940)
- 'Boil Some Water - Lots of It', Esquire (March 1940)
- Teamed with Genius, Esquire (April 1940)
- Pat Hobby and Orson Welles, Esquire (May 1940)
- Pat Hobby's Secret, Esquire (June 1940)
- The End of Hate, Collier's (22 June 1940)
- Pat Hobby, Putative Father, Esquire (July 1940)
- The Homes of the Stars, Esquire (August 1940)
- Pat Hobby Does His Bit, Esquire (September 1940)
- Pat Hobby's Preview, Esquire (October 1940)
- No Harm Trying, Esquire (November 1940)
- On the Trail of Pat Hobby, Esquire (January 1941)
- Fun in an Artist's Studio, Esquire (February 1941)
- On an Ocean Wave, Esquire (February 1941)
- Two Old-Timers, Esquire (March 1941)
- Mightier than the Sword, Esquire (April 1941)
- Pat Hobby's College Days, Esquire (May 1941)

Letters

- The Letters of F. Scott Fitzgerald, New York: Scribners, 1964
- Dear Scott/Dear Max, New York: Scribners, 1971
- As Ever, Scott Fitz—-, Philadelphia and New York: J.B. Lippincott. 1972
- Correspondence of F. Scott Fitzgerald, New York: Random House, 1980
- F. Scott Fitzgerald: A Life in Letters, New York: Scribners, 1994

5.3 John Steinbeck

Overcoming financial difficulties

John Steinbeck (1902-1968) was born in California, where his father, John Ernst Steinbeck (1862-1935) served as Monterey County Treasurer. Steinbeck's mother, Olive Hamilton (1867-1934) shared her son's passion for reading and writing.

John Steinbeck studied English literature at Stanford University, but he left without a degree in 1925 and traveled to New York City, intending to make his living as a writer. However, he failed to publish his work in New York, and he was forced to return to California.

His generous parents then gave John free housing in a cottage that they owned on the Monterey Peninsula. They also gave him paper for his manuscripts, and loans that allowed him to write without looking for work. During the Great Depression John Steinbeck bought a small boat, and he claimed that he and his wife could live on fish and crabs that he caught with it, combined with vegetables grown in his garden.

Steinbeck became a close friend of the marine biologist Ed Ricketts, from whose wide-ranging knowledge of ecology he learned a great deal. He helped Ricketts to gather biological specimens to be sold to schools and colleges, and his wife, Carol, worked in Ricketts' laboratory.

Steinbeck's first published book was *Cup of Gold* (1929), was based on the life and death of the privateer, Henry Morgan, This was followed by *The Pastures of Heaven* (1932), *The Red Pony* (1933) and *To a God Unknown* (1933).

His first critical success was *Tortilla Flat*, published in 1935. The book is a comic account of the dissolute life of a group of jobless young men of Mexican-Indian-Spanish extraction, living in two houses inherited by one of them. It won the California Commonwealth Club's Gold Medal, and it was also a great success with readers. It provided relief from the gloom of the Great Depression.

After *Tortilla Flat*, Steinbeck was a well-known writer, something he never doubted that he would become. In fact, he never doubted that he would become a great writer.

The Grapes of Wrath

Dust bowl books

After *Tortilla Flat*, Steinbeck began to write a series of novels based on the tragic stories of farmers from Oklahoma, who were forced by dust storms to migrate to California, only to be mercilessly exploited by greedy landowners, who took advantage of the over-full labor market and reduced wages to the starvation level. His three novels, *In Dubious Battle*, *Of Mice And Men*, and *The Grapes of Wrath* belong to this period.

Steinbeck's *The Grapes of Wrath* (1939) is based on a series of newspaper articles that he had written about the plight of migrant farm workers. The novel follows the troubles of the Joad family, who are forced by dust storms to leave Oklahoma and travel to California, where they are exploited by the landowners.

Attacks by the land-owning and banking class

The Grapes of Wrath won the National Book Award and the Pulitzer Prize for Fiction. It was also the best.selling book of 1939. However, it brought down on Steinbeck's head the wrath of the landowning class. For example, in 1939, the book was banned in Kansas City, Missouri and Kern County, California. It was also burned by the East St. Louis, Illinois Public Library and barred from the Buffalo, New York Public Library. In 1953, the book was banned in Ireland.

Figure 5.9: **Steinbeck in 1939.**

Films based on Steinbeck's dustbowl books

Two famous films were based on Steinbeck's dustbowl books:

- 1939 *Of Mice and Men*, directed by Lewis Milestone, featuring Burgess Meredith, Lon Chaney, Jr., and Betty Field
- 1940 *The Grapes of Wrath*, directed by John Ford, featuring Henry Fonda, Jane Darwell and John Carradine

Steinbeck visited the studios during the production of both films.

East of Eden

Biblical parallels

John Steinbeck's book, *East of Eden* is a family saga which parallels the Biblical story of Adam and Eve and the rivalry between their two sons, Cain and Able. It was a great success with readers, and was also made into a successful 1955 film, directed by Elia Kazan, and featuring James Dean, Julie Harris, Jo Van Fleet, and Raymond Massey.

Harsh judgement by critics

Steinbeck himself believed *East of Eden* to be one of his best books, but critics at the time of its publication judged the book harshly. They complained the Steinbeck's Biblical parallels were too heavy-handed, and that the depraved behavior of the figure representing Eve was too exaggerated to be believable.

Steinbeck's own evaluation

Steinbeck wrote to a friend after completing his manuscript, "I finished my book a week ago... Much the longest and surely the most difficult work I have ever done... I have put all the things I have wanted to write all my life. This is *the book*. If it is not good I have fooled myself all the time. I don't mean I will stop but this is a definite milestone and I feel released. Having done this I can do anything I want. Always I had this book waiting to be written"

The 1962 Nobel Prize in Literature

Here is the speech given by Anders Österling, Permanent Secretary of the Swedish Academy, at the award ceremony:

John Steinbeck, the author awarded this year's Nobel Prize in Literature, was born in the little town of Salinas, California, a few miles from the Pacific coast near the fertile Salinas Valley. This locality forms the background for many of his descriptions of the

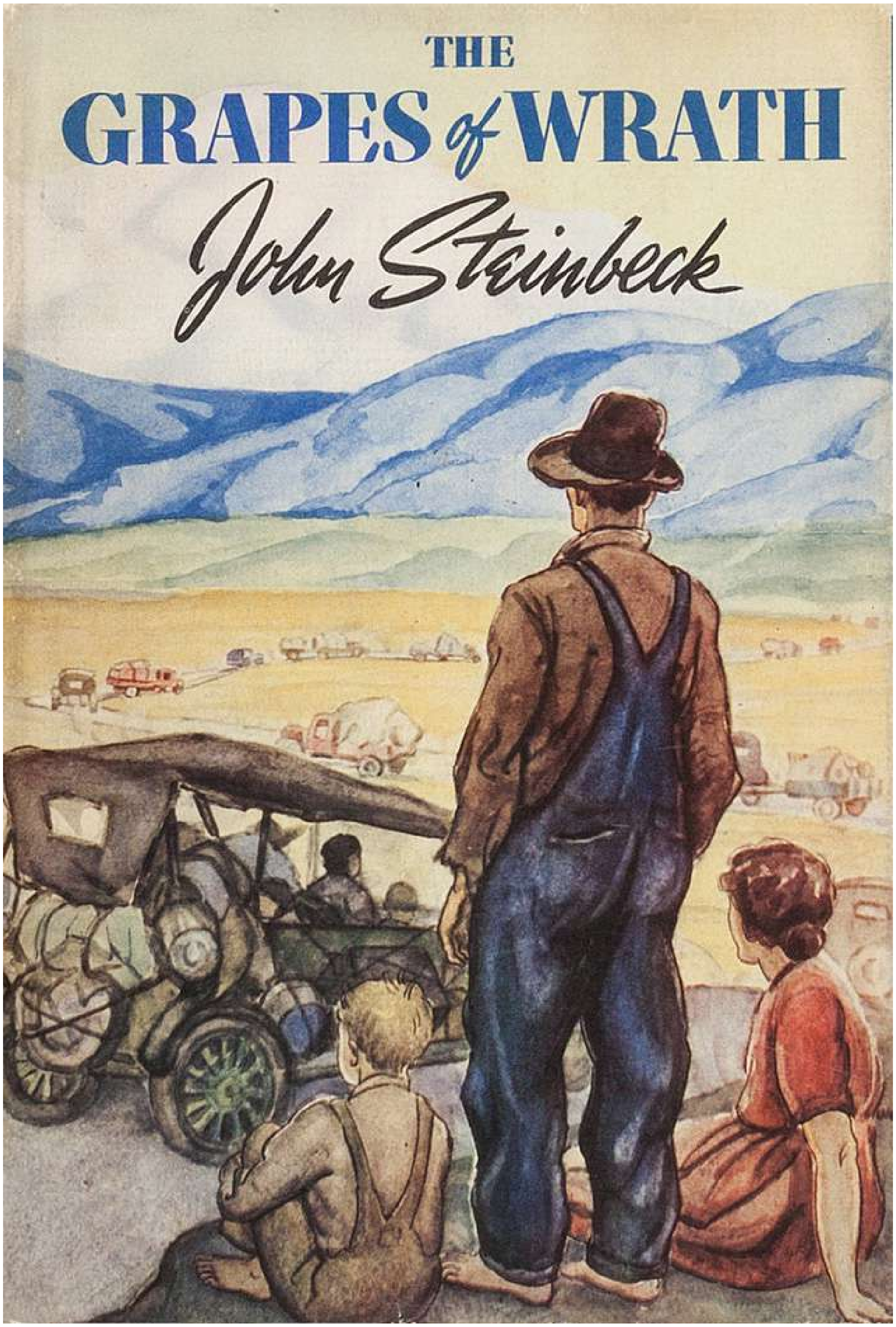

Figure 5.10: **Book cover illustration of a child, man, and woman on a roadside watching as dozens of cars and trucks drive off into the distance.**

Figure 5.11: **Theatrical poster for the 1940 film *The Grapes of Wrath.***

Figure 5.12: **Henry Fonda as Tom Joad.**

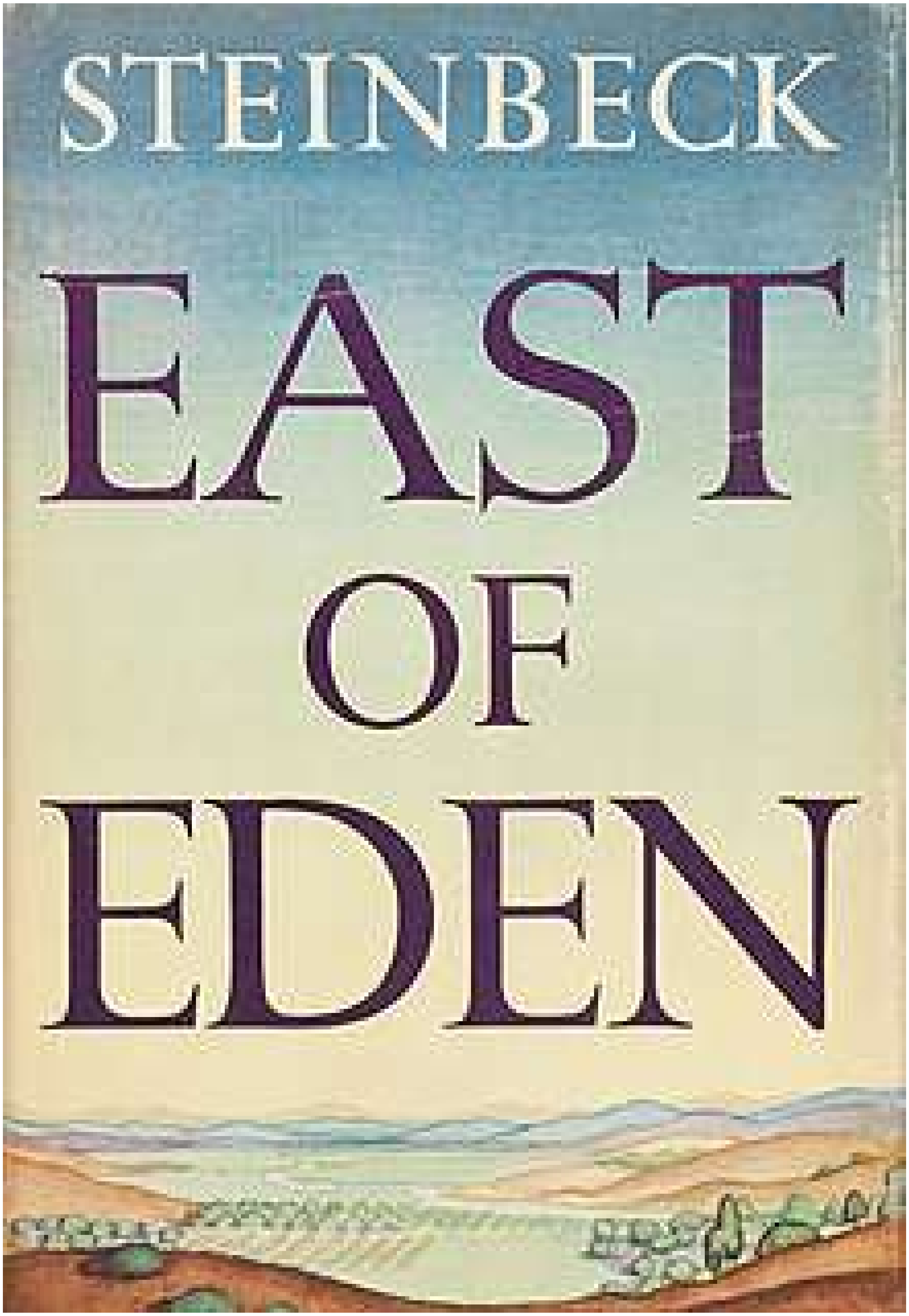

Figure 5.13: **First-edition dust jacket cover of *East of Eden* (1952) by John Steinbeck.**

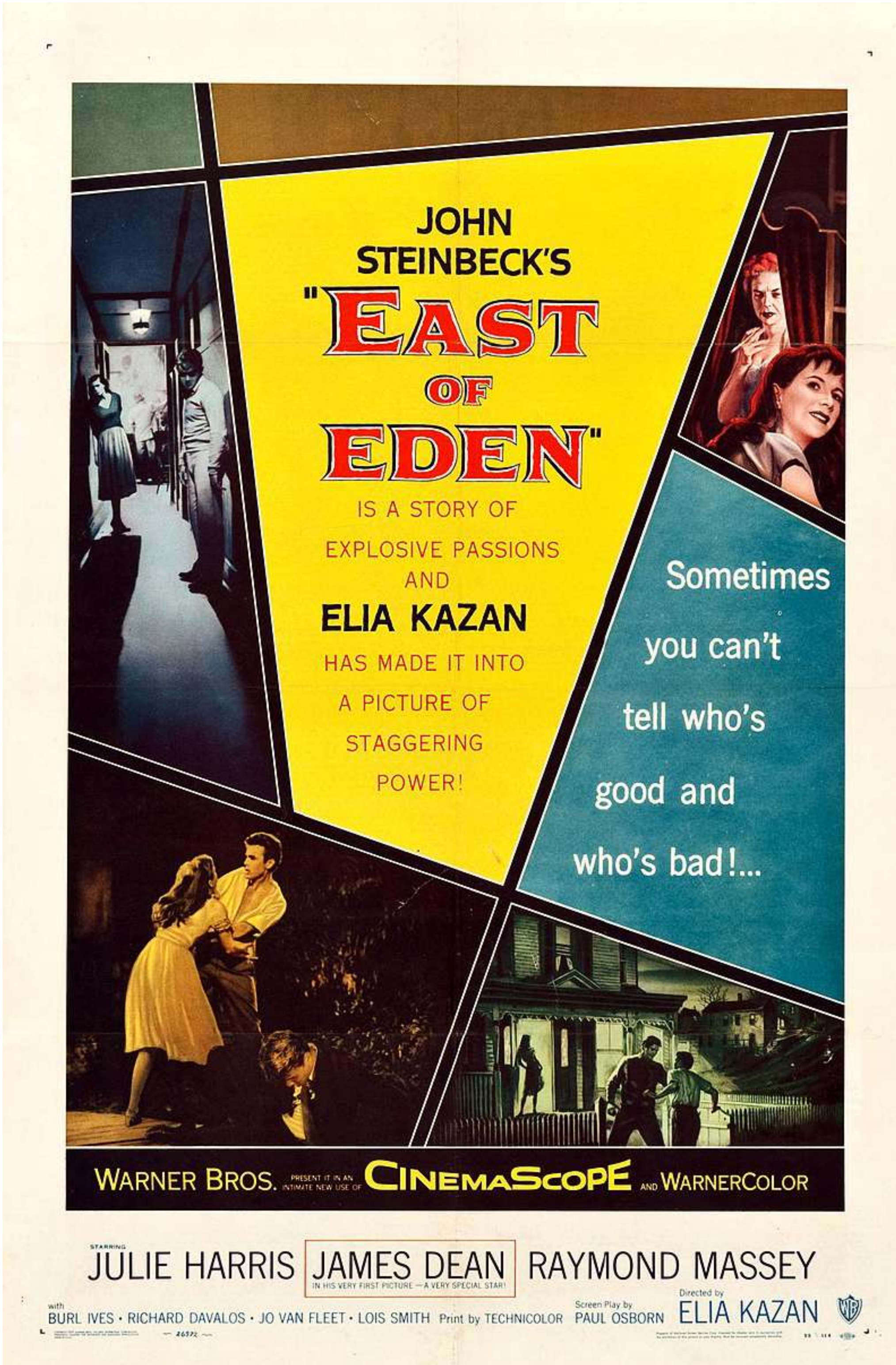

Figure 5.14: **Theatrical release poster for the 1955 film *East of Eden*, based on John Steinbeck's 1952 novel of the same name.**

Figure 5.15: **Julie Harris and James Dean in *East of Eden*.**

common man's everyday life. He was raised in moderate circumstances, yet he was on equal terms with the workers' families in this rather diversified area. While studying at Stanford University, he often had to earn his living by working on the ranches. He left Stanford without graduating and, in 1925, went to New York as a freelance writer. After bitter years of struggling to exist, he returned to California, where he found a home in a lonely cottage by the sea. There he continued his writing.

Although he had already written several books by 1935, he achieved his first popular success in that year with Tortilla Flat. He offered his readers spicy and comic tales about a gang of paisanos, asocial individuals who, in their wild revels, are almost caricatures of King Arthur's Knights of the Round Table. It has been said that in the United States this book came as a welcome antidote to the gloom of the then prevailing depression. The laugh was now on Steinbeck's side.

But he had no mind to be an unoffending comforter and entertainer. The topics he chose were serious and denunciatory, as for example the bitter strikes on California's fruit and cotton plantations which he depicted in his novel In Dubious Battle (1936). The power of his literary style increased steadily during these years. The little masterpiece Of Mice and Men (1937), which is the story of Lennie, the imbecile giant who, out of tenderness, alone squeezes the life out of every living creature that comes into his hands, was followed by those incomparable short stories which he collected in the volume The Long Valley (1938). The way had now been paved for the great work that is principally associated with Steinbeck's name, the epic chronicle The Grapes of Wrath (1939). This is the story of the emigration to California which was forced upon a group of people from Oklahoma through unemployment and abuse of power. This tragic episode in the social history of the United States inspired in Steinbeck a poignant description of the experiences of one particular farmer and his family during their endless, heartbreaking journey to a new home.

In this brief presentation it is not possible to dwell at any length on individual works which Steinbeck later produced. If at times the critics have seemed to note certain signs of flagging powers, of repetitions that might point to a decrease in vitality, Steinbeck belied their fears most emphatically with The Winter of Our Discontent (1961), a novel published last year. Here he attained the same standard which he set in The Grapes of Wrath. Again he holds his position as an independent expounder of the truth with an unbiased instinct for what is genuinely American, be it good or bad.

In this recent novel, the central figure is the head of a family who has come down in the world. After serving in the war, he fails at whatever he tries until at last he is employed in the simple work of a grocery store clerk in the New England town of his forefathers. He is an honest man and he does not complain without due cause, although he is constantly exposed to temptation when he sees the means by which material success must be purchased. However, such means require both hard scrupulousness and moral obduracy, qualities he cannot muster without risking his personal integrity. Tellingly displayed in his sensitive conscience, irradiated like a prism, is a whole body of questions which bear on the nation's welfare problems. This is done without any theorizing, using concrete, or even trivial, everyday situation, which are nonetheless convincing when described with all of Steinbeck's vigorous and realistic verve. Even with his insistence on the factual, there are harmonic *tones of daydreaming, fumbling speculations around the eternal theme of life and death.*

Steinbeck's latest book is an account of his experiences during a three-month tour of forty American states Travels with Charley, (1962). He travelled in a small truck equipped with a cabin where he slept and kept his stores. He travelled incognito, his only companion being a black poodle. We see here what a very experienced observer and raisonneur he is. In a series of admirable explorations into local colour, he rediscovers his country and its people. In its informal way this book is also a forceful criticism of society. The traveller in Rosinante - the name which he gave his truck - shows a slight tendency to praise the old at the expense of the new, even though it is quite obvious that he is on guard against the temptation. "I wonder why progress so often looks like destruction", he says in one place when he sees the bulldozers flattening out the verdant forest of Seattle to make room for the feverishly expanding residential areas and the skyscrapers. It is, in any case, a most topical reflection, valid also outside America.

Among the masters of modern American literature who have already been awarded this Prize - from Sinclair Lewis to Ernest Hemingway - Steinbeck more than holds his own, independent in position and achievement. There is in him a strain of grim humour which, to some extent, redeems his often cruel and crude motif. His sympathies always go out to the oppressed, to the misfits and the distressed; he likes to contrast the simple joy of life with the brutal and cynical craving for money. But in him we find the American temperament also in his great feeling for nature, for the tilled soil, the wasteland, the mountains, and the ocean coasts, all an inexhaustible source of inspiration to Steinbeck in the midst of, and beyond, the world of human beings.

The Swedish Academy's reason for awarding the prize to John Steinbeck reads, "for his realistic as well as imaginative writings, distinguished by a sympathetic humour and a keen social perception."

Dear Mr. Steinbeck - You are not a stranger to the Swedish public any more than to that of your own country and of the whole world. With your most distinctive works you have become a teacher of good will and charity, a defender of human values, which can well be said to correspond to the proper idea of the Nobel Prize. In expressing the congratulations of the Swedish Academy, I now ask you to receive this year's Nobel Prize in Literature from the hands of His Majesty, the King.

Films based on Steinbeck's writing

- 1939 *Of Mice and Men*, directed by Lewis Milestone, featuring Burgess Meredith, Lon Chaney, Jr., and Betty Field

- 1940 *The Grapes of Wrath*, directed by John Ford, featuring Henry Fonda, Jane Darwell and John Carradine

- 1941 *The Forgotten Village*, directed by Alexander Hammid and Herbert Kline, narrated by Burgess Meredith, music by Hanns Eisler

- 1942 *Tortilla Flat*, directed by Victor Fleming, featuring Spencer Tracy, Hedy Lamarr and John Garfield

- 1943 *The Moon is Down*,directed by Irving Pichel, featuring Lee J. Cobb and Sir Cedric Hardwicke

- 1944 *Lifeboat*, directed by Alfred Hitchcock, featuring Tallulah Bankhead, Hume Cronyn, and John Hodiak

- 1944 *A Medal for Benny*, directed by Irving Pichel, featuring Dorothy Lamour and Arturo de Cordova

- 1947 *La Perla (The Pearl, Mexico)*, directed by Emilio Fernandez, featuring Pedro Armendariz and Maria Elena Marqués

- 1949 *The Red Pony*, directed by Lewis Milestone, featuring Myrna Loy, Robert Mitchum, and Louis Calhern

- 1952 *Viva Zapata!*, directed by Elia Kazan, featuring Marlon Brando, Anthony Quinn and Jean Peters

- 1955 *East of Eden*, directed by Elia Kazan, featuring James Dean, Julie Harris, Jo Van Fleet, and Raymond Massey

- 1957 *The Wayward Bus*, directed by Victor Vicas, featuring Rick Jason, Jayne Mansfield, and Joan Collins

- 1961 *Flight*, featuring Efrain Ramirez and Arnelia Cortez

- 1962 *Ikimize bir dünya*, (Of Mice and Men, Turkey)

- 1972 *Topoli*, (Of Mice and Men, Iran)

- 1982 *Cannery Row*, directed by David S. Ward, featuring Nick Nolte and Debra Winger

- 1992 *Of Mice and Men*, directed by Gary Sinise and starring John Malkovich and Gary Sinise

- 2016 *In Dubious Battle*, directed by James Franco and featuring Franco, Nat Wolff and Selena Gomez

5.4 George Orwell

A lower-upper middle class family and education

Eric Arthur Blair (1903-1950), better known by his pen name George Orwell, was the great-grandson of Charles Blair, a wealthy country gentleman, and Lady Mary Fane, daughter of the Earl of Westmorland. Over the generations that separated Eric Blair from his great-grandparents, some of the gentility remained but most of the wealth disappeared, and he described his family as being "lower-upper middle class".

Eric Blair was born in British India where his father was working, but when he was one year old his mother took the family to England. Eric attended a Catholic boarding school called St. Cyprians, where his work in history and his writing won him scholarships to both Wellington and Eton. He attended both schools, because at first there was no place available at Eton.

Burmese Days

While at Eton, Eric Blair paid more attention to extra-curricular activities than to his studies, and his family, who could not afford to send him to university without a scholarship, decided that he would never win one. Instead of attending a university, Eric Blair joined the Imperial Police. He chose Burma, where his maternal grandmother was still living.

After serving several years in Burma in positions of increasing responsibility, Orwell became seriously ill in 1927, and he was allowed to return to England. By this time, he had become disillusioned with colonialism. He now saw it as a system whereby the soldiers held the poor Indian or Burmese citizen down, while the merchant went through his pockets. Orwell described his experiences as a colonial police officer in his book, *Burmese Days*

Down and Out in Paris and London (1933)

After Orwell returned from Burma, he became interested in the lives of very poor people in Europe. While he was on a visit to Paris, all of his money was stolen. He could have written to his guardian in England to ask for help, but instead he decided to find out for himself what it was like to be completely destitute. Returning to London, he later continued his personal experiment with extreme poverty.

After living at the extreme lower edge of society for several years, Orwell described his experiences in *Down and Out in Paris and London*. Orwell's descriptions are so vivid and his sense of humor so sharp that the book is both riveting and enjoyable to read. Other excellent books by Orwell describing not quite so extreme poverty include *Keep the Aspidistra Flying* (1936), and *The road to Wigan Pier* (1937).

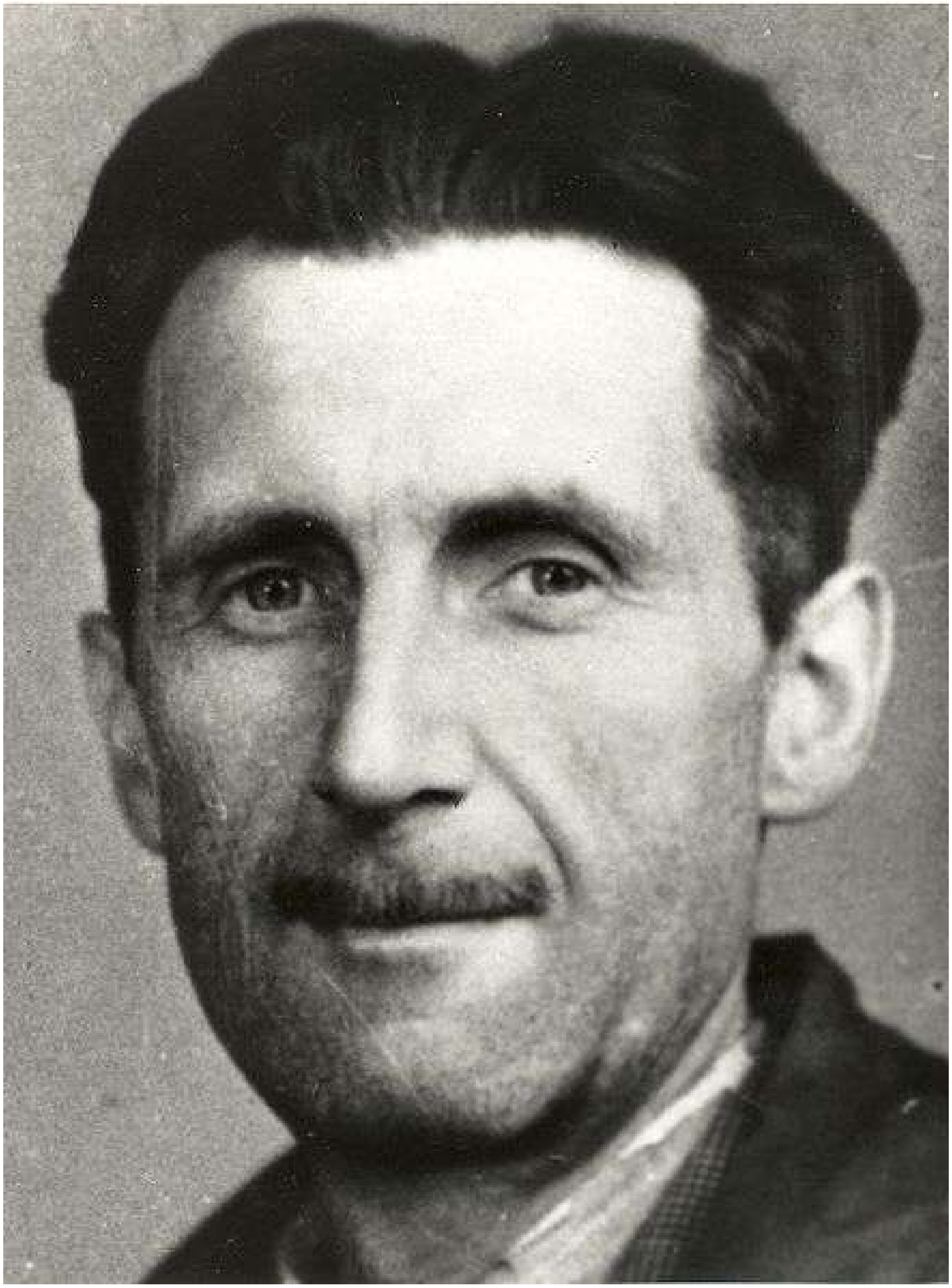

Figure 5.16: **George Orwell's press card portrait, 1943.**

Figure 5.17: **Blair family home at Shiplake, Oxfordshire.**

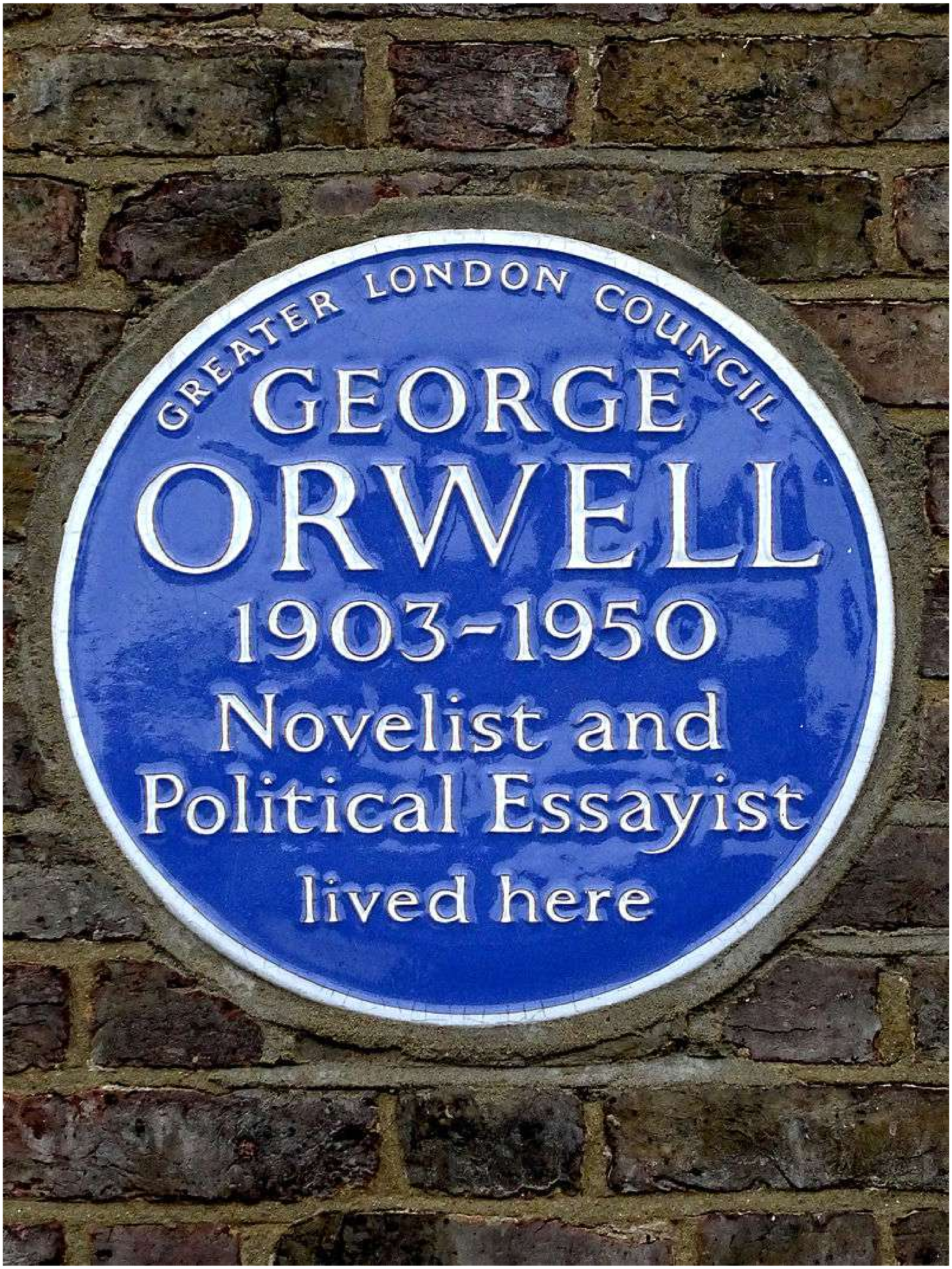

Figure 5.18: **English Heritage blue plaque in Kentish Town, London where Orwell lived from August 1935 until January 1936.**

Figure 5.19: **The square in Barcelona renamed in Orwell's honour.**

Figure 5.20: **Orwell spoke on many BBC and other broadcasts, but no recordings are known to survive.**

Figure 5.21: **Statue of George Orwell outside Broadcasting House, headquarters of the BBC.**

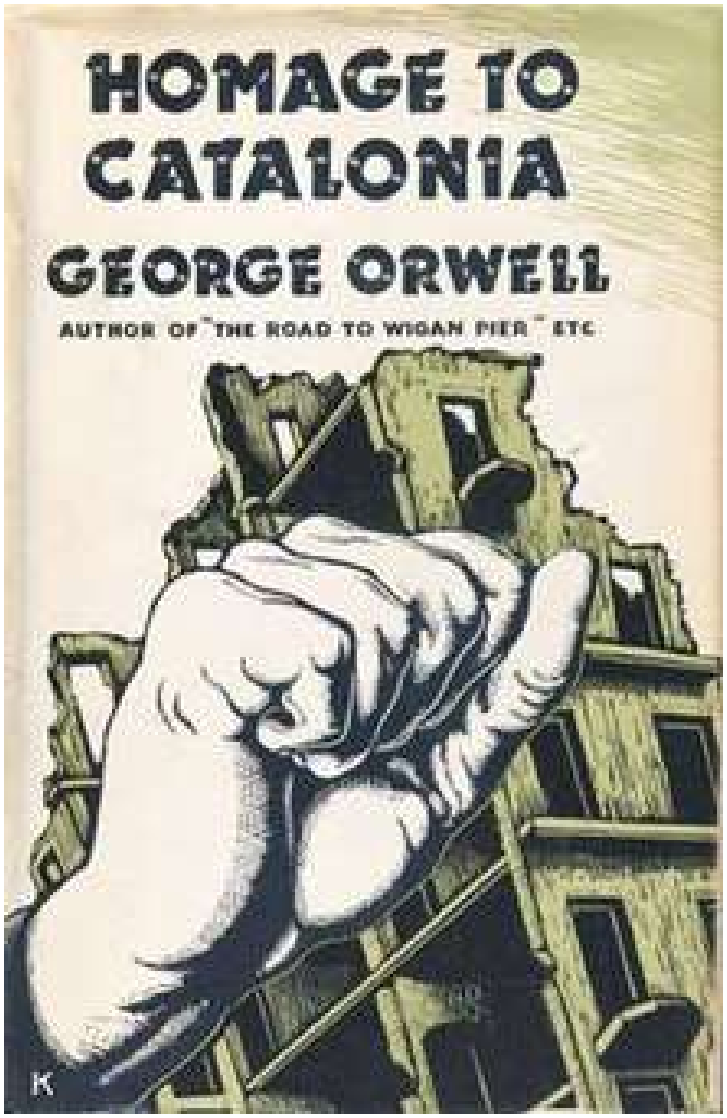

Figure 5.22: **George Orwell fought on the Republican side in the Spanish Civil War, and his book, *Homage to Catalonia* describes his experiences, which affected all of his future work as a writer. Regarding the effect of the war on his political outlook, he wrote: "Every line of serious work that I have written since 1936 has been written, directly or indirectly, against totalitarianism and for Democratic Socialism, as I understand it."**

Homage to Catalonia (1938)

This book describes Orwell's experiences during the Spanish Civil War. He served as a soldier in the unsuccessful struggle to prevent Franco's fascist army from overthrowing the elected government.

Animal Farm (1945)

This brilliant satiric and allegorical novella reflects Orwell's disillusionment with Russia's post-revolutionary government under Stalin. Orwell saw Stalinism as a brutal dictatorship. In his essay *Why I Write* (1946) Orwell says that *Animal Farm* is the first book in which he tried "to fuse political purpose and artistic purpose into one whole".

At the start of *Animal Farm* an old boar called Major (Marx and/or Lenin ?) teaches the animals to sing *Beasts of England* (the *Internationale*?). Orwell describes the tune as being halfway between *La Cucaratcha* and *My Darling Clementine*. Here are the words of the song:

Beasts of England, Beasts of Ireland,
Beasts of every land and clime,
Hearken to my joyful tidings
Of the Golden future time.

Soon or late the day is coming,
Tyrant Man shall be o'erthrown,
And the fruitful fields of England
Shall be trod by beasts alone.

Rings shall vanish from our noses,
And the harness from our back,
Bit and spur shall rust forever,
Cruel whips no more shall crack.

Riches more than mind can picture,
Wheat and barley, oats and hay,
Clover, beans, and mangel-wurzels
Shall be ours upon that day.

Bright will shine the fields of England,
Purer shall its waters be,
Sweeter yet shall blow its breezes
On the day that sets us free.

For that day we all must labour,

Though we die before it break;
Cows and horses, geese and turkeys,
All must toil for freedom's sake.

Beasts of England, Beasts of Ireland,
Beasts of every land and clime,
Hearken well, and spread my tidings
Of the Golden future time

After a successful revolution by the animals, Farmer Jones is expelled, and the Seven Principles of Animalism are established, the most important of which is

All animals are equal.

The pigs, being (as they say themselves) the most intelligent of the animals, gradually take over the running of the farm. Meetings of all the animals are replaced by meetings of the pigs. The faithful hardworking old horse, Boxer, is sold to the gluemaking knacker in order to buy whisky for the pigs. The first principle of Animalism is replaced by:

All animals are equal, but some animals are more equal than others.

Finally, the pigs start to carry whips and to walk on two legs. They become indistinguishable from humans.

Orwell's *Animal Farm*, published at the start of the Cold War, was a great commercial success, and it was translated into many languages.

Nineteen Eighty-Four **(1949)**

George Orwell's famous dystopian novel *Nineteen Eighty-four* (often published as *1984*) has changed the English language and added new words, for example "Orwellian", "doublethink", "thoughtcrime", " Big Brother", "newspeak", "nonperson" and "memory hole". Like *Animal Farm*, it expresses Orwell's deep dislike of Stalin's brutal dictatorship. However, the novel also so aptly describes recent conditions in the United States and elsewhere that today it has hit the top of best-seller lists.

The novel follows the life of Winston Smith, who lives in Airstrip One (formerly known as Great Britain). Airstrip One is part of the superstete Ociania, which is perpetually at war with two other superstates. Pictures of the ruler of Ociania, Big Brother, are everywhere and a cult of personality surrounds him, although he may not even exist.

Surveillance is also everywhere, performed by ubiquitous "telescreens", which both transmit and record. Under huge photographs of the leader of Ociania, there is usually the caption: "Big Brother is watching you". The Thought Police encourage children to report anyone who might be guilty of "thoughtcrimes", including their own parents.

The citizens of Ociania are divided into three classes. The highest and most privileged class is the Inner Party. Next come members of the Outer Party, and finally come the lowest class, the Proletariat, who make up the bulk of the population.

Winston Smith belongs to the Outer Party, and he works in the Ministry of Truth (Minitruth), where his job is to rewrite history so that it will conform to the constantly-changing doctrines of the Inner Party, He changes written records, alters photographs, and converts people who are out of favour to "nonpersons" by destroying every record of their existence. Winston is good at his job, but he gradually come to detest the whole system. This, of course is a "thoughtcrime".

Another worker in the Ministry of Truth is Julia, who runs Minitruth's novel-writing machines. She hands Winston a note telling him that she is in love with him. Winston finds out that Julia shares his detestation of the system, and an affair blossoms between them. They meet in a rented room in a proletarian district where they believe they will be free from surveillance.

Later Winston is approached by O'Brian, a member of the Inner Party who is believed by Winston to be a member of the Brotherhood, a secret society that opposes the Party. Winston and Julia tell O'Brian of their detestation of the whole system. But O'Brian is not a member of the Brotherhood. He is actually a member of the Thought Police. Winston and Julia are arrested and tortured so severely that they finally betray each other.

Winston is tortured again and again. Simultaneously he is brainwashed to such an extent that he becomes a believer in the system, and can be sent back into society. The new, brainwashed Winston believes wholeheartedly in the doctrines of the Party, and he has finally learned to love Big Brother.

During the writing of *Nineteen Eighty-four*, Orwell was very ill with tuberculosis, and he died soon afterwards from the disease.

Here are some quotations from *Nineteen Eighty-four*:

Now I will tell you the answer to my question. It is this. The Party seeks power entirely for its own sake. We are not interested in the good of others; we are interested solely in power, pure power. What pure power means you will understand presently. We are different from the oligarchies of the past in that we know what we are doing. All the others, even those who resembled ourselves, were cowards and hypocrites. The German Nazis and the Russian Communists came very close to us in their methods, but they never had the courage to recognize their own motives. They pretended, perhaps they even believed, that they had seized power unwillingly and for a limited time, and that just around the corner there lay a paradise where human beings would be free and equal. We are not like that. We know that no one ever seizes power with the intention of relinquishing it. Power is not a means; it is an end. One does not establish a dictatorship in order to safeguard a revolution; one makes the revolution in order to establish the dictatorship. The object of persecution is persecution. The object of torture is torture. The object of power is power. Now you begin to understand me. (from 1984)

War is peace. Freedom is slavery. Ignorance is strength.

Politics and the English Language, and other essays

George Orwell was a brilliant and prolific essayist, and many of his essays that have been made available by Project Gutenberg[2]

A few things that George Orwell said

Actions are held to be good or bad, not on their own merits, but according to who does them. There is almost no kind of outrage -torture, imprisonment without trial, assassination, the bombing of civilians - which does not change its moral color when it is committed by 'our' side. The nationalist not only does not disapprove of atrocities committed by his own side, he has a remarkable capacity for not even hearing about them.

The essence of oligarchical rule is not father-to-son inheritance, but the persistence of a certain world-view and a certain way of life ... A ruling group is a ruling group so long as it can nominate its successors... Who wields power is not important, provided that the hierarchical structure remains always the same

In a time of deceit telling the truth is a revolutionary act.

The creatures outside looked from pig to man, and from man to pig, and from pig to man again; but already it was impossible to say which was which.

The most effective way to destroy people is to deny and obliterate their own understanding of their history.

If you want a picture of the future, imagine a boot stamping on a human face - forever.

Political language is designed to make lies sound truthful and murder respectable, and to give an appearance of solidity to pure wind.

But if thought corrupts language, language can also corrupt thought.

If liberty means anything at all, it means the right to tell people what they do not want to hear.

Doublethink means the power of holding two contradictory beliefs in one's mind simultaneously, and accepting both of them.

[2] http://gutenberg.net.au/ebooks03/0300011h.html

Until they became conscious they will never rebel, and until after they have rebelled they cannot become conscious.

The essence of being human is that one does not seek perfection.

Being in a minority, even in a minority of one, did not make you mad. There was truth and there was untruth, and if you clung to the truth even against the whole world, you were not mad.

The great enemy of clear language is insincerity.

To see what is in front of one's nose requires a constant struggle.

Advertising is the rattling of a stick inside a swill bucket.

War is a way of shattering to pieces, or pouring into the stratosphere, or sinking in the depths of the sea, materials which might otherwise be used to make the masses too comfortable, and hence, in the long run, too intelligent.

List of books by George Orwell

- ***Down and Out in Paris and London*** **(9 January 1933, Victor Gollancz Ltd)**
- ***Burmese Days*** **(25 October 1934, Harper & Brothers)**
- ***A Clergyman's Daughter*** **(11 March 1935, Victor Gollancz Ltd)**
- ***Keep the Aspidistra Flying*** **(20 April 1936, Victor Gollancz Ltd)**
- ***The Road to Wigan Pier*** **(February 1937, Left Book Club edition; 8 March 1937 Victor Gollancz Ltd edition for the general public)**
- ***Homage to Catalonia*** **(25 April 1938, Secker and Warburg)**
- ***Coming Up for Air*** **(12 June 1939, Victor Gollancz Ltd)**
- ***Animal Farm*** **(17 August 1945, Secker and Warburg)**
- ***Nineteen Eighty-Four*** **(8 June 1949, Secker and Warburg)**

George Orwell wrote many hundreds of essays. articles and pamphlets. The last eleven volumes of the twenty-volume series *The Complete Works of George Orwell* are devoted to essays, letters, and journal entries. The entire series was initially printed by Secker and Warburg in 1986, and was finished by Random House in 1998, and revised between 2000 and 2002.

5.5 Aldous Huxley

A famous family of scientists

Aldous Leonard Huxley (1894-1963) was a member of a famous family of biologists. His grandfather was Thomas Henry Huxley ("Darwin's bulldog"). His brother, Sir Julian Huxley, was an evolutionary biologist, the author of almost 50 books, and the first Director-General of UNESCO. His half-brother, Andrew Huxley, shared a Nobel Prize for his discovery of the mechanism by which nerves transmit signals. Aldous Huxley, who chose a career in literature rather than biology, was nominated seven times for the Nobel Prize in Literature.

Brave New World

Like his brother Julian, Aldous Huxley was the author of almost 50 books, but he is most famous for his dystopian novel "Brave New World", which he wrote in 1931. Huxley said that the book was initially a reaction to H.G. Wells' Utopian books, such as "A Modern Utopia" (1905) and "Men Like Gods" (1923). In a letter to and American acquaintance, Huxley wrote that he "had been having a little fun pulling the leg of H.G. Wells... but got caught up in the excitement of my own ideas".

The theme of "Brave New World" was foreshadowed in Huxley's novel "Chrome Yellow" (1921), which satirizes life at Gossington Hall, the estate of Lady Ottoline Morrell, one of the central figures in the famous Bloomsbury Group of writers and artists. Huxley, who was disqualified for military duty because of serious problems with his vision, spent the duration of World War I working as an agricultural labourer on Lady Ottoline's estate. One of the characters in "Chrome Yellow describes the future world in the following words: "Impersonal generation [will] take the place of Nature's hideous system. In vast state incubators, rows upon rows of gravid bottles will supply the world with the population it requires. The family system will disappear; society, sapped at its very base, will have to find new foundations; and Eros, beautifully and irresponsibly free, will flit like a gay butterfly from flower to flower through a sunlit world."

This quotation shows that Huxley's ideas were already taking form in 1921. He wrote "Brave New World" in four months. from May to August 1931, while living in France. Huxley was was probably influenced by J.B.S. Haldane's short book "Daedalus; or, Science and the Future" (1924) where a future society making use of in vitro fertilization is described. He was also influenced by a trip which he made to see Sir Alfred Mond's hyper-efficient plant for nitrogen fixation, which greatly impressed him. On a trip to America, Huxley read "My Life and Work" by Henry Ford. On the same trip, he was "outraged by the culture of youth, commercial cheeriness and sexual promiscuity, and the inward-looking nature of many Americans". It seemed to Huxley that Ford's mass production principles dominated American life.

"Brave New World" takes its title from Marinda's speech in Shakespeare's "The Tempest":

Figure 5.23: **Aldous Huxley (1894-1963).**

Figure 5.24: **English Heritage blue plaque at 16 Bracknell Gardens, Hampstead, London, commemorating Aldous, his brother Julian, and his father Leonard.**

Figure 5.25: **Thomas Henry Huxley ("Darwin's bulldog") with his grandson Julian in 1893.**

Oh wonder!
How many goodly creatures are there here!
How beauteous mankind is! O brave new world
That has such people in't!

In French translations, the English title is often replaced by Le Meilleur des mondes (The Best of All Worlds), an allusion to Voltaire's "Candide" which satirizes the optimism of the mathematician and philosopher Gottfried Wilhelm von Leibnez.

In "Brave New World" Ford everywhere takes the place of God and Jesus. One of the characters. Muphistapha Mond, the Resident Controller of Europe in the World State, is referred to as "his Fordship". When people are upset, they say "Oh Ford! Ford!". When relieved, people exclaim, "Thank Ford!" The Arch-Community-Songster of Canterbury replaces the Arch-Bishop of Canterbury, and he presides over services on Our Ford's Day. The novel itself takes place in the year AF (After Ford) 632, or AD 2540 in our familiar calendar. The Christian cross is replacer with the T (for Ford's Model T).

In 1931, when Huxley wrote "Brave New World", economic depression was a great threat, and this is reflected in the novel. In the future society which it visualizes, all other values are sacrificed for the sake of stability. The strong emotions of the pre-Ford era, are replaced by universal continual happiness, sometimes induced by the drug soma, which sends its users into a carefree "soma holiday", in which they are blissfully free from worries of any kind.

Many of the strong dangerous emotions of the pre-Ford viviperpus era, are associated with family life, but in the brave new world of the future, these are non-existent because there no families. Everyone belongs to everyone. Babies are not born, they are decanted. Embryos are produced by in-vitro fertilization in vast hatcheries, where they are also conditioned and predestined for a particular role in society.

One of the main characters in the novel is the D.H.C., the Director of Hatcheries and Conditioning. Another main character is Bernard Marx, who is a high-caste alpha-plus, but nevertheless a misfit, because he is not tall. People suspect that alcohol may have been accidentally added to his blood-surrogate when he was an embryo. Bernard works as a sleep-learning specialist at the Central London Hatchery and Conditioning Centre, and he is very good at his job. Also working at the same centre is Lenina Crowne, a young, beautiful and popular fetus technician.

The main events of the novel take place when Bernard invites Lenina to go with him to the Malpais Reservation in New Mexico, where savages are allowed to live viviperously so that they can be studied. After some hesitation (because Bernard is such a strange person) Lenina accepts. She is completely disgusted by the dirt and squalor of Malpais, but nevertheless both she and Bernard find the savages of the reservation fascinating. Even more fascinating is their discovery among the native population, of a much-decayed fat old white woman, who turns out to be the lost wife of the Director of Hatcheries and Conditioning. She disappeared when she and the D.H.C. visited Malpais many years previously. Linda, despite faithfully performing her Malthusian Drill, had become pregnant and given birth to a boy, John. Realizing the hold which this will give him over the sometimes-hostile D.H.C., Bernard invites Linda and John to go with them back to civilized London; and they accept.

As a result, Bernard becomes (temporarily) a celebrity. Everyone, even the Arch-Community-Songster, wants to see the Savage (John). His curious behavior, for example asceticism and self-flagellation, excite enormous interest. At first John is available for viewing, but soon he becomes disgusted by what he sees of "civilization" and refuses to attend Bernard's parties. As a result, Bernard's celebrity status disappears. overnight.

The Savage (John) is very handsome, and Lenina falls in love with him. He is also in love with her, but John has formed his ideas of romance from native American practices and from Shakespeare's dramas. Taught to read by Linda, he had discovered the book containing Romeo and Juliet and other now-banned pre-Fordian dramas in an old box at Malpais, and these formed his ideas of what love should be like. When Lenina offers her naked body to John, he denounces her as a strumpet, and violently rejects her.

Meanwhile, John's mother Linda becomes terminally ill. Totally drugged by soma, she is moved to the Park Lane Hospital for the Dying, a place where children are brought to enjoy the spectacle of people dying. This re-enforces the children's conditioning, which makes them accept dying as a joyful event. John rushes to see Linda, but his behavior at the hospital is outrageous. Not only does he show grief, but he also uses the word "mother", which in the brave new civilized world is the worst imaginable obscenity. To make matters still worse, attacks the Bokinofskified (cloned) group of identical twins who have assembled to enjoy Linda's death.

News that John is at the hospital and that he has gone mad reaches Bernard and the gifted writer, Helmholtz Watson, Bernard's only true friend. They rush to the hospital, to find John quoting passages from Shakespeare, and these words are recognized by Helmholtz as the eloquence for which he has been searching. He joins John in attacking the group of cloned identical twins.

The result of this episode is that John, Helmholtz and Bernard are arrested and brought before Mustapha Mond, the highly intelligent and urbane Resident World Controller for Western Europe. Mond is so intelligent that he completely understands the motivations of John, Bernard and Helmholtz, and far from condemning their actions, he sympathizes with them.

Mond patiently explains to them the principles and philosophy behind the brave new "civilized" world. It would have been possible, he says, to produce a population consisting entirely of highly intelligent alphas, but such a society would not be stable, because there would be a struggle among the alphas to avoid menial work. It was better to produce a society with classes, alphas, betas, gammas, deltas and finally semi-moron epsilons, each with abilities suited to the work which they are predestined to perform, and each happy to be what they are. In order to achieve social stability, Mond explains, culture must be sacrificed, including high art, music, literature and science. These are replaced by Feelies (cinema with tactile and scent effects), scent organs, synthetic music, and expensive equipment-using games like Centrifugal Bumblepuppy, Electromagnetic Golf and Elevator Squash Racquets. Authors from the past, the Greek philosophers, Pascal, Shakespeare and so on must be banned.

Although sympathetic and understanding, Mond judges John, Bernard and Helmholtz to be dangerous to social stability. He exiles Bernard and Helmholtz to live on islands, but explains that this is really a reward, rather than a punishment, because other exiles whom they will meet on the islands are the most interesting men and women in the world.

John is allowed to remain in England in an isolated tower, far from any city. But even here he cannot escape the the curiosity of crowds of people who throng to observe the curious behavior of the Savage. Finally he can stand it no more, and he commits suicide.

A comparison between Orwell and Huxley

Social critic Neil Postman contrasted the worlds of Nineteen Eighty-Four and Brave New World in the foreword of his 1985 book Amusing Ourselves to Death. He writes:

"What Orwell feared were those who would ban books. What Huxley feared was that there would be no reason to ban a book, for there would be no one who wanted to read one. Orwell feared those who would deprive us of information. Huxley feared those who would give us so much that we would be reduced to passivity and egotism. Orwell feared that the truth would be concealed from us. Huxley feared the truth would be drowned in a sea of irrelevance. Orwell feared we would become a captive culture. Huxley feared we would become a trivial culture, preoccupied with some equivalent of the feelies, the orgy porgy, and the centrifugal bumblepuppy. As Huxley remarked in Brave New World Revisited, the civil libertarians and rationalists who are ever on the alert to oppose tyranny 'failed to take into account man's almost infinite appetite for distractions.' In 1984, Orwell added, people are controlled by inflicting pain. In Brave New World, they are controlled by inflicting pleasure. In short, Orwell feared that our fear will ruin us. Huxley feared that our desire will ruin us.

Niel Postman's book, "Amusing Ourselves To Death; or Public Discourse in an Age of Show Business" (1985), had its origins at the Frankfurt Book Fair, where Postman was invited to join a panel discussing George Orwell's "Nineteen Eighty-Four". Postman said that our present situation was better predicted by Huxley's "Brave New World". Today, he maintained it is not fear that bars us from truth. Instead, truth is drowned in distractions and the pursuit of pleasure, by the public's addiction to amusement.

Postman sees television as the modern equivalent of Huxley's pleasure-inducing drug, soma, and he maintains that that television, as a medium, is intrinsicly superficial and unable to discuss serious issues.

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Chapter 6

SOME 20TH CENTURY POETS

6.1 Wilfred Owen, 1893-1918

Expressing the horror of war

Wilfred Owen and his mentor, Siegfried Sassoon were two poets who eloquently described the horrors of World War I. They met in a military hospital, after both had been wounded in the war. Owen had been writing poetry since the age of 11, but not about war. When he became friends with Sassoon during their hospital stay, Owen was inspired by Sassoon's example and realized that the horrors of trenches and gas warfare deserved to be described realistically in poetry. Against the strong advice of Sassoon, Owen insisted on returning to active duty in France, where he wrote the eloquent and bitter war poems for which he is remembered.

Owen was killed in action exactly one week before the end of the war. His mother received the telegram informing her of his death on Armistice Day, as the church bells were ringing out in celebration. Here are two of Owen's poems:

Dulce et decorum Est

Bent double, like old beggars under sacks,
Knock-kneed, coughing like hags, we cursed through sludge,
Till on the haunting flares we turned out backs,
And towards our distant rest began to trudge.
Men marched asleep. Many had lost their boots,
But limped on, blood-shod. All went lame, all blind;
Drunk with fatigue; deaf even to the hoots
Of gas-shells dropping softly behind.

Gas! GAS! Quick, boys! - An ecstasy of fumbling
Fitting the clumsy helmets just in time,
But someone still was yelling out and stumbling

And flound'ring like a man in fire or lime.
Dim through the misty panes and thick green light,
As under a green sea, I saw him drowning.
In all my dreams before my helpless sight
He plunges at me, guttering, choking, drowning.

If in some smothering dreams, you too could pace
Behind the wagon that we flung him in,
And watch the white eyes writhing in his face,
His hanging face, like a devil's sick of sin,
If you could hear, at every jolt, the blood
Come gargling from the froth-corrupted lungs
Obscene as cancer, bitter as the cud
Of vile, incurable sores on innocent tongues,
My friend, you would not tell with such high zest
To children ardent for some desperate glory,
The old Lie: Dulce et decorum est
Pro patria mori.

The parable of the old man and the young

So Abram rose, and clave the wood, and went,
And took the fire with him, and a knife.
And as they sojourned both of them together,
Isaac the first-born spake and said, My Father,
Behold the preparations, fire and iron,
But where the lamb for this burnt-offering?
Then Abram bound the youth with belts and straps,
and builded parapets and trenches there,
And stretchèd forth the knife to slay his son.
When lo! an angel called him out of heaven,
Saying, Lay not thy hand upon the lad,
Neither do anything to him. Behold,
A ram, caught in a thicket by its horns;
Offer the Ram of Pride instead of him.

But the old man would not so, but slew his son,
And half the seed of Europe, one by one.

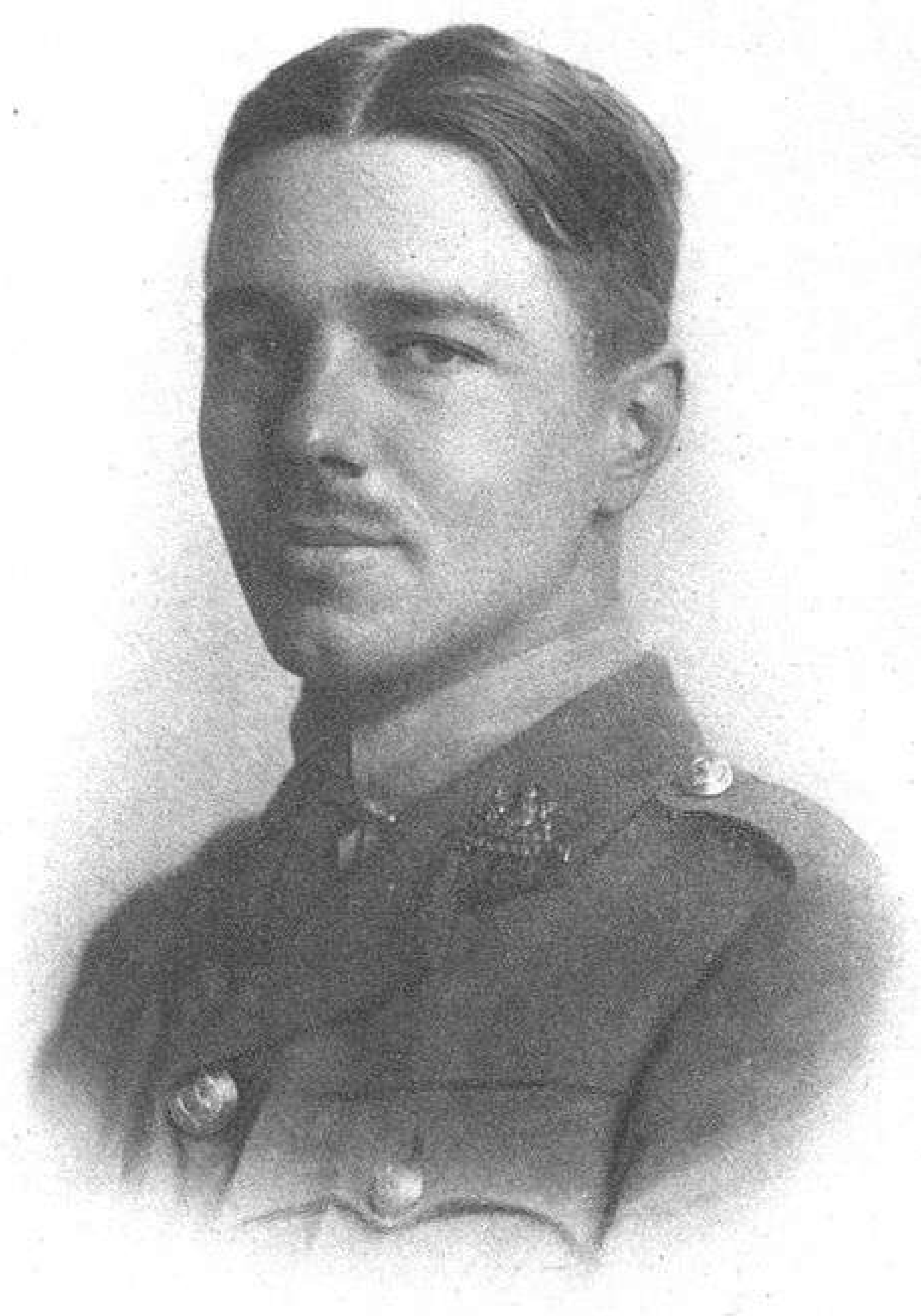

Figure 6.1: **Wilfred Owen.**

Siegfried Sassoon

Siegfried Sassoon was born into a wealthy family, and prior to World War I, he led a privileged life. During the war, he served in France, and he received the Military Cross for bringing back a wounded soldier under heavy fire. After being wounded, he shared a hospital room with Wilfred Owen. Sassoon's bitter poems describing the horrors of war inspired Owen's own poems. Here are two by Sassoon:

Attack

At dawn the ridge emerges massed and dun
In the wild purple of the glow'ring sun,
Smouldering through spouts of drifting smoke that shroud
The menacing scarred slope; and, one by one,
Tanks creep and topple forward to the wire.
The barrage roars and lifts. Then, clumsily bowed
With bombs and guns and shovels and battle-gear,
Men jostle and climb to, meet the bristling fire.
Lines of grey, muttering faces, masked with fear,
They leave their trenches, going over the top,
While time ticks blank and busy on their wrists,
And hope, with furtive eyes and grappling fists,
Flounders in mud. O Jesus, make it stop!

The death bed

He drowsed and was aware of silence heaped
Round him, unshaken as the steadfast walls;
Aqueous like floating rays of amber light,
Soaring and quivering in the wings of sleep.
Silence and safety; and his mortal shore
Lipped by the inward, moonless waves of death.

Someone was holding water to his mouth.
He swallowed, unresisting; moaned and dropped
Through crimson gloom to darkness; and forgot
The opiate throb and ache that was his wound.
Water - calm, sliding green above the weir;
Water - a sky-lit alley for his boat,
Bird-voiced, and bordered with reflected flowers
And shaken hues of summer: drifting down,
He dipped contented oars, and sighed, and slept.

Night, with a gust of wind, was in the ward,
Blowing the curtain to a gummering curve.
Night. He was blind; he could not see the stars
Glinting among the wraiths of wandering cloud;
Queer blots of colour, purple, scarlet, green,
Flickered and faded in his drowning eyes.

Rain - he could hear it rustling through the dark;
Fragrance and passionless music woven as one;
Warm rain on drooping roses; pattering showers
That soak the woods; not the harsh rain that sweeps
Behind the thunder, but a trickling peace,
Gently and slowly washing life away.

He stirred, shifting his body; then the pain
Leaped like a prowling beast, and gripped and tore
His groping dreams with grinding claws and fangs.
But someone was beside him; soon he lay
Shuddering because that evil thing had passed.
And death, who'd stepped toward him, paused and stared.

Light many lamps and gather round his bed.
Lend him your eyes, warm blood, and will to live.
Speak to him; rouse him; you may save him yet.
He's young; he hated war; how should he die
When cruel old campaigners win safe through?

But death replied: "I choose him." So he went,
And there was silence in the summer night;
Silence and safety; and the veils of sleep.
Then, far away, the thudding of the guns.

Figure 6.2: **Siegfried Sassoon.**

6.2 Dylan Thomas, 1914-1953

A Child's Christmas in Wales

One Christmas was so much like another, in those years around the sea-town corner now and out of all sound except the distant speaking of the voices I sometimes hear a moment before sleep, that I can never remember whether it snowed for six days and six nights when I was twelve or whether it snowed for twelve days and twelve nights when I was six.

All the Christmases roll down toward the two-tongued sea, like a cold and headlong moon bundling down the sky that was our street; and they stop at the rim of the ice-edged fish-freezing waves, and I plunge my hands in the snow and bring out whatever I can find. In goes my hand into that wool-white bell-tongued ball of holidays resting at the rim of the carol-singing sea, and out come Mrs. Prothero and the firemen.

It was on the afternoon of the Christmas Eve, and I was in Mrs. Prothero's garden, waiting for cats, with her son Jim. It was snowing. It was always snowing at Christmas. December, in my memory, is white as Lapland, though there were no reindeers. But there were cats. Patient, cold and callous, our hands wrapped in socks, we waited to snowball the cats. Sleek and long as jaguars and horrible-whiskered, spitting and snarling, they would slink and sidle over the white back-garden walls, and the lynx-eyed hunters, Jim and I, fur-capped and moccasined trappers from Hudson Bay, off Mumbles Road, would hurl our deadly snowballs at the green of their eyes. The wise cats never appeared.

We were so still, Eskimo-footed arctic marksmen in the muffling silence of the eternal snows - eternal, ever since Wednesday - that we never heard Mrs. Prothero's first cry from her igloo at the bottom of the garden. Or, if we heard it at all, it was, to us, like the far-off challenge of our enemy and prey, the neighbor's polar cat. But soon the voice grew louder. "Fire!" cried Mrs. Prothero, and she beat the dinner-gong.

And we ran down the garden, with the snowballs in our arms, toward the house; and smoke, indeed, was pouring out of the dining-room, and the gong was bombilating, and Mrs. Prothero was announcing ruin like a town crier in Pompeii. This was better than all the cats in Wales standing on the wall in a row. We bounded into the house, laden with snowballs, and stopped at the open door of the smoke-filled room.
Something was burning all right; perhaps it was Mr. Prothero, who always slept there after midday dinner with a newspaper over his face. But he was standing in the middle of the room, saying, "A fine Christmas!" and smacking at the smoke with a slipper.

"Call the fire brigade," cried Mrs. Prothero as she beat the gong. "There won't be there," said Mr. Prothero, "it's Christmas." There was no fire to be seen, only clouds of smoke and Mr. Prothero standing in the middle of them, waving his slipper as though he were conducting. "Do something," he said. And we threw all our snowballs into the smoke -

I think we missed Mr. Prothero - and ran out of the house to the telephone box. "Let's call the police as well," Jim said. "And the ambulance." "And Ernie Jenkins, he likes fires."

But we only called the fire brigade, and soon the fire engine came and three tall men in helmets brought a hose into the house and Mr. Prothero got out just in time before they turned it on. Nobody could have had a noisier Christmas Eve. And when the firemen turned off the hose and were standing in the wet, smoky room, Jim's Aunt, Miss. Prothero, came downstairs and peered in at them. Jim and I waited, very quietly, to hear what she would say to them. She said the right thing, always. She looked at the three tall firemen in their shining helmets, standing among the smoke and cinders and dissolving snowballs, and she said, "Would you like anything to read?"

Years and years ago, when I was a boy, when there were wolves in Wales, and birds the color of red-flannel petticoats whisked past the harp-shaped hills, when we sang and wallowed all night and day in caves that smelt like Sunday afternoons in damp front farmhouse parlors, and we chased, with the jawbones of deacons, the English and the bears, before the motor car, before the wheel, before the duchess-faced horse, when we rode the daft and happy hills bareback, it snowed and it snowed. But here a small boy says: "It snowed last year, too. I made a snowman and my brother knocked it down and I knocked my brother down and then we had tea."

"But that was not the same snow," I say. "Our snow was not only shaken from white wash buckets down the sky, it came shawling out of the ground and swam and drifted out of the arms and hands and bodies of the trees; snow grew overnight on the roofs of the houses like a pure and grandfather moss, minutely -ivied the walls and settled on the postman, opening the gate, like a dumb, numb thunder-storm of white, torn Christmas cards."

"Were there postmen then, too?" "With sprinkling eyes and wind-cherried noses, on spread, frozen feet they crunched up to the doors and mittened on them manfully. But all that the children could hear was a ringing of bells." "You mean that the postman went rat-a-tat-tat and the doors rang?" "I mean that the bells the children could hear were inside them." "I only hear thunder sometimes, never bells." "There were church bells, too." "Inside them?" "No, no, no, in the bat-black, snow-white belfries, tugged by bishops and storks. And they rang their tidings over the bandaged town, over the frozen foam of the powder and ice-cream hills, over the crackling sea. It seemed that all the churches boomed for joy under my window; and the weathercocks crew for Christmas, on our fence."

"Get back to the postmen" "They were just ordinary postmen, found of walking and dogs and Christmas and the snow. They knocked on the doors with blue knuckles ...." "Ours has got a black knocker...." "And then they stood on the white Welcome mat in the little, drifted porches and huffed and puffed, making ghosts with their breath, and jogged from foot to foot like small boys wanting to go out." "And then the presents?" "And then the Presents, after the Christmas box. And the cold postman, with a rose on his button-nose,

tingled down the tea-tray-slithered run of the chilly glinting hill. He went in his ice-bound boots like a man on fishmonger's slabs. "He wagged his bag like a frozen camel's hump, dizzily turned the corner on one foot, and, by God, he was gone."

"Get back to the Presents." "There were the Useful Presents: engulfing mufflers of the old coach days, and mittens made for giant sloths; zebra scarfs of a substance like silky gum that could be tug-o'-warred down to the galoshes; blinding tam-o'- shanters like patchwork tea cozies and bunny-suited busbies and balaclavas for victims of head-shrinking tribes; from aunts who always wore wool next to the skin there were mustached and rasping vests that made you wonder why the aunts had any skin left at all; and once I had a little crocheted nose bag from an aunt now, alas, no longer whinnying with us. And pictureless books in which small boys, though warned with quotations not to, would skate on Farmer Giles' pond and did and drowned; and books that told me everything about the wasp, except why."

"Go on the Useless Presents." "Bags of moist and many-colored jelly babies and a folded flag and a false nose and a tram-conductor's cap and a machine that punched tickets and rang a bell; never a catapult; once, by mistake that no one could explain, a little hatchet; and a celluloid duck that made, when you pressed it, a most unducklike sound, a mewing moo that an ambitious cat might make who wished to be a cow; and a painting book in which I could make the grass, the trees, the sea and the animals any colour I pleased, and still the dazzling sky-blue sheep are grazing in the red field under the rainbow-billed and pea-green birds. Hardboileds, toffee, fudge and allsorts, crunches, cracknels, humbugs, glaciers, marzipan, and butterwelsh for the Welsh. And troops of bright tin soldiers who, if they could not fight, could always run. And Snakes-and-Families and Happy Ladders. And Easy Hobbi-Games for Little Engineers, complete with instructions. Oh, easy for Leonardo! And a whistle to make the dogs bark to wake up the old man next door to make him beat on the wall with his stick to shake our picture off the wall. And a packet of cigarettes: you put one in your mouth and you stood at the corner of the street and you waited for hours, in vain, for an old lady to scold you for smoking a cigarette, and then with a smirk you ate it. And then it was breakfast under the balloons."

"Were there Uncles like in our house?" "There are always Uncles at Christmas. The same Uncles. And on Christmas morning, with dog-disturbing whistle and sugar fags, I would scour the swatched town for the news of the little world, and find always a dead bird by the Post Office or by the white deserted swings; perhaps a robin, all but one of his fires out. Men and women wading or scooping back from chapel, with taproom noses and wind-bussed cheeks, all albinos, huddles their stiff black jarring feathers against the irreligious snow. Mistletoe hung from the gas brackets in all the front parlors; there was sherry and walnuts and bottled beer and crackers by the dessertspoons; and cats in their fur-abouts watched the fires; and the high-heaped fire spat, all ready for the chestnuts and the mulling pokers. Some few large men sat in the front parlors, without their collars, Uncles almost certainly, trying their new cigars, holding them out judiciously at arms' length, returning them to their mouths, coughing, then holding them out again as though waiting for the explosion; and

some few small aunts, not wanted in the kitchen, nor anywhere else for that matter, sat on the very edge of their chairs, poised and brittle, afraid to break, like faded cups and saucers."

Not many those mornings trod the piling streets: an old man always, fawn-bowlered, yellow-gloved and, at this time of year, with spats of snow, would take his constitutional to the white bowling green and back, as he would take it wet or fire on Christmas Day or Doomsday; sometimes two hale young men, with big pipes blazing, no overcoats and wind blown scarfs, would trudge, unspeaking, down to the forlorn sea, to work up an appetite, to blow away the fumes, who knows, to walk into the waves until nothing of them was left but the two furling smoke clouds of their inextinguishable briars. Then I would be slap-dashing home, the gravy smell of the dinners of others, the bird smell, the brandy, the pudding and mince, coiling up to my nostrils, when out of a snow-clogged side lane would come a boy the spit of myself, with a pink-tipped cigarette and the violet past of a black eye, cocky as a bullfinch, leering all to himself.

I hated him on sight and sound, and would be about to put my dog whistle to my lips and blow him off the face of Christmas when suddenly he, with a violet wink, put his whistle to his lips and blew so stridently, so high, so exquisitely loud, that gobbling faces, their cheeks bulged with goose, would press against their tinsled windows, the whole length of the white echoing street. For dinner we had turkey and blazing pudding, and after dinner the Uncles sat in front of the fire, loosened all buttons, put their large moist hands over their watch chains, groaned a little and slept. Mothers, aunts and sisters scuttled to and fro, bearing tureens. Auntie Bessie, who had already been frightened, twice, by a clock-work mouse, whimpered at the sideboard and had some elderberry wine. The dog was sick. Auntie Dosie had to have three aspirins, but Auntie Hannah, who liked port, stood in the middle of the snowbound back yard, singing like a big-bosomed thrush. I would blow up balloons to see how big they would blow up to; and, when they burst, which they all did, the Uncles jumped and rumbled. In the rich and heavy afternoon, the Uncles breathing like dolphins and the snow descending, I would sit among festoons and Chinese lanterns and nibble dates and try to make a model man-o'-war, following the Instructions for Little Engineers, and produce what might be mistaken for a sea-going tramcar.

Or I would go out, my bright new boots squeaking, into the white world, on to the seaward hill, to call on Jim and Dan and Jack and to pad through the still streets, leaving huge footprints on the hidden pavements. "I bet people will think there's been hippos." "What would you do if you saw a hippo coming down our street?" "I'd go like this, bang! I'd throw him over the railings and roll him down the hill and then I'd tickle him under the ear and he'd wag his tail." "What would you do if you saw two hippos?"

Iron-flanked and bellowing he-hippos clanked and battered through the scudding snow toward us as we passed Mr. Daniel's house. "Let's post Mr. Daniel a snow-ball through his letter box." "Let's write things in the snow." "Let's write, 'Mr. Daniel looks like a spaniel' all over his lawn." Or we walked on the white shore. "Can the fishes see it's snowing?"

The silent one-clouded heavens drifted on to the sea. Now we were snow-blind travelers lost on the north hills, and vast dewlapped dogs, with flasks round their necks, ambled and shambled up to us, baying "Excelsior." We returned home through the poor streets where only a few children fumbled with bare red fingers in the wheel- rutted snow and cat-called after us, their voices fading away, as we trudged uphill, into the cries of the dock birds and the hooting of ships out in the whirling bay. And then, at tea the recovered Uncles would be jolly; and the ice cake loomed in the center of the table like a marble grave. Auntie Hannah laced her tea with rum, because it was only once a year.

Bring out the tall tales now that we told by the fire as the gaslight bubbled like a diver. Ghosts whooed like owls in the long nights when I dared not look over my shoulder; animals lurked in the cubbyhole under the stairs and the gas meter ticked. And I remember that we went singing carols once, when there wasn't the shaving of a moon to light the flying streets. At the end of a long road was a drive that led to a large house, and we stumbled up the darkness of the drive that night, each one of us afraid, each one holding a stone in his hand in case, and all of us too brave to say a word. The wind through the trees made noises as of old and unpleasant and maybe webfooted men wheezing in caves. We reached the black bulk of the house. "What shall we give them? Hark the Herald?" "No," Jack said, "Good King Wencelas. I'll count three." One, two three, and we began to sing, our voices high and seemingly distant in the snow-felted darkness round the house that was occupied by nobody we knew. We stood close together, near the dark door. Good King Wencelas looked out On the Feast of Stephen ... And then a small, dry voice, like the voice of someone who has not spoken for a long time, joined our singing: a small, dry, eggshell voice from the other side of the door: a small dry voice through the keyhole. And when we stopped running we were outside our house; the front room was lovely; balloons floated under the hot-water-bottle-gulping gas; everything was good again and shone over the town. "Perhaps it was a ghost," Jim said. "Perhaps it was trolls," Dan said, who was always reading. "Let's go in and see if there's any jelly left," Jack said. And we did that.

Always on Christmas night there was music. An uncle played the fiddle, a cousin sang "Cherry Ripe," and another uncle sang "Drake's Drum." It was very warm in the little house. Auntie Hannah, who had got on to the parsnip wine, sang a song about Bleeding Hearts and Death, and then another in which she said her heart was like a Bird's Nest; and then everybody laughed again; and then I went to bed. Looking through my bedroom window, out into the moonlight and the unending smoke-colored snow, I could see the lights in the windows of all the other houses on our hill and hear the music rising from them up the long, steady falling night. I turned the gas down, I got into bed. I said some words to the close and holy darkness, and then I slept.

Figure 6.3: **Dylan Thomas at a bookstore in New York in 1952. Although he wrote in English rather than in Welsh, the people of Wales regard him as their great national poet. His verse play *Under Milk Wood* is much loved.**

6.3 Robert Frost, 1874-1963

Two Tramps In Mud Time

Out of the mud two strangers came
And caught me splitting wood in the yard,
And one of them put me off my aim
By hailing cheerily "Hit them hard!"
I knew pretty well why he had dropped behind
And let the other go on a way.
I knew pretty well what he had in mind:
He wanted to take my job for pay.

Good blocks of oak it was I split,
As large around as the chopping block;
And every piece I squarely hit
Fell splinterless as a cloven rock.
The blows that a life of self-control
Spares to strike for the common good,
That day, giving a loose to my soul,
I spent on the unimportant wood.

The sun was warm but the wind was chill.
You know how it is with an April day
When the sun is out and the wind is still,
You're one month on in the middle of May.
But if you so much as dare to speak,
A cloud comes over the sunlit arch,
A wind comes off a frozen peak,
And you're two months back in the middle of March.

A bluebird comes tenderly up to alight
And turns to the wind to unruffle a plume,
His song so pitched as not to excite
A single flower as yet to bloom.
It is snowing a flake; and he half knew
Winter was only playing possum.
Except in color he isn't blue,
But he wouldn't advise a thing to blossom.

The water for which we may have to look
In summertime with a witching wand,
In every wheelrut's now a brook,

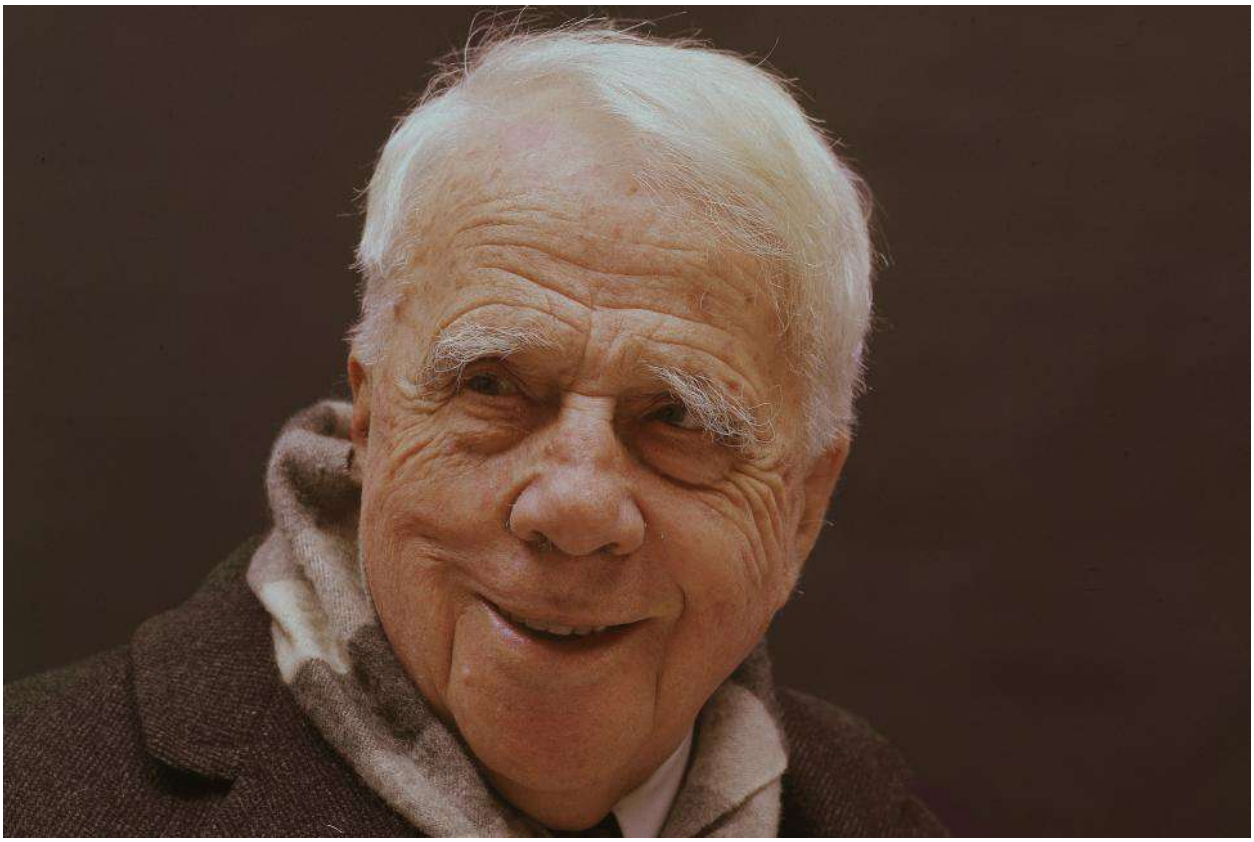

Figure 6.4: **Robert Frost was the only poet to win four Pulitzer Prizes for his work. Although he was born in San Francisco, he came from an old New England family, and his poetry often describes life in rural New England. In many of his poems, Frost seems to be describing a concrete scene or experience, but at the end, the reader realizes that he has been aiming at something larger - he wants to tell us a universal truth about the human experience. The poems are constructed almost like the a pole-vaulter's run along the level track, followed by a final swing, high up into the air.**

In every print of a hoof a pond.
Be glad of water, but don't forget
The lurking frost in the earth beneath
That will steal forth after the sun is set
And show on the water its crystal teeth.

The time when most I loved my task
The two must make me love it more
By coming with what they came to ask.
You'd think I never had felt before
The weight of an ax-head poised aloft,
The grip of earth on outspread feet,
The life of muscles rocking soft
And smooth and moist in vernal heat.

Out of the wood two hulking tramps
(From sleeping God knows where last night,
But not long since in the lumber camps).
They thought all chopping was theirs of right.
Men of the woods and lumberjacks,
They judged me by their appropriate tool.
Except as a fellow handled an ax
They had no way of knowing a fool.

Nothing on either side was said.
They knew they had but to stay their stay
And all their logic would fill my head:
As that I had no right to play
With what was another man's work for gain.
My right might be love but theirs was need.
And where the two exist in twain
Theirs was the better right–agreed.

But yield who will to their separation,
My object in living is to unite
My avocation and my vocation
As my two eyes make one in sight.
Only where love and need are one,
And the work is play for mortal stakes,
Is the deed ever really done
For Heaven and the future's sakes.

The Road Not Taken

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;
Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same,
And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.
I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I-
I took the one less traveled by,
And that has made all the difference.

Fire and Ice

Some say the world will end in fire,
Some say in ice.
From what I've tasted of desire
I hold with those who favor fire.
But if it had to perish twice,
I think I know enough of hate
To say that for destruction ice
Is also great
And would suffice.

Mending Wall

Something there is that doesn't love a wall,
That sends the frozen-ground-swell under it,
And spills the upper boulders in the sun;
And makes gaps even two can pass abreast.
The work of hunters is another thing:

I have come after them and made repair
Where they have left not one stone on a stone,
But they would have the rabbit out of hiding,
To please the yelping dogs. The gaps I mean,
No one has seen them made or heard them made,
But at spring mending-time we find them there.
I let my neighbor know beyond the hill;
And on a day we meet to walk the line
And set the wall between us once again.
We keep the wall between us as we go.
To each the boulders that have fallen to each.
And some are loaves and some so nearly balls
We have to use a spell to make them balance:
'Stay where you are until our backs are turned!'
We wear our fingers rough with handling them.
Oh, just another kind of out-door game,
One on a side. It comes to little more:
There where it is we do not need the wall:
He is all pine and I am apple orchard.
My apple trees will never get across
And eat the cones under his pines, I tell him.
He only says, 'Good fences make good neighbors.'
Spring is the mischief in me, and I wonder
If I could put a notion in his head:
'Why do they make good neighbors? Isn't it
Where there are cows? But here there are no cows.
Before I built a wall I'd ask to know
What I was walling in or walling out,
And to whom I was like to give offense.
Something there is that doesn't love a wall,
That wants it down.' I could say 'Elves' to him,
But it's not elves exactly, and I'd rather
He said it for himself. I see him there
Bringing a stone grasped firmly by the top
In each hand, like an old-stone savage armed.
He moves in darkness as it seems to me,
Not of woods only and the shade of trees.
He will not go behind his father's saying,
And he likes having thought of it so well
He says again, 'Good fences make good neighbors.'

Stopping by Woods on a Snowy Evening

Whose woods these are I think I know.
His house is in the village though;
He will not see me stopping here
To watch his woods fill up with snow.

My little horse must think it queer
To stop without a farmhouse near
Between the woods and frozen lake
The darkest evening of the year.

He gives his harness bells a shake
To ask if there is some mistake.
The only other sound's the sweep
Of easy wind and downy flake.

The woods are lovely, dark and deep,
But I have promises to keep,
And miles to go before I sleep,
And miles to go before I sleep.

6.4 T.S. Eliot, 1888-1965

The Love Song of J. Alfred Prufrock

S'io credesse che mia risposta fosse
A persona che mai tornasse al mondo,
Questa fiamma staria senza piu scosse.
Ma perciocche giammai di questo fondo
Non torno vivo alcun, s'i'odo il vero,
Senza tema d'infamia ti rispondo.

Let us go then, you and I,
When the evening is spread out against the sky
Like a patient etherised upon a table;
Let us go, through certain half-deserted streets,
The muttering retreats
Of restless nights in one-night cheap hotels
And sawdust restaurants with oyster-shells:
Streets that follow like a tedious argument

Of insidious intent
To lead you to an overwhelming question...
Oh, do not ask, "What is it?"
Let us go and make our visit.

In the room the women come and go
Talking of Michelangelo.

The yellow fog that rubs its back upon the window-panes,
The yellow smoke that rubs its muzzle on the window-panes,
Licked its tongue into the corners of the evening
Lingered upon the pools that stand in drains,
Let fall upon its back the soot that falls from chimneys,
Slipped by the terrace, made a sudden leap,
And seeing that it was a soft October night,
Curled once about the house, and fell asleep.
And indeed there will be time
For the yellow smoke that slides along the street
Rubbing its back upon the window-panes;
There will be time, there will be time
To prepare a face to meet the faces that you meet;
There will be time to murder and create,
And time for all the works and days of hands
That lift and drop a question on your plate,
Time for you and time for me,
And time yet for a hundred indecisions,
And for a hundred visions and revisions,
Before the taking of a toast and tea.

In the room the women come and go
Talking of Michelangelo.

And indeed there will be time
To wonder, "Do I dare?" and, "Do I dare?"
Time to turn back and descend the stair,
With a bald spot in the middle of my hair-
(They will say: "How his hair is growing thin!")
My morning coat, my collar mounting firmly to the chin,
My necktie rich and modest, but asserted by a simple pin-
(They will say: "But how his arms and legs are thin!")

Do I dare
Disturb the universe?

In a minute there is time
For decisions and revisions which a minute win reverse.

For I have known them all already, known them all-
Have known the evenings, mornings, afternoons,
I have measured out my life with coffee spoons;
I know the voices dying with a dying fall
Beneath the music from a farther room.
So how should I presume?

And I have known the eyes already, known them all-
The eyes that fix you in a formulated phrase,
And when I am formulated, sprawling on a pin,
When I am pinned and wriggling on the wall,
Then how should I begin
To spit out all the butt-ends of my days and ways?
And how should I presume?

And I have known the arms already, known them all-
Arms that are braceleted and white and bare
(But in the lamplight, downed with light brown hair!)
Is it perfume from a dress
That makes me so digress?
Arms that lie along a table, or wrap about a shawl.
And should I then presume?
And how should I begin?

Shall I say, I have gone at dusk through narrow streets
And watched the smoke that rises from the pipes
Of lonely men in shirt-sleeves, leaning out of windows?

I should have been a pair of ragged claws
Scuttling across the floors of silent seas.
. . . . .
And the afternoon, the evening, sleeps so peacefully!
Smoothed by long fingers,
Asleep ... tired ... or it malingers,
Stretched on the floor, here beside you and me.
Should I, after tea and cakes and ices,
Have the strength to force the moment to its crisis?
But though I have wept and fasted, wept and prayed,
Though I have seen my head (grown slightly bald) brought in
upon a platter,

Figure 6.5: **Thomas Stearns Eliot, photographed in 1934 by Lady Ottoline Morrell. Eliot was born in St. Louis Missouri, but he left the United States for England at the age of 25, married in England, and later renounced his American citizenship. His poems, *The Love Song of J. Alfred Prufrock*, *The Wasteland*, *The Hollow Men*, *Ash Wednesday*, and *Four Quartets*, pioneered modern forms of poetry. Eliot also authored the plays *Murder in the Cathedral* and *The Cocktail Party.* He was awarded the Nobel Prize in Literature in 1948.**

I am no prophet-and here's no great matter;
I have seen the moment of my greatness flicker,
And I have seen the eternal Footman hold my coat, and snicker,
And in short, I was afraid.

And would it have been worth it, after all,
After the cups, the marmalade, the tea,
Among the porcelain, among some talk of you and me,
Would it have been worth while,
To have bitten off the matter with a smile,
To have squeezed the universe into a ball
To roll it towards some overwhelming question,
To say: "I am Lazarus, come from the dead,
Come back to tell you all, I shall tell you all"-
If one, settling a pillow by her head,
Should say: "That is not what I meant at all.
That is not it, at all."

And would it have been worth it, after all,
Would it have been worth while,
After the sunsets and the dooryards and the sprinkled streets,
After the novels, after the teacups, after the skirts that trail along the floor-
And this, and so much more?-
It is impossible to say just what I mean!
But as if a magic lantern threw the nerves in patterns on a screen:
Would it have been worth while
If one, settling a pillow or throwing off a shawl,
And turning toward the window, should say:
"That is not it at all,
That is not what I meant, at all."

No! I am not Prince Hamlet, nor was meant to be;
Am an attendant lord, one that will do
To swell a progress, start a scene or two,
Advise the prince; no doubt, an easy tool
Deferential, glad to be of use,
Politic, cautious, and meticulous;
Full of high sentence, but a bit obtuse;
At times, indeed, almost ridiculous-
Almost, at times, the Fool.

I grow old ... I grow old ...

I shall wear the bottoms of my trousers rolled.

Shall I part my hair behind? Do I dare to eat a peach?
I shall wear white flannel trousers, and walk upon the beach.
I have heard the mermaids singing, each to each.

I do not think that they will sing to me.

I have seen them riding seaward on the waves
Combing the white hair of the waves blown back
When the wind blows the water white and black.

We have lingered in the chambers of the sea
By sea-girls wreathed with seaweed red and brown
Till human voices wake us, and we drown.

6.5 Edna St. Vincent Millay, 1892-1950

Edna St. Vincent Millay (1892-1950), is known for her lyric poetry, but she also wrote some of the finest sonnets in the English language, combining classic form with modern imagery. Many of these sonnets are based on the emotions that she experienced in her love affairs. However, my own favorite is a serious sequence of eighteen sonnets, *Epitaph for the Race of Man*, published in 1934, just as the catastrophe of World War II was about to engulf our planet.

The basic premise of Millay's *Epitaph*' is that we know from the evolutionary history of life on earth, that no species survives forever. She speculates on what will be the final cause of the extinction of the human race, and concludes that Man will die by his own hand, since none the innumerable disasters that nature has thrown at us over the millennia has persuaded humankind "to lay aside the lever and the spade, and be as dust among the dusts that blow'"'. Here are the eighteen sonnets from the sequence:

Epitaph For The Race Of Man

Before this cooling planet shall be cold,
Long, long before the music of the Lyre,
Like the faint roar of distant breakers rolled
On reefs unseen, when wind and flood conspire
To drive the ships inshore - long, long, I say,
Before this ominous humming hits the ear,
Earth will have come upon a stiller day,
Man and his engines be no longer here.

Figure 6.6: **The beautiful red-haired American poet, Edna St. Vincent Millay (1892-1950), was the daughter of a divorced, poor, but very literate, mother, Millay grew up in Maine. At 14, she won the St. Nicolas Gold Badge for poetry, and by 15, she had published her poetry in the high-profile anthology, Current Literature. She was able attend Vassar College, because her fees were paid by an admirer who was impressed by her talent. Millay often wrote sonnets, combining classic form with modern imagery, and many consider her sonnets to be the best written in the 20th century. The English novelist, Thomas Hardy, said of her, "America has two attractions: skyscrapers and Edna St. Vincent Millay".**

High on his naked rock the mountain sheep
Will stand alone against the final sky,
Drinking a wind of danger new and deep,
Staring on Vega with a piercing eye,
And gather up his slender hooves and leap
From crag to crag down Chaos, and so go by.

When Death was young and bleaching bones were few,
A moving hill against the risen day
The dinosaur at morning made his way,
And dropped his dung along the blazing dew;
Trees with no name that now are agate grew
Lushly beside him in the steamy clay;
He woke and hungered, rose and stalked his prey,
And slept contented, in a world he knew.
In punctual season, with the race in mind,
His consort held aside her heavy tail,
And took the seed; and heard the seed confined
Roar in her womb; and made a nest to hold
A hatched-out conqueror . . . but to no avail:
The veined and fertile eggs are long since cold.

Cretaceous bird, your giant claw no lime
From bark of holly bruised or mistletoe
Could have arrested, could have held you so
Through fifty million years of jostling time;
Yet cradled with you in the catholic slime
Of the young ocean's tepid lapse and flow
Slumbered an agent, weak in embryo,
Should grip you straitly, in its sinewy prime.
What bright collision in the zodiac brews,
What mischief dimples at the planet's core
For shark, for python, for the dove that coos
Under the leaves? - what frosty fate's in store
For the warm blood of man, - man, out of ooze
But lately crawled, and climbing up the shore?

Oh Earth, unhappy planet, born to die,
Might I your scribe and your confessor be,
What wonders must you not relate to me
Of Man, who, when his destiny was high
Strode like the sun into the middle sky
And shone an hour, and who so bright as he,

And like the sun went down into the sea,
Leaving no spark to be remembered by.
But no; you have not learned in all these years
To tell the leopard and the newt apart;
Man, with his singular laughter, his droll tears,
His engines and his conscience and his art,
Made but a simple sound upon your ears:
The patient beating of an animal heart.

When man is gone and only gods remain
To stride the world, their mighty bodies hung
With golden shields, and golden curls outflung
Above their childish foreheads; when the plain
Round skull of Man is lifted and again
Abandoned by the ebbing wave, among
The sand and pebbles of the beach, - what tongue
Will tell the marvel of the human brain?
Heavy with music once this windy shell,
Heavy with knowledge of the clustered stars;
The one-time tenant of this draughty hall
Himself, in learned pamphlet, did foretell,
After some aeons of study jarred by wars,
This toothy gourd, this head emptied of all.

See where Capella with her golden kids
Grazes the slope between the east and north?
Thus when the builders of the pyramids
Flung down their tools at nightfall and poured forth
Homeward to supper and a poor man's bed,
Shortening the road with friendly jest and slur,
The risen She-Goat showing blue and red
Climbed the clear dusk, and three stars followed her.
Safe in their linen and their spices lie
The kings of Egypt; even as long ago
Under these constellations, with long eye
And scented limbs they slept, and feared no foe.
Their will was law; their will was not to die:
And so they had their way; or nearly so.

He heard the coughing tiger in the night
Push at his door; close by his quiet head
About the wattled cabin the soft tread
Of heavy feet he followed, and the slight

Sigh of the long banana leaves; in sight
At last and leaning westward overhead
The Centaur and the Cross now heralded
The sun, far off but marching, bringing light.
What time the Centaur and the Cross were spent
Night and the beast retired into the hill,
Whereat serene and undevoured he lay,
And dozed and stretched and listened and lay still,
Breathing into his body with content
The temperate dawn before the tropic day.

Observe how Miyanoshita cracked in two
And slid into the valley; he that stood
Grinning with terror in the bamboo wood
Saw the earth heave and thrust its bowels through
The hill, and his own kitchen slide from view,
Spilling the warm bowl of his humble food
Into the lap of horror; mark how lewd
This cluttered gulf, - 'twas here his paddy grew.
Dread and dismay have not encompassed him;
The calm sun sets; unhurried and aloof
Into the riven village falls the rain;
Days pass; the ashes cool; he builds again
His paper house upon oblivion's brim,
And plants the purple iris in its roof.

He woke in terror to a sky more bright
Than middle day; he heard the sick earth groan,
And ran to see the lazy-smoking cone
Of the fire-mountain, friendly to his sight
As his wife's hand, gone strange and full of fright;
Over his fleeing shoulder it was shown
Rolling its pitchy lake of scalding stone
Upon his house that had no feet for flight.
Where did he weep? Where did he sit him down
And sorrow, with his head between his knees?
Where said the Race of Man, "Here let me drown"?
"Here let me die of hunger"? . "let me freeze"?
By nightfall he has built another town:
This boiling pot, this clearing in the trees.

The broken dike, the levee washed away,
The good fields flooded and the cattle drowned,

Estranged and treacherous all the faithful ground,
And nothing left but floating disarray
Of tree and home uprooted, - was this the day
Man dropped upon his shadow without a sound
And died, having laboured well and having found
His burden heavier than a quilt of clay?
No, no. I saw him when the sun had set
In water, leaning on his single oar
Above his garden faintly glimmering yet ...
There bulked the plough, here washed the updrifted weeds ...
And scull across his roof and make for shore,
With twisted face and pocket full of seeds.

Sweeter was loss than silver coins to spend,
Sweeter was famine than the belly filled;
Better than blood in the vein was the blood spilled;
Better than corn and healthy flocks to tend
And a tight roof and acres without end
Was the barn burned and the mild creatures killed,
And the back aging fast, and all to build:
For then it was, his neighbor was his friend.
Then for a moment the averted eye
Was turned upon him with benignant beam,
Defiance faltered, and derision slept;
He saw in a not unhappy dream
The kindly heads against the horrid sky,
And scowled, and cleared his throat and spat, and wept.

Now forth to meadows as the farmer goes
With shining buckets to the milking-ground,
He meets the black ant hurrying from his mound
To milk the aphid pastured on the rose;
But no good-morrow, as you might suppose,
No nod of greeting, no perfunctory sound
Passes between them; no occasion's found
For gossip as to how the fodder grows.
In chilly autumn on the hardening road
They meet again, driving their flocks to stall,
Two herdsmen, each with winter for a goad;
They meet and pass, and never a word at all
Gives one to t'other. On the quaint abode
Of each, the evening and the first snow fall.

His heatless room the watcher of the stars
Nightly inhabits when the night is clear;
Propping his mattress on the turning sphere,
Saturn his rings or Jupiter his bars
He follows, or the fleeing moons of Mars,
Till from his ticking lens they disappear...
Whereat he sighs, and yawns, and on his ear
The busy chirp of Earth remotely jars.
Peace at the void's heart through the wordless night,
A lamb cropping the awful grasses, grazed;
Earthward the trouble lies, where strikes his light
At dawn industrious Man, and unamazed
Goes forth to plough, flinging a ribald stone
At all endeavor alien to his own.

Him not the golden fang of furious heaven,
Nor whirling Aeolus on his awful wheel,
Nor foggy specter ramming the swift keel,
Nor flood, nor earthquake, nor the red tongue even
Of fire, disaster's dog - him, him bereaven
Of all save the heart's knocking, and to feel
The air upon his face: not the great heel
Of headless Force into the dust was driven.
These sunken cities, tier on tier, bespeak
How ever from the ashes with proud beak
And shining feathers did the phoenix rise,
And sail, and send the vulture from the skies...
That in the end returned; for Man was weak
Before the unkindness in his brother's eyes.

Now sets his foot upon the eastern sill
Aldeberan, swiftly rising, mounting high,
And tracks the Pleiads down the crowded sky,
And drives his wedge into the western hill;
Now for the void sets forth, and further still,
The questioning mind of man... that by and by
From the void's rim returns with swooping eye,
Having seen himself into the maelstrom spill.
Blench not, O race of Adam, lest you find
In the sun's bubbling bowl anonymous death,
Or lost in whistling space without a mind
To monstrous Nothing yield your little breath:
You shall achieve destruction where you stand,

In intimate conflict, at your brother's hand.

Alas for Man, so stealthily betrayed,
Bearing the bad cell in him from the start,
Pumping and feeding on his healthy heart
That wild disorder never to be stayed
When once established, destined to invade
With angry hordes the true and proper part,
'Til Reason joggles in the headsman's cart,
And Mania spits from every balustrade.
Would he had searched his closet for his bane,
Where lurked the trusted ancient of his soul,
Obsequious Greed, and seen that visage plain;
Would he had whittled treason from his side
In his stout youth and bled his body whole,
Then had he died a king, or never died.'"

Only the diamond and the diamond's dust
Can render up the diamond unto Man;
One and invulnerable as it began
Had it endured, but for the treacherous thrust
That laid its hard heart open, as it must,
And ground it down and fitted it to span
A turbaned brow or fret an ivory fan,
Lopped of its stature, pared of its proper crust.
So Man, by all the wheels of heaven unscored,
Man, the stout ego, the exuberant mind
No edge could cleave, no acid could consume,
Being split along the vein by his own kind,
Gives over, rolls upon the palm abhorred,
Is set in brass on the swart thumb of Doom.

Here lies, and none to mourn him but the sea,
That falls incessant on the empty shore,
Most various Man, cut down to spring no more;
Before his prime, even in his infancy
Cut down, and all the clamour that was he,
Silenced; and all the riveted pride he wore,
A rusted iron column whose tall core
The rains have tunneled like an aspen tree.
Man, doughty Man, what power has brought you low,
That heaven itself in arms could not persuade
To lay aside the lever and the spade

And be as dust among the dusts that blow?
Whence, whence the broadside? Whose the heavy blade?...
Strive not to speak, poor scattered mouth; I know.

It seems to me that although Millay's words were extremely appropriate as a warning to humankind in 1934, they are even more heavy with meaning today. Millay speaks eloquently to us over the years:.

Conscientious Objector

I shall die, but
that is all that I shall do for Death.
I hear him leading his horse out of the stall;
I hear the clatter on the barn-floor.
He is in haste; he has business in Cuba,
business in the Balkans, many calls to make this morning.
But I will not hold the bridle
while he clinches the girth.
And he may mount by himself:
I will not give him a leg up.

Though he flick my shoulders with his whip,
I will not tell him which way the fox ran.
With his hoof on my breast, I will not tell him where
the black boy hides in the swamp.
I shall die, but that is all that I shall do for Death;
I am not on his pay-roll.

I will not tell him the whereabout of my friends
nor of my enemies either.
Though he promise me much,
I will not map him the route to any man's door.
Am I a spy in the land of the living,
that I should deliver men to Death?
Brother, the password and the plans of our city
are safe with me; never through me Shall you be overcome.

Afternoon On A Hill

I will be the gladdest thing
Under the sun!

I will touch a hundred flowers
And not pick one.

I will look at cliffs and clouds
With quiet eyes,
Watch the wind bow down the grass,
And the grass rise.

And when lights begin to show
Up from the town,
I will mark which must be mine,
And then start down!

Recuerdo

We were very tired, we were very merry –
We had gone back and forth all night upon the ferry.
It was bare and bright, and smelled like a stable –
But we looked into a fire, we leaned across a table,
We lay on the hill-top underneath the moon;
And the whistles kept blowing, and the dawn came soon.
We were very tired, we were very merry –
We had gone back and forth all night on the ferry;
And you ate an apple, and I ate a pear,
From a dozen of each we had bought somewhere;
And the sky went wan, and the wind came cold,
And the sun rose dripping, a bucketful of gold.

We were very tired, we were very merry,
We had gone back and forth all night on the ferry.
We hailed, "Good morrow, mother!" to a shawl-covered head,
And bought a morning paper, which neither of us read;
And she wept, "God bless you!" for the apples and the pears,
And we gave her all our money but our subway fares.

My Spirit, Sore from Marching

My spirit, sore from marching
Toward that receding west
Where Pity shall be governor,
With Wisdom for his guest:

Lie down beside these waters
That bubble from the spring;
Hear in the desert silence
The desert sparrow sing;

Draw from the shapeless moment
Such pattern as you can;
And cleave henceforth to Beauty;
Expect no more from man.

Man, with his ready answer,
His sad and hearty word,
For every cause in limbo,
For every debt deferred,

For every pledge forgotten,
His eloquent and grim
Deep empty gaze upon you, –
Expect no more from him.

From pure and aimless Beauty
Your help and comfort take,
Beauty, that makes no promise,
And has no word to break;

Have eyes for Beauty only,
That has no eyes for you;
Follow her struck pavilion,
Halt with her retinue;

Have ears for Beauty only,
Follow her distant call.
Here's hope for saint and sinner;
Here's heresy for all.

A Few Figs From Thistles

First Fig:

My candle burns at both ends;
It will not last the night;

But ah, my foes, and oh, my friends-
It gives a lovely light.

Second Fig:

Safe upon the solid rock the ugly houses stand:
Come and see my shining palace built upon the sand!

6.6 The San Francisco poets, 1950's and 1960's

Howl, by Allen Ginsberg, Part 1

I saw the best minds of my generation destroyed by madness, starving hysterical naked, dragging themselves through the negro streets at dawn looking for an angry fix, angelheaded hipsters burning for the ancient heavenly connection to the starry dynamo in the machinery of night, who poverty and tatters and hollow-eyed and high sat up smoking in the supernatural darkness of cold-water flats floating across the tops of cities contemplating jazz, who bared their brains to Heaven under the El and saw Mohammedan angels staggering on tenement roofs illuminated, who passed through universities with radiant cool eyes hallucinating Arkansas and Blake-light tragedy among the scholars of war, who were expelled from the academies for crazy & publishing obscene odes on the windows of the skull, who cowered in unshaven rooms in underwear, burning their money in wastebaskets and listening to the Terror through the wall, who got busted in their pubic beards returning through Laredo with a belt of marijuana for New York, who ate fire in paint hotels or drank turpentine in Paradise Alley, death, or purgatoried their torsos night after night with dreams, with drugs, with waking nightmares, alcohol and cock and endless balls, incomparable blind; streets of shuddering cloud and lightning in the mind leaping toward poles of Canada& Paterson, illuminating all the mo- tionless world of Time between, Peyote solidities of halls, backyard green tree cemetery dawns, wine drunkenness over the rooftops, storefront boroughs of teahead joyride neon blinking traffic light, sun and moon and tree vibrations in the roaring winter dusks of Brooklyn, ashcan rantings and kind king light of mind, who chained themselves to subways for the endless ride from Battery to holy Bronx on benzedrine until the noise of wheels and children brought them down shuddering mouth-wracked and battered bleak of brain all drained of brilliance in the drear light of Zoo, who sank all night in submarine light of Bickford's floated out and sat through the stale beer after noon in desolate Fugazzi's, listening to the crack of doom on the hydrogen jukebox, who talked continuously seventy hours from park to pad to bar to Bellevue to museum to the Brooklyn Bridge, lost battalion of platonic conversationalists jumping down the stoops off fire escapes off windowsills off Empire State out of the moon, yacketayakking screaming vomiting whispering facts and memories and anecdotes and eyeball kicks and shocks of hospitals and jails and *wars, whole intellects disgorged in total recall for seven days and nights with brilliant eyes, meat for the Synagogue cast on the pavement, who vanished into nowhere Zen New Jersey leaving a trail of ambiguous picture postcards of Atlantic City Hall, suffering Eastern sweats and Tangerian bone-grindings and migraines of China under junk-withdrawal in Newark's bleak furnished room, who wandered around and around at midnight in the railroad yard wondering where to go, and went, leaving no broken hearts, who lit cigarettes in boxcars boxcars boxcars racketing through snow toward lonesome farms in grandfather night, who studied Plotinus Poe St. John of the Cross telepathy and bop kabbalah because the cosmos in- stinctively vibrated at their feet in Kansas, who loned it through the streets of Idaho seeking visionary indian angels who were visionary indian angels, who thought they were only mad when Baltimore gleamed in supernatural ecstasy, who jumped in limousines with the Chinaman of Oklahoma on the impulse of winter midnight street light smalltown rain, who lounged hungry and lonesome through Houston seeking jazz or sex or soup, and followed the brilliant Spaniard to converse about America and Eternity, a hopeless task, and so took ship to Africa, who disappeared into the volcanoes of Mexico leaving behind nothing but the shadow of dungarees and the lava and ash of poetry scattered in fire place Chicago, who reappeared on the West Coast investigating the F.B.I. in beards and shorts with big pacifist eyes sexy in their dark skin passing out incomprehensible leaflets, who burned cigarette holes in their arms protesting the narcotic tobacco haze of Capitalism, who distributed Supercommunist pamphlets in Union Square weeping and undressing while the sirens of Los Alamos wailed them down, and wailed down Wall, and the Staten Island ferry also wailed, who broke down crying in white gymnasiums naked and trembling before the machinery of other skeletons, who bit detectives in the neck and shrieked with delight in policecars for committing no crime but their own wild cooking pederasty and intoxication, who howled on their knees in the subway and were dragged off the roof waving genitals and manuscripts, who let themselves be fucked in the ass by saintly motorcyclists, and screamed with joy, who blew and were blown by those human seraphim, the sailors, caresses of Atlantic and Caribbean love, who balled in the morning in the evenings in rose gardens and the grass of public parks and cemeteries scattering their semen freely to whomever come who may, who hiccuped endlessly trying to giggle but wound up with a sob behind a partition in a Turkish Bath when the blond & naked angel came to pierce them with a sword, who lost their loveboys to the three old shrews of fate the one eyed shrew of the heterosexual dollar the one eyed shrew that winks out of the womb and the one eyed shrew that does nothing but sit on her ass and snip the intellectual golden threads of the craftsman's loom, who copulated ecstatic and insatiate with a bottle of beer a sweetheart a package of cigarettes a candle and fell off the bed, and continued along the floor and down the hall and ended fainting on the wall with a vision of ultimate cunt and come eluding the last gyzym of consciousness, who sweetened the snatches of a million girls trembling in the sunset, and were red eyed in the morning but prepared to sweeten the snatch of the sun rise, flashing buttocks under barns and naked in the lake, who went out whoring through Colorado in myriad stolen night-cars, N.C., secret hero of these poems, cocksman and Adonis of Denver–joy to the memory of his innumerable lays of girls in empty lots& diner backyards, moviehouses' rickety rows, on mountaintops in caves or with gaunt waitresses in familiar roadside lonely petticoat upliftings& especially* *secret gas-station solipsisms of johns,& hometown alleys too, who faded out in vast sordid movies, were shifted in dreams, woke on a sudden Manhattan, and picked themselves up out of basements hung over with heartless Tokay and horrors of Third Avenue iron dreams& stumbled to unemploy- ment offices, who walked all night with their shoes full of blood on the snowbank docks waiting for a door in the East River to open to a room full of steamheat and opium, who created great suicidal dramas on the apartment cliff-banks of the Hudson under the wartime blue floodlight of the moon& their heads shall be crowned with laurel in oblivion, who ate the lamb stew of the imagination or digested the crab at the muddy bottom of the rivers of Bowery, who wept at the romance of the streets with their pushcarts full of onions and bad music, who sat in boxes breathing in the darkness under the bridge, and rose up to build harpsichords in their lofts, who coughed on the sixth floor of Harlem crowned with flame under the tubercular sky surrounded by orange crates of theology, who scribbled all night rocking and rolling over lofty incantations which in the yellow morning were stanzas of gibberish, who cooked rotten animals lung heart feet tail borsht & tortillas dreaming of the pure vegetable kingdom, who plunged themselves under meat trucks looking for an egg, who threw their watches off the roof to cast their ballot for Eternity outside of Time, & alarm clocks fell on their heads every day for the next decade, who cut their wrists three times successively unsuccessfully, gave up and were forced to open antique stores where they thought they were growing old and cried, who were burned alive in their innocent flannel suits on Madison Avenue amid blasts of leaden verse & the tanked-up clatter of the iron regiments of fashion & the nitroglycerine shrieks of the fairies of advertising & the mustard gas of sinister intelligent editors, or were run down by the drunken taxicabs of Absolute Reality, who jumped off the Brooklyn Bridge this actually happened and walked away unknown and forgotten into the ghostly daze of Chinatown soup alley ways & firetrucks, not even one free beer, who sang out of their windows in despair, fell out of the subway window, jumped in the filthy Passaic, leaped on negroes, cried all over the street, danced on broken wineglasses barefoot smashed phonograph records of nostalgic European 1930s German jazz finished the whiskey and threw up groaning into the bloody toilet, moans in their ears and the blast of colossal steam whistles, who barreled down the highways of the past journeying to each other's hotrod-Golgotha jail-solitude watch or Birmingham jazz incarnation, who drove crosscountry seventytwo hours to find out if I had a vision or you had a vision or he had a vision to find out Eternity, who journeyed to Denver, who died in Denver, who came back to Denver & waited in vain, who watched over Denver & brooded & loned in Denver and finally went away to find out the Time, & now Denver is lonesome for her heroes, who fell on their knees in hopeless cathedrals praying for each other's salvation and light and breasts, until the soul illuminated its hair for a second, who crashed through their minds in jail waiting for impossible criminals with golden heads and the charm of reality in their hearts who sang sweet blues to Alcatraz, who retired to Mexico to cultivate a habit, or Rocky Mount to tender Buddha or Tangiers to boys or Southern Pacific to the black locomotive or Harvard to Narcissus to Woodlawn to the daisychain or grave, who demanded sanity trials accusing the radio of hyp notism& were left with their insanity & their hands& a hung jury, who threw potato salad at CCNY lecturers on Dadaism and subsequently presented themselves on the granite steps of the madhouse with shaven heads and harlequin speech of* *suicide, demanding instantaneous lobotomy, and who were given instead the concrete void of insulin Metrazol electricity hydrotherapy psychotherapy occupational therapy pingpong & amnesia, who in humorless protest overturned only one symbolic pingpong table, resting briefly in catatonia, returning years later truly bald except for a wig of blood, and tears and fingers, to the visible mad man doom of the wards of the madtowns of the East, Pilgrim State's Rockland's and Greystone's foetid halls, bickering with the echoes of the soul, rocking and rolling in the midnight solitude-bench dolmen-realms of love, dream of life a nightmare, bodies turned to stone as heavy as the moon, with mother finally ******, and the last fantastic book flung out of the tenement window, and the last door closed at 4. A.M. and the last telephone slammed at the wall in reply and the last furnished room emptied down to the last piece of mental furniture, a yellow paper rose twisted on a wire hanger in the closet, and even that imaginary, nothing but a hopeful little bit of hallucination– ah, Carl, while you are not safe I am not safe, and now you're really in the total animal soup of time– and who therefore ran through the icy streets obsessed with a sudden flash of the alchemy of the use of the ellipse the catalog the meter & the vibrating plane, who dreamt and made incarnate gaps in Time & Space through images juxtaposed, and trapped the archangel of the soul between 2 visual images and joined the elemental verbs and set the noun and dash of consciousness together jumping with sensation of Pater Omnipotens Aeterna Deus to recreate the syntax and measure of poor human prose and stand before you speechless and intelligent and shaking with shame, rejected yet confessing out the soul to conform to the rhythm of thought in his naked and endless head, the madman bum and angel beat in Time, unknown, yet putting down here what might be left to say in time come after death, and rose reincarnate in the ghostly clothes of jazz in the goldhorn shadow of the band and blew the suffering of America's naked mind for love into an eli eli lamma lamma sabacthani saxophone cry that shivered the cities down to the last radio with the absolute heart of the poem of life butchered out of their own bodies good to eat a thousand years.*

Constantly Risking Absurdity by Lawrence Ferlinghetti

Constantly risking absurdity
and death
whenever he performs
above the heads
of his audience
the poet like an acrobat
climbs on rime
to a high wire of his own making
and balancing on eyebeams
above a sea of faces
paces his way
to the other side of the day

Figure 6.7: **Allen Ginsberg. His poem *Howl* was confiscated by police and was the subject of an obscenity trial. Ginsberg, Jack Kerouac and William S. Burroughs formed the core of the "Beat Generation" which vigorously opposed militarism, economic materialism and sexual repression. Ginsberg was a Buddhist, and he lived very modestly, always buying his cloths at second-hand stores.**

performing entrachats
and sleight-of-foot tricks
and other high theatrics
and all without mistaking
any thing
for what it may not be
For he's the super realist
who must perforce perceive
taut truth
before the taking of each stance or step
in his supposed advance
toward that still higher perch
where Beauty stands and waits
with gravity
to start her death-defying leap
And he
a little charleychaplin man
who may or may not catch
her fair eternal form
spreadeagled in the empty air
of existence

Wild Dreams Of A New Beginning by Lawrence Ferlinghetti

There's a breathless hush on the freeway tonight
Beyond the ledges of concrete
restaurants fall into dreams
with candlelight couples
Lost Alexandria still burns
in a billion lightbulbs
Lives cross lives
idling at stoplights
Beyond the cloverleaf turnoffs
'Souls eat souls in the general emptiness'
A piano concerto comes out a kitchen window
A yogi speaks at Ojai
'It's all taking pace in one mind'
On the lawn among the trees
lovers are listening
for the master to tell them they are one
with the universe
Eyes smell flowers and become them

There's a deathless hush
on the freeway tonight
as a Pacific tidal wave a mile high
sweeps in
Los Angeles breathes its last gas
and sinks into the sea like the Titanic all lights lit
Nine minutes later Willa Cather's Nebraska
sinks with it
The sea comes over in Utah
Mormon tabernacles washed away like barnacles
Coyotes are confounded & swim nowhere
An orchestra onstage in Omaha
keeps on playing Handel's Water Music
Horns fill with water
as bass players float away on their instruments
clutching them like lovers horizontal
Chicago's Loop becomes a rollercoaster
Skyscrapers filled like water glasses
Great Lakes mixed with Buddhist brine
Great Books watered down in Evanston
Milwaukee beer topped with sea foam
Beau Fleuve of Buffalo suddenly become salt
Manhattan Island swept clean in sixteen seconds
buried masts of Amsterdam arise
as the great wave sweeps on Eastward
to wash away over-age Camembert Europe
manhatta steaming in sea-vines
the washed land awakes again to wilderness
the only sound a vast thrumming of crickets
x a cry of seabirds high over
in empty eternity
as the Hudson retakes its thickets
and Indians reclaim their canoes

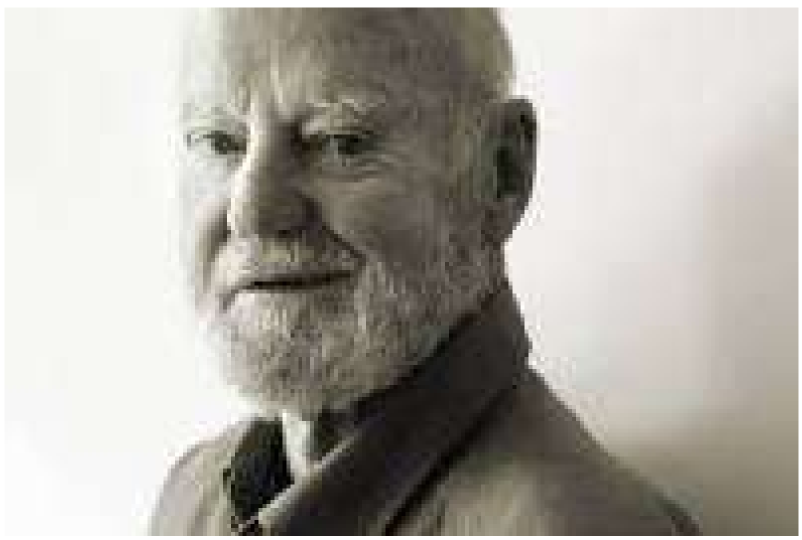

Figure 6.8: **Lawrence Ferlinghetti (1919-2021) was the co-founder of the City Lights Bookstore in San Francisco, a center for poets of the counterculture. His collection of poems, *A Coney Island of the Mind*, has been translated into nine languages and has sold more than a million copies. He lived to be 101 years old.**

Chapter 7

ICONS OF THE 20TH CENTURY PEACE MOVEMENT

7.1 Mahatma Gandhi

If humans are ever to achieve a stable global society in the future, they will have to become much more modest in their economic behavior and much more peaceful in their politics. For both modesty and peace, Gandhi is a useful source of ideas. The problems with which he struggled during his lifetime are extremely relevant to us in the 21st Century, when both nuclear and ecological catastrophes threaten the world.

Avoiding escalation of conflicts

Today we read almost every day of killings that are part of escalating cycles of revenge and counter-revenge, for example in the Middle East. Gandhi's experiences both in South Africa and in India convinced him that such cycles could only be ended by unilateral acts of kindness and understanding from one of the parties in a conflict. He said, "An eye for an eye makes the whole world blind".

To the insidious argument that "the end justifies the means", Gandhi answered firmly: "They say that 'means are after all means'. I would say that 'means are after all everything'. As the means, so the end. Indeed, the Creator has given us limited power over means, none over end... The means may be likened to a seed, and the end to a tree; and there is the same inviolable connection between the means and the end as there is between the seed and the tree. Means and end are convertible terms in my philosophy of life."

Gandhi's advocacy of non-violence is closely connected to his attitude towards ends and means. He believed that violent methods for achieving a desired social result would inevitably result in an escalation of violence. The end achieved would always be contaminated by the methods used. He was influenced by Leo Tolstoy with whom he exchanged many letters, and he in turn influenced Martin Luther King and Nelson Mandela.

The power of truth

Gandhi was trained as a lawyer, and when he began to practice in South Africa, in his first case, he was able to solve a conflict by proposing a compromise that satisfied both parties. Of this result he said, "My joy was boundless. I had learnt the true practice of law. I had learnt to find out the better side of human nature and to enter men's hearts. I realized that the true function of a lawyer was to unite parties riven asunder." When Gandhi became involved with the struggle for civil rights of the Indian minority in South Africa, his background as a lawyer once more helped him. This time his jury was public opinion in England. When Gandhi lead the struggle for reform, he insisted that the means of protest used by his followers should be non-violent, even though violence was frequently used against them. In this way they won their case in the court of public opinion. Gandhi called this method of protest "satyagraha", a Sanskrit word meaning "the power of truth". In today's struggles for justice and peace, the moral force of truth and nonviolence can win victories in the court of world public opinion.

Harmony between religious groups

Gandhi believed that at their core, all religions are based on the concepts of truth, love, compassion, nonviolence and the Golden Rule. When asked whether he was a Hindu, Gandhi answered, "Yes I am. I am also a Christian, a Muslim, a Buddhist and a Jew." When praying at his ashram, Gandhi made a point of including prayers from many religions. One of the most serious problems that he had to face in his efforts to free India from British rule was disunity and distrust, even hate, between the Hindu and Muslim communities. Each community felt that with the British gone, they might face violence and repression from the other. Gandhi made every effort to bridge the differences and to create unity and harmony. His struggles with this problem are highly relevant to us today, when the world is split by religious and ethnic differences.

Solidarity with the poor

Today's world is characterized by intolerable economic inequalities, both between nations and within nations. 8 million children die each year from poverty-related causes. 1.3 billion people live on less than 1.25 dollars a day. Gandhi's concern for the poor can serve as an example to us today, as we work to achieve a more equal world. He said, "There is enough for every man's need, but not for every man's greed."

Voluntary reduction of consumption

After Gandhi's death, someone took a photograph of all his worldly possessions. It was a tiny heap, consisting of his glasses, a pair of sandals, a homespun cloth (his only garment) and a watch. That was all. By reducing his own needs and possessions to an absolute

Figure 7.1: **Gandhi in London as a law student.**

Figure 7.2: **Gandhi (left) and his wife Kasturba (right) (1902)**

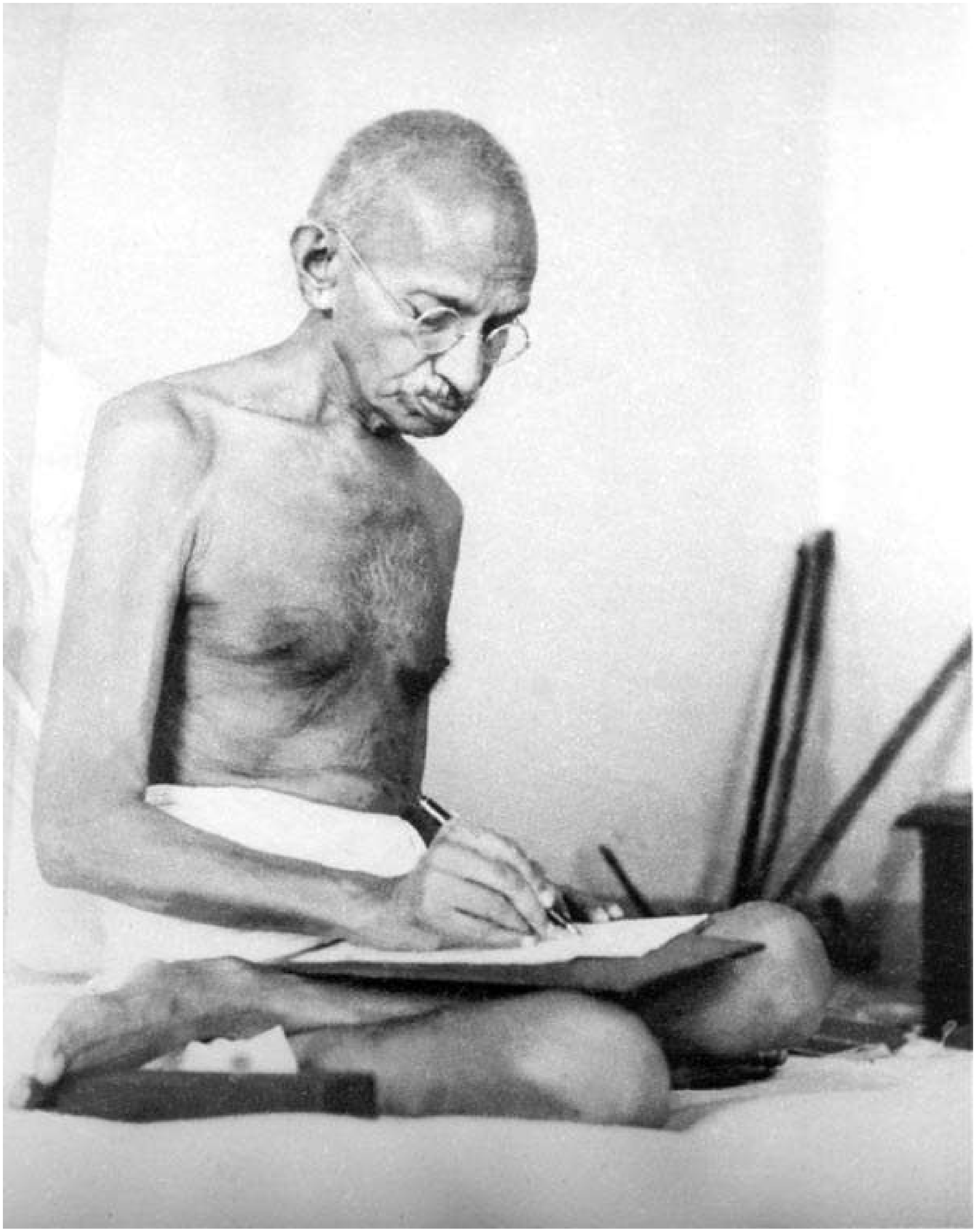

Figure 7.3: **Gandhi in 1942, the year he launched the Quit India Movement.**

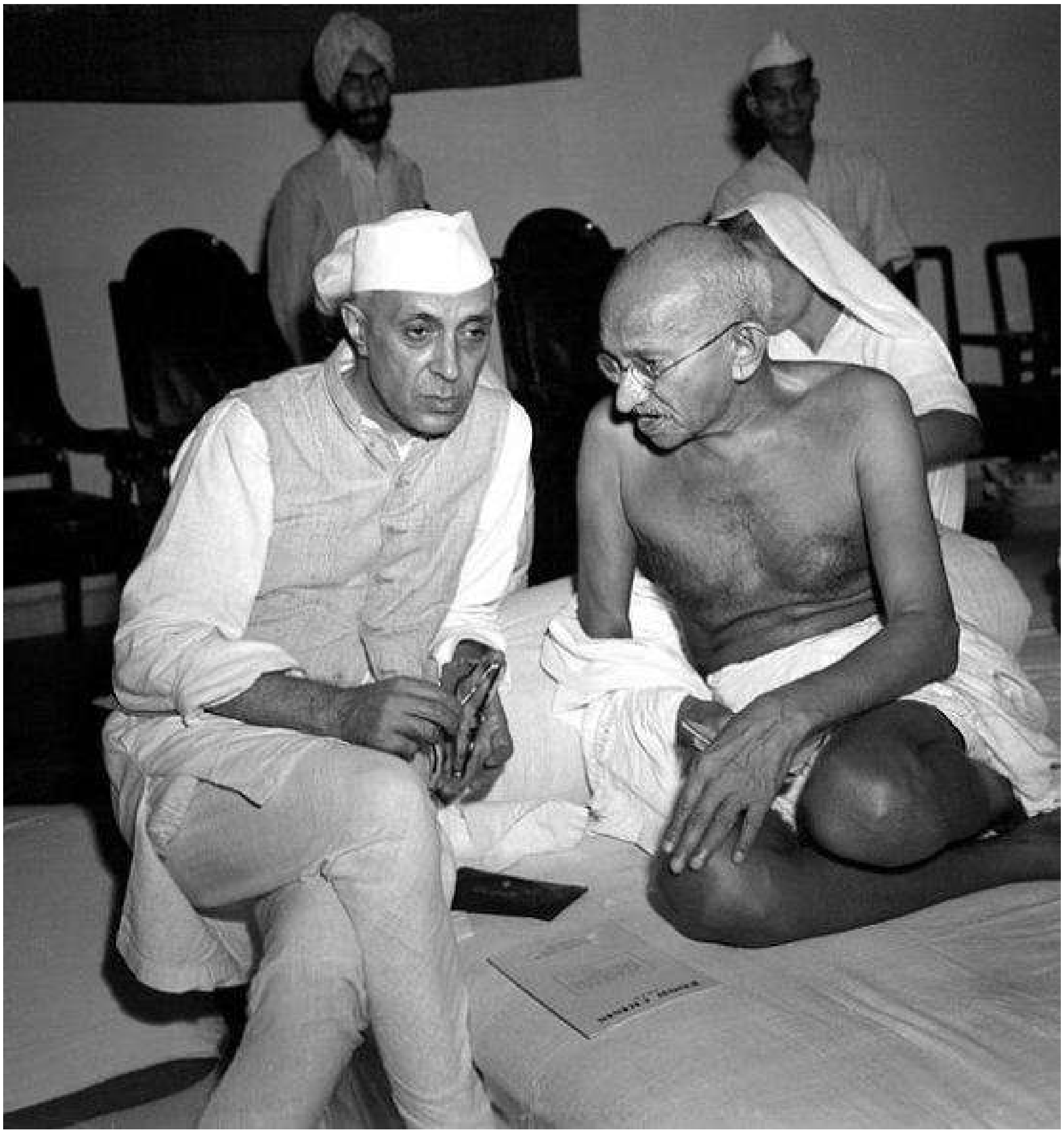

Figure 7.4: **Gandhi and Nehru at a meeting of the Congress Party. After India gained its independence, it was Nehru's vision of an urbanized and industrialized India that prevailed. Gandhi's much more sustainable vision of "India of villages" was lost.**

minimum, Gandhi had tried to demonstrate that the commonly assumed connection between wealth and merit is false. This is relevant today, in a world where we face a crisis of diminishing resources. Not only fossil fuels, but also metals and arable land per capita will become scarce in the future. This will force a change in lifestyle, particularly in the industrialized countries, away from consumerism and towards simplicity. Gandhi's example can teach us that we must cease to use wealth and "conspicuous consumption" as a measure of merit.

Gandhian economics

In his autobiography, Mahatma Gandhi says: "Three moderns have left a deep impression on my life and captivated me: Raychandbhai (the Indian philosopher and poet) by his living contact; Tolstoy by his book 'The Kingdom of God is Within You'; and Ruskin by his book 'Unto This Last'." Ruskin's book, "Unto This Last", which Gandhi read in 1904, is a criticism of modern industrial society. Ruskin believed that friendships and warm interpersonal relationships are a form of wealth that economists have failed to consider. He felt that warm human contacts are most easily achieved in small agricultural communities, and that therefore the modern tendency towards centralization and industrialization may be a step backward in terms of human happiness. While still in South Africa, Gandhi founded two religious Utopian communities based on the ideas of Tolstoy and Ruskin, Phoenix Farm (1904) and Tolstoy Farm (1910).

Because of his growing fame as the leader of the Indian civil rights movement in South Africa, Gandhi was persuaded to return to India in 1914 and to take up the cause of Indian home rule. In order to reacquaint himself with conditions in India, he travelled tirelessly, now always going third class as a matter of principle.

During the next few years, Gandhi worked to reshape the Congress Party into an organization which represented not only India's Anglicized upper middle class but also the millions of uneducated villagers who were suffering under an almost intolerable burden of poverty and disease. In order to identify himself with the poorest of India's people, Gandhi began to wear only a white loincloth made of rough homespun cotton. He traveled to the remotest villages, recruiting new members for the Congress Party, preaching non-violence and "firmness in the truth", and becoming known for his voluntary poverty and humility. The villagers who flocked to see him began to call him "Mahatma" (Great Soul).

Disturbed by the spectacle of unemployment and poverty in the villages, Gandhi urged the people of India to stop buying imported goods, especially cloth, and to make their own. He advocated the reintroduction of the spinning wheel into village life, and he often spent some hours spinning himself. The spinning wheel became a symbol of the Indian independence movement, and was later incorporated into the Indian flag.

The movement for boycotting British goods was called the "Swadeshi movement". The word Swadeshi derives from two Sanskrit roots: Swa, meaning self, and Desh, meaning country. Gandhi described Swadeshi as "a call to the consumer to be aware of the violence he is causing by supporting those industries that result in poverty, harm to the workers and to humans or other creatures."

Gandhi tried to reconstruct the crafts and self-reliance of village life that he felt had been destroyed by the colonial system. "I would say that if the village perishes, India will perish too", he wrote, "India will be no more India. Her own mission in the world will get lost. The revival of the village is only possible when it is no more exploited. Industrialization on a mass scale will necessarily lead to passive or active exploitation of the villagers as problems of competition and marketing come in. Therefore we have to concentrate on the village being self-contained, manufacturing mainly for use. Provided this character of the village industry is maintained, there would be no objection to villagers using even the modern machines that they can make and can afford to use. Only they should not be used as a means of exploitation by others."

"You cannot build nonviolence on a factory civilization, but it can be built on self-contained villages... Rural economy as I have conceived it, eschews exploitation altogether, and exploitation is the essence of violence... We have to make a choice between India of the villages that are as ancient as herself and India of the cities which are a creation of foreign domination..."

"Machinery has its place; it has come to stay. But it must not be allowed to displace necessary human labour. An improved plow is a good thing. But if by some chances, one man could plow up, by some mechanical invention of his, the whole of the land of India, and control all the agricultural produce, and if the millions had no other occupation, they would starve, and being idle, they would become dunces, as many have already become. There is hourly danger of many being reduced to that unenviable state."

In these passages we see Gandhi not merely as a pioneer of nonviolence; we see him also as an economist. Faced with misery and unemployment produced by machines, Gandhi tells us that social goals must take precedence over blind market mechanisms. If machines are causing unemployment, we can, if we wish, and use labor-intensive methods instead. With Gandhi, the free market is not sacred; we can do as we wish, and maximize human happiness, rather than maximizing production and profits.

Mahatma Gandhi was assassinated by a Hindu extremist on January 30, 1948. After his death, someone collected and photographed all his worldly goods. These consisted of a pair of glasses, a pair of sandals, a pocket watch and a white homespun loincloth. Here, as in the Swadeshi movement, we see Gandhi as a pioneer of economics. He deliberately reduced his possessions to an absolute minimum in order to demonstrate that there is no connection between personal merit and material goods. Like Veblen, Mahatma Gandhi told us that we must stop using material goods as a means of social competition. We must start to judge people not by what they have, but by what they are.

7.2 Martin Luther King, Jr.

King applies the teachings of Thoreau and Gandhi to the Civil Rights movement

The son of a southern Baptist minister, Martin Luther King, Jr received his Ph.D. in theology from Boston University in 1955. During his studies, he had admired Thoreau's essay "On the Duty of Civil Disobedience," and he had also been greatly moved by the life and teachings of Mahatma Gandhi.

Martin Luther King Jr. had been pastor of the Dexter Avenue Baptist Church in Montgomery Alabama for only a year when he was chosen to lead a boycott protesting segregation in the Montgomery buses. Suddenly thrust into this situation of intense conflict, he remembered both the Christian principle of loving one's enemies and Gandhi's methods of non-violent protest. In his first speech as President of the Montgomery Improvement Association (a speech which the rapid pace of events had forced him to prepare in only twenty minutes, five of which he spent in prayer), he said:

"Our method will be that of persuasion, not coercion. We will only say to people, 'Let your conscience be your guide'. Our actions must be guided by the deepest principles of our Christian faith. Love must be our regulating ideal. Once again we must hear the words of Jesus echoing across the centuries: 'Love your enemies, bless them that curse you, and pray for them that despitefully use you.' If we fail to do this, our protest will end up as a meaningless drama on the stage of history, and its memory will be shrouded by the ugly garments of shame. In spite of the mistreatment that we have confronted, we must not become bitter and end up by hating our white brothers. As Booker T. Washington said, 'Let no man pull you down so low as to make you hate him.'"

"If you will protest courageously, and yet with dignity and Christian love, when the history books are written in future generations, the historians will have to pause and say, 'There lived a great people, a black people, who injected new meaning and dignity into the veins of civilization.' This is our challenge and our overwhelming responsibility."

Victory in the court of public opinion

This speech, which Dr. King made in December 1955, set the tone of the black civil rights movement. Although the protesters against racism were often faced with brutality and violence; although many of them, including Dr. King were unjustly jailed; although the homes of the leaders were bombed; although they constantly received telephone calls threatening their lives; although many civil rights workers were severely beaten, and several of them killed, they never resorted to violence in their protests against racial discrimination. Because of this adherence to Christian ethics, public opinion shifted to the side of the civil rights movement, and the United States Supreme Court ruled bus segregation to be unconstitutional.

Welcomed to India by Nehru

In 1959, while recovering from an almost-fatal stabbing, Martin Luther King Jr. visited India at the invitation of Prime Minister Jawaharlal Nehru. Dr. King and his wife Coretta were warmly welcomed by Nehru, who changed his schedule in order to meet them. They had an opportunity to visit a religious community or "ashram" that Gandhi had founded, and they discussed non-violence with many of Gandhi's disciples.

King is awarded the Nobel Peace Prize

In 1964, the change in public opinion produced by the non-violent black civil rights movement resulted in the passage of the civil rights act. In the same year, Dr. King was awarded the Nobel Peace Prize. He accepted it, not as an individual, but on behalf of all civil rights workers; and he immediately gave all the prize money to the movement.

Opposition to the Viet Nam War

In 1967, a year before his assassination, Dr. King forcefully condemned the Viet Nam war in an address at a massive peace rally in New York City. He felt that opposition to war followed naturally from his advocacy of non-violence. Speaking against the Viet Nam War, Dr. King said: "We have corrupted their women and children and killed their men. They move sadly and apathetically as we herd them off the land of their fathers into concentration camps where minimal social needs are rarely met. They know they must move on or be destroyed by our bombs ... primarily women and children and the aged watch as we poison their water, as we kill a million acres of their crops. They must weep as the bulldozers roar through their areas preparing to destroy the precious trees. They wander into the hospitals. So far we may have killed a million of them, [in Vietnam by 1967] mostly children. They wander into the towns and see thousands of the children, homeless, without clothes, running in packs on the streets like animals. They see the children degraded by our soldiers as they beg for food. They see the children selling their sisters to our soldiers, soliciting for their mothers."

Opposition to nuclear weapons

In his book, "Strength to Love", Dr. King wrote,"Wisdom born of experience should tell us that war is obsolete. There may have been a time when war served a negative good by preventing the spread of an evil force, but the power of modern weapons eliminates even the possibility that war may serve as a negative good. If we assume that life is worth living, and that man has a right to survival, then we must find an alternative to war ... I am convinced that the Church cannot be silent while mankind faces the threat of nuclear annihilation. If the church is true to her mission, she must call for an end to the nuclear arms race."

Figure 7.5: **Rosa Parks with King (left), 1955**

Figure 7.6: **Martin Luther King Jr. speaking in Washington. Source: American Civil Liberties Union of Virginia, acluva.org**

Assassination

On April 4, 1968, Dr. King was shot and killed. A number of people, including members of his own family, believe that he was killed because of his opposition to the Viet Nam War. This conclusion is supported by the result of a 1999 trial initiated by members of the King family. Summing up the arguments to the jury, the family's lawyer said "We are dealing in conspiracy with agents of the City of Memphis and the governments of the State of Tennessee and the United States of America. We ask that you find that a conspiracy existed." After two and a half hour's deliberation, the jury found that Lloyd Jowers and "others, including governmental agencies, were parties to this conspiracy". The verdict of the jury remains judicially valid today, and it has never been overturned in a court of law, although massive efforts have been made to discredit it.

Redemptive love

Concerning the Christian principle of loving one's enemies, Dr. King wrote: "Why should we love our enemies? Returning hate for hate multiplies hate, adding deeper darkness to a night already devoid of stars. Darkness cannot drive out darkness; only light can do that. Hate cannot drive out hate. Only love can do that ... Love is the only force capable of transforming an enemy into a friend. We never get rid of an enemy by meeting hate with hate; we get rid of an enemy by getting rid of enmity... It is this attitude that made it possible for Lincoln to speak a kind word about the South during the Civil War, when feeling was most bitter. Asked by a shocked bystander how he could do this, Lincoln said, 'Madam, do I not destroy my enemies when I make them my friends?' This is the power of redemptive love."

To a large extent, the black civil rights movement of the '50's and '60's succeeded in ending legalized racial discrimination in America. If the methods used had been violent, the movement could easily have degenerated into a nightmare of interracial hatred; but by remembering the Christian message, "Love your enemy; do good to them that despitefully use you", Martin Luther King Jr. raised the ethical level of the civil rights movement; and the final result was harmony and understanding between the black and white communities. Later the nonviolent methods of Gandhi and King were successfully applied to the South African struggle against Apartheid by Nelson Mandela and his followers.

Here are a few more things that Martin Luther King said

I have decided to stick to love...Hate is too great a burden to bear

Faith is taking the first step even when you can't see the whole staircase.

Our lives begin to end the day we become silent about things that matter.

In the end, we will remember not the words of our enemies, but the silence of our friends.

If you can't fly then run, if you can't run then walk, if you can't walk then crawl, but whatever you do you have to keep moving forward.

Only in the darkness can you see the stars.

There comes a time when a person must take a position that is neither safe, nor politic, nor popular, but he must take it because conscience tells him it is right.

Everybody can be great...because anybody can serve. You don't have to have a college degree to serve. You don't have to make your subject and verb agree to serve. You only need a heart full of grace. A soul generated by love.

Forgiveness is not an occasional act, it is a constant attitude.

We must accept finite disappointment, but never lose infinite hope.

There is some good in the worst of us and some evil in the best of us. When we discover this, we are less prone to hate our enemies.

We must live together as brothers or perish together as fools.

Intelligence plus character - that is the goal of true education.

True peace is not merely the absence of tension; it is the presence of justice.

Science investigates; religion interprets. Science gives man knowledge, which is power; religion gives man wisdom, which is control. Science deals mainly with facts; religion deals mainly with values. The two are not rivals.

The ultimate measure of a man is not where he stands in moments of comfort and convenience, but where he stands at times of challenge and controversy.

We know through painful experience that freedom is never voluntarily given by the oppressor, it must be demanded by the oppressed.

Injustice anywhere is a threat to justice everywhere. We are caught in an inescapable network of mutuality, tied in a single garment of destiny. Whatever affects one directly, affects all indirectly.

We have also come to this hallowed spot to remind America of the fierce urgency of Now. This is no time to engage in the luxury of cooling off or to take the tranquilizing drug of gradualism. Now is the time to make real the promises of democracy.

The time is always right to do what is right.

For when people get caught up with that which is right and they are willing to sacrifice for it, there is no stopping point short of victory.

All we say to America is, 'Be true to what you said on paper.' If I lived in... any totalitarian country, maybe I could understand the denial of certain basic First Amendment privileges, because they hadn't committed themselves to that over there. But somewhere I read of the freedom of assembly. Somewhere I read of the freedom of speech. Somewhere I read of the freedom of the press. Somewhere I read that the greatness of America is the right to protest for right.

We've got some difficult days ahead. But it really doesn't matter with me now because I've been to the mountaintop . . .I've looked over and I've seen the promised land. I may not get there with you. But I want you to know tonight that we as a people will get to the promised land.

An excerpt from Martin Luther King, Jr.'s Riverside Church speech

This I believe to be the privilege and the burden of all of us who deem ourselves bound by allegiances and loyalties which are broader and deeper than nationalism and which go beyond our nation's self-defined goals and positions. We are called to speak for the weak, for the voiceless, for the victims of our nation and for those it calls "enemy," for no document from human hands can make these humans any less our brothers.

And as I ponder the madness of Vietnam and search within myself for ways to understand and respond in compassion, my mind goes constantly to the people of that peninsula. I speak now not of the soldiers of each side, not of the ideologies of the Liberation Front, not of the junta in Saigon, but simply of the people who have been living under the curse of war for almost three continuous decades now. I think of them, too, because it is clear to me that there will be no meaningful solution there until some attempt is made to know them and hear their broken cries.

They must see Americans as strange liberators. The Vietnamese people proclaimed their own independence in 1954 – in 1945 rather – after a combined French and Japanese occupation and before the communist revolution

in China. They were led by Ho Chi Minh. Even though they quoted the American Declaration of Independence in their own document of freedom, we refused to recognize them. Instead, we decided to support France in its reconquest of her former colony. Our government felt then that the Vietnamese people were not ready for independence, and we again fell victim to the deadly Western arrogance that has poisoned the international atmosphere for so long. With that tragic decision we rejected a revolutionary government seeking self-determination and a government that had been established not by China – for whom the Vietnamese have no great love – but by clearly indigenous forces that included some communists. For the peasants this new government meant real land reform, one of the most important needs in their lives.

For nine years following 1945 we denied the people of Vietnam the right of independence. For nine years we vigorously supported the French in their abortive effort to recolonize Vietnam. Before the end of the war we were meeting eighty percent of the French war costs. Even before the French were defeated at Dien Bien Phu, they began to despair of their reckless action, but we did not. We encouraged them with our huge financial and military supplies to continue the war even after they had lost the will. Soon we would be paying almost the full costs of this tragic attempt at recolonization.

After the French were defeated, it looked as if independence and land reform would come again through the Geneva Agreement. But instead there came the United States, determined that Ho should not unify the temporarily divided nation, and the peasants watched again as we supported one of the most vicious modern dictators, our chosen man, Premier Diem. The peasants watched and cringed as Diem ruthlessly rooted out all opposition, supported their extortionist landlords, and refused even to discuss reunification with the North. The peasants watched as all this was presided over by United States' influence and then by increasing numbers of United States troops who came to help quell the insurgency that Diem's methods had aroused. When Diem was overthrown they may have been happy, but the long line of military dictators seemed to offer no real change, especially in terms of their need for land and peace.

The only change came from America, as we increased our troop commitments in support of governments which were singularly corrupt, inept, and without popular support. All the while the people read our leaflets and received the regular promises of peace and democracy and land reform. Now they languish under our bombs and consider us, not their fellow Vietnamese, the real enemy. They move sadly and apathetically as we herd them off the land of their fathers into concentration camps where minimal social needs are rarely met. They know they must move on or be destroyed by our bombs.

So they go, primarily women and children and the aged. They watch as we poison their water, as we kill a million acres of their crops. They must weep as the bulldozers roar through their areas preparing to destroy the precious trees.

They wander into the hospitals with at least twenty casualties from American firepower for one Vietcong-inflicted injury. So far we may have killed a million of them, mostly children. They wander into the towns and see thousands of the children, homeless, without clothes, running in packs on the streets like animals. They see the children degraded by our soldiers as they beg for food. They see the children selling their sisters to our soldiers, soliciting for their mothers.

What do the peasants think as we ally ourselves with the landlords and as we refuse to put any action into our many words concerning land reform? What do they think as we test out our latest weapons on them, just as the Germans tested out new medicine and new tortures in the concentration camps of Europe? Where are the roots of the independent Vietnam we claim to be building? Is it among these voiceless ones?

We have destroyed their two most cherished institutions: the family and the village. We have destroyed their land and their crops. We have cooperated in the crushing – in the crushing of the nation's only non-Communist revolutionary political force, the unified Buddhist Church. We have supported the enemies of the peasants of Saigon. We have corrupted their women and children and killed their men.

Now there is little left to build on, save bitterness. Soon, the only solid – solid physical foundations remaining will be found at our military bases and in the concrete of the concentration camps we call "fortified hamlets." The peasants may well wonder if we plan to build our new Vietnam on such grounds as these. Could we blame them for such thoughts? We must speak for them and raise the questions they cannot raise. These, too, are our brothers.

Perhaps a more difficult but no less necessary task is to speak for those who have been designated as our enemies. What of the National Liberation Front, that strangely anonymous group we call "VC" or "communists"? What must they think of the United States of America when they realize that we permitted the repression and cruelty of Diem, which helped to bring them into being as a resistance group in the South? What do they think of our condoning the violence which led to their own taking up of arms? How can they believe in our integrity when now we speak of "aggression from the North" as if there were nothing more essential to the war? How can they trust us when now we charge them with violence after the murderous reign of Diem and charge them with violence while we pour every new weapon of death into their land? Surely we must understand their feelings, even if we do not condone their actions. Surely we must see that the men we supported pressed them to their violence. Surely we must see that our own computerized plans of destruction simply dwarf their greatest acts.

How do they judge us when our officials know that their membership is less than twenty-five percent communist, and yet insist on giving them the blanket name? What must they be thinking when they know that we are aware of

their control of major sections of Vietnam, and yet we appear ready to allow national elections in which this highly organized political parallel government will not have a part? They ask how we can speak of free elections when the Saigon press is censored and controlled by the military junta. And they are surely right to wonder what kind of new government we plan to help form without them, the only party in real touch with the peasants. They question our political goals and they deny the reality of a peace settlement from which they will be excluded. Their questions are frighteningly relevant. Is our nation planning to build on political myth again, and then shore it up upon the power of new violence?

Here is the true meaning and value of compassion and nonviolence, when it helps us to see the enemy's point of view, to hear his questions, to know his assessment of ourselves. For from his view we may indeed see the basic weaknesses of our own condition, and if we are mature, we may learn and grow and profit from the wisdom of the brothers who are called the opposition.

So, too, with Hanoi. In the North, where our bombs now pummel the land, and our mines endanger the waterways, we are met by a deep but understandable mistrust. To speak for them is to explain this lack of confidence in Western words, and especially their distrust of American intentions now. In Hanoi are the men who led the nation to independence against the Japanese and the French, the men who sought membership in the French Commonwealth and were betrayed by the weakness of Paris and the willfulness of the colonial armies. It was they who led a second struggle against French domination at tremendous costs, and then were persuaded to give up the land they controlled between the thirteenth and seventeenth parallel as a temporary measure at Geneva. After 1954 they watched us conspire with Diem to prevent elections which could have surely brought Ho Chi Minh to power over a united Vietnam, and they realized they had been betrayed again. When we ask why they do not leap to negotiate, these things must be remembered.

Also, it must be clear that the leaders of Hanoi considered the presence of American troops in support of the Diem regime to have been the initial military breach of the Geneva Agreement concerning foreign troops. They remind us that they did not begin to send troops in large numbers and even supplies into the South until American forces had moved into the tens of thousands.

Hanoi remembers how our leaders refused to tell us the truth about the earlier North Vietnamese overtures for peace, how the president claimed that none existed when they had clearly been made. Ho Chi Minh has watched as America has spoken of peace and built up its forces, and now he has surely heard the increasing international rumors of American plans for an invasion of the North. He knows the bombing and shelling and mining we are doing are part of traditional pre-invasion strategy. Perhaps only his sense of humor and of irony can save him when he hears the most powerful nation of the world speaking of aggression as it drops thousands of bombs on a poor, weak nation more than eight hundred – rather, eight thousand miles away from its shores.

At this point I should make it clear that while I have tried in these last few minutes to give a voice to the voiceless in Vietnam and to understand the arguments of those who are called ”enemy,” I am as deeply concerned about our own troops there as anything else. For it occurs to me that what we are submitting them to in Vietnam is not simply the brutalizing process that goes on in any war where armies face each other and seek to destroy. We are adding cynicism to the process of death, for they must know after a short period there that none of the things we claim to be fighting for are really involved. Before long they must know that their government has sent them into a struggle among Vietnamese, and the more sophisticated surely realize that we are on the side of the wealthy, and the secure, while we create a hell for the poor.

Somehow this madness must cease. We must stop now. I speak as a child of God and brother to the suffering poor of Vietnam. I speak for those whose land is being laid waste, whose homes are being destroyed, whose culture is being subverted. I speak of the – for the poor of America who are paying the double price of smashed hopes at home, and death and corruption in Vietnam. I speak as a citizen of the world, for the world as it stands aghast at the path we have taken. I speak as one who loves America, to the leaders of our own nation: The great initiative in this war is ours; the initiative to stop it must be ours.

This is the message of the great Buddhist leaders of Vietnam. Recently one of them wrote these words, and I quote: “Each day the war goes on the hatred increases in the heart of the Vietnamese and in the hearts of those of humanitarian instinct. The Americans are forcing even their friends into becoming their enemies. It is curious that the Americans, who calculate so carefully on the possibilities of military victory, do not realize that in the process they are incurring deep psychological and political defeat. The image of America will never again be the image of revolution, freedom, and democracy, but the image of violence and militarism”.

If we continue, there will be no doubt in my mind and in the mind of the world that we have no honorable intentions in Vietnam. If we do not stop our war against the people of Vietnam immediately, the world will be left with no other alternative than to see this as some horrible, clumsy, and deadly game we have decided to play. The world now demands a maturity of America that we may not be able to achieve. It demands that we admit that we have been wrong from the beginning of our adventure in Vietnam, that we have been detrimental to the life of the Vietnamese people. The situation is one in which we must be ready to turn sharply from our present ways. In order to atone for our sins and errors in Vietnam, we should take the initiative in bringing a halt to this tragic war.

I would like to suggest five concrete things that our government should do [immediately] to begin the long and difficult process of extricating ourselves

from this nightmarish conflict:

Number one: End all bombing in North and South Vietnam.

Number two: Declare a unilateral cease-fire in the hope that such action will create the atmosphere for negotiation.

Three: Take immediate steps to prevent other battlegrounds in Southeast Asia by curtailing our military buildup in Thailand and our interference in Laos.

Four: Realistically accept the fact that the National Liberation Front has substantial support in South Vietnam and must thereby play a role in any meaningful negotiations and any future Vietnam government.

Five: Set a date that we will remove all foreign troops from Vietnam in accordance with the 1954 Geneva Agreement...

In 1957, a sensitive American official overseas said that it seemed to him that our nation was on the wrong side of a world revolution. During the past ten years, we have seen emerge a pattern of suppression which has now justified the presence of U.S. military advisors in Venezuela. This need to maintain social stability for our investments accounts for the counterrevolutionary action of American forces in Guatemala. It tells why American helicopters are being used against guerrillas in Cambodia and why American napalm and Green Beret forces have already been active against rebels in Peru.

It is with such activity in mind that the words of the late John F. Kennedy come back to haunt us. Five years ago he said, "Those who make peaceful revolution impossible will make violent revolution inevitable." Increasingly, by choice or by accident, this is the role our nation has taken, the role of those who make peaceful revolution impossible by refusing to give up the privileges and the pleasures that come from the immense profits of overseas investments. I am convinced that if we are to get on the right side of the world revolution, we as a nation must undergo a radical revolution of values. We must rapidly begin...we must rapidly begin the shift from a thing-oriented society to a person-oriented society. When machines and computers, profit motives and property rights, are considered more important than people, the giant triplets of racism, extreme materialism, and militarism are incapable of being conquered.

A true revolution of values will soon cause us to question the fairness and justice of many of our past and present policies. On the one hand, we are called to play the Good Samaritan on life's roadside, but that will be only an initial act. One day we must come to see that the whole Jericho Road must be transformed so that men and women will not be constantly beaten and robbed as they make their journey on life's highway. True compassion is more than flinging a coin to a beggar. It comes to see that an edifice which produces beggars needs restructuring.

A true revolution of values will soon look uneasily on the glaring contrast of poverty and wealth. With righteous indignation, it will look across the seas and see individual capitalists of the West investing huge sums of money in Asia,

Africa, and South America, only to take the profits out with no concern for the social betterment of the countries, and say, ”This is not just.” It will look at our alliance with the landed gentry of South America and say, “This is not just.” The Western arrogance of feeling that it has everything to teach others and nothing to learn from them is not just.

A true revolution of values will lay hand on the world order and say of war, “This way of settling differences is not just.” This business of burning human beings with napalm, of filling our nation’s homes with orphans and widows, of injecting poisonous drugs of hate into the veins of peoples normally humane, of sending men home from dark and bloody battlefields physically handicapped and psychologically deranged, cannot be reconciled with wisdom, justice, and love. A nation that continues year after year to spend more money on military defense than on programs of social uplift is approaching spiritual death.

7.3 Bertrand Russell

Bertrand Arthur William Russell, 3rd Earl Russell, OM, FRS, (1872-1970), was born into a wealthy and influential English family, whose members had been active in politics since the time of the Tudors. Bertrand Russell’s grandfather, Lord John Russell, the third son of the Duke of Bedford and 1st Earl Russell, had twice served as Prime Minister during Queen Victoria’s reign.

Because of the early death of his parents (Viscount and Viscountess Amberly) Bertrand Russell was brought up by his grandparents, Lord John Russell and Lady Russell, who lived at Pembroke Lodge near Richmond Park, about fifteen miles west of London. Bertrand Russell’s grandfather soon died too, and his grandmother became the dominant influence on the boy’s early life. Although she was a religious conservative, Russell’s grandmother nevertheless believed in independence of thought, accepted Darwinism, and supporter Irish Home Rule. She also had the motto (taken from the Bible) “Thou shalt not follow a multitude to do evil.”

Bertrand Russell and his elder brother Frank were educated at home by tutors, and they had rather lonely and unhappy childhoods in the emotionally repressed atmosphere of Pembroke Lodge. However, when Bertrand was eleven years old, Frank introduced him to the work of Euclid. Bertrand Russell later described this event in his autobiography as “one of the great events of my life, as dazzling as first love”. It is interesting that Albert Einstein had similar feelings when he encountered the works of Euclid at almost the same age.

During these early years Russell also discovered the writings of the poet Shelley, and he later wrote:“I spent all my spare time reading him, and learning him by heart, knowing no one to whom I could speak of what I thought or felt, I used to reflect how wonderful it would have been to know Shelley, and to wonder whether I should meet any live human being with whom I should feel so much sympathy”.

In 1890, when Bertrand Russell was 18, he started his studies in mathematics at Trinity

College, Cambridge University. He graduated with distinction, but because of his agnostic religious beliefs, he encountered difficulties. Nevertheless he continued to teach at Cambridge University, his most notable student being the Austrian-British philosopher Ludwig Wittgenstein (1889-1951).

During the years 1910-1913, Russell collaborated with his former teacher. Alfred North Whitehead (1861-1947) to write a 3-volume treatise entitled *Principia Mathematica*, which dealt with the logical foundations of mathematics and languages. At the end of the huge effort which he had devoted to writing this enormous work, Russell underwent a sudden conversion, during which all the aims of his life changed completely. Observing the terrible isolation of Whitehead's wife while she suffered an attack of angina, he had a sudden insight into the isolation of each human being and the need for better communication to break this isolation. As a result of this moment of intuition, Bertrand Russell resolved to abandon mathematics, and instead devote his life to making human existence happier and better.

Russell's idealism, honesty and humor shine from the pages of the enormous number of books, articles and letters that he wrote during the remainder of his life. His wide-ranging and influential writing won him not only great fame, but also the 1950 Nobel Prize in Literature.

Bertrand Russell was the author of the Russell-Einstein Declaration of 1955, the founding document of Pugwash Conferences on Science and World Affairs, an organization which won the Nobel Peace Prize in 1995. Russell devoted much of the last part of his life to working for the complete abolition of nuclear weapons.

Here are a few things that Bertrand Russell said:

War does not determine who is right, but only who is left.

The world is full of magical things patiently waiting for our wits to become sharper.

Men are born ignorant, not stupid. They are made stupid by education.

To fear love is to fear life, and those who fear life are already three parts dead.

The only thing that will redeem mankind is cooperation.

The trouble with the world is that the stupid are cocksure, and the intelligent are full of doubt.

Love is something more than desire for sexual intercourse; it is the principle means of escape from the loneliness which afflicts men and women throughout

the greater part of their lives.

The good life is one inspired by love and guided by knowledge.

Those who have never known the deep intimacy and the intense companionship of mutual love have missed the best thing that life has to give.

Science is what you know, philosophy is what you don't know.

I would never die for my beliefs, because I might be wrong.

Extreme hopes are born from extreme misery.

To conquer fear is the beginning of wisdom.

The fact that an opinion has been widely held is no evidence whatever that it is not utterly absurd.

I have made an odd discovery. Every time I talk with a savant, I am convinced that happiness is no longer possible. Yet when I talk with my gardener, I'm convinced of the opposite.

Patriotism is the willingness to kill and be killed for trivial reasons.

Three passions, simple but overwhelmingly strong, have governed my life: the longing for love, the search for knowledge, and unbearable pity for the suffering of mankind.

There lies before us, if we choose, continual progress in happiness, knowledge, and wisdom. Shall we, instead, choose death, because we cannot forget our quarrels? We appeal, as human beings, to human beings: Remember your humanity, and forget the rest. If you can do so, the way lies open to a new Paradise; if you cannot, there lies before you the risk of universal death.

Figure 7.7: **Pembroke Lodge, near Richmond Park, Bertrand Russell's childhood home.**

Figure 7.8: **Russell at the age of four.**

Figure 7.9: **Russell at Trinity College Cambridge in 1893.**

Figure 7.10: **Russell with two of his children, John and Kate. His second son, Conrad (1937-2004, not shown here) became the 5th Earl Russell, and had a very distinguished career as a liberal parliamentarian and historian.**

7.4 Sir Joseph Rotblat

Pugwash Conferences on Science and World Affairs

In March, 1954, the US tested a hydrogen bomb at the Bikini Atoll in the Pacific Ocean. It was 1000 times more powerful than the Hiroshima bomb. The Japanese fishing boat, Lucky Dragon, was 130 kilometers from the Bikini explosion, but radioactive fallout from the test killed one crew member and made all the others seriously ill.

In England, Prof. Joseph Rotblat, a Polish scientist who had resigned from the Manhattan Project for for moral reasons when it became clear that Germany would not develop nuclear weapons, was asked to appear on a BBC program to discuss the Bikini test. He was asked to discuss the technical aspects of H-bombs, while the Archbishop of Canterbury and the philosopher Lord Bertrand Russell were asked to discuss the moral aspects.

Rotblat had became convinced that the Bikini bomb must have involved a third stage, where fast neutrons from the hydrogen thermonuclear reaction produced fission in a casing of ordinary uranium. Such a bomb would produce enormous amounts of highly dangerous radioactive fallout, and Rotblat became extremely worried about the possibly fatal effect on all living things if large numbers of such bombs were ever used in a war. He confided his worries to Bertrand Russell, whom he had met on the BBC program.

After discussing the Bikini test and its radioactive fallout with Joseph Rotblat, Lord Russell became concerned for the future of the human gene pool if large numbers of such bombs should ever be used in a war. After consultations with Albert Einstein and others, he drafted a document warning of the grave dangers presented by fission-fusion-fission bombs. On July 9, 1955, with Rotblat in the chair, Russell read the Manifesto to a packed press conference.

The document contains the words: "Here then is the problem that we present to you, stark and dreadful and inescapable: Shall we put an end to the human race, or shall mankind renounce war?... There lies before us, if we choose, continual progress in happiness, knowledge and wisdom. Shall we, instead, choose death because we cannot forget our quarrels? We appeal as human beings to human beings: Remember your humanity, and forget the rest. If you can do so, the way lies open to a new Paradise; if you cannot, there lies before you the risk of universal death."

In 1945, with the horrors of World War II fresh in everyone's minds, the United Nations had been established with the purpose of eliminating war. A decade later, the Russell-Einstein Manifesto reminded the world that war *must* be abolished as an institution because of the constantly increasing and potentially catastrophic power of modern weapons.

The Russell-Einstein Manifesto called for a meeting of scientists from both sides of the Cold War to try to minimize the danger of a thermonuclear conflict. The first meeting took place at the summer home of the Canadian philanthropist Cyrus Eaton at the small village of Pugwash, Nova Scotia.

From this small beginning, a series of conferences developed, in which scientists, especially physicists, attempted to work for peace, and tried to address urgent problems related to science. These conferences were called Pugwash Conferences on Science and

Figure 7.11: **Joseph Rotblat believed that the Bikini bomb was of a fission-fusion-fission type. Besides producing large amounts of fallout, such a bomb can be made enormously powerful at very little expense.**

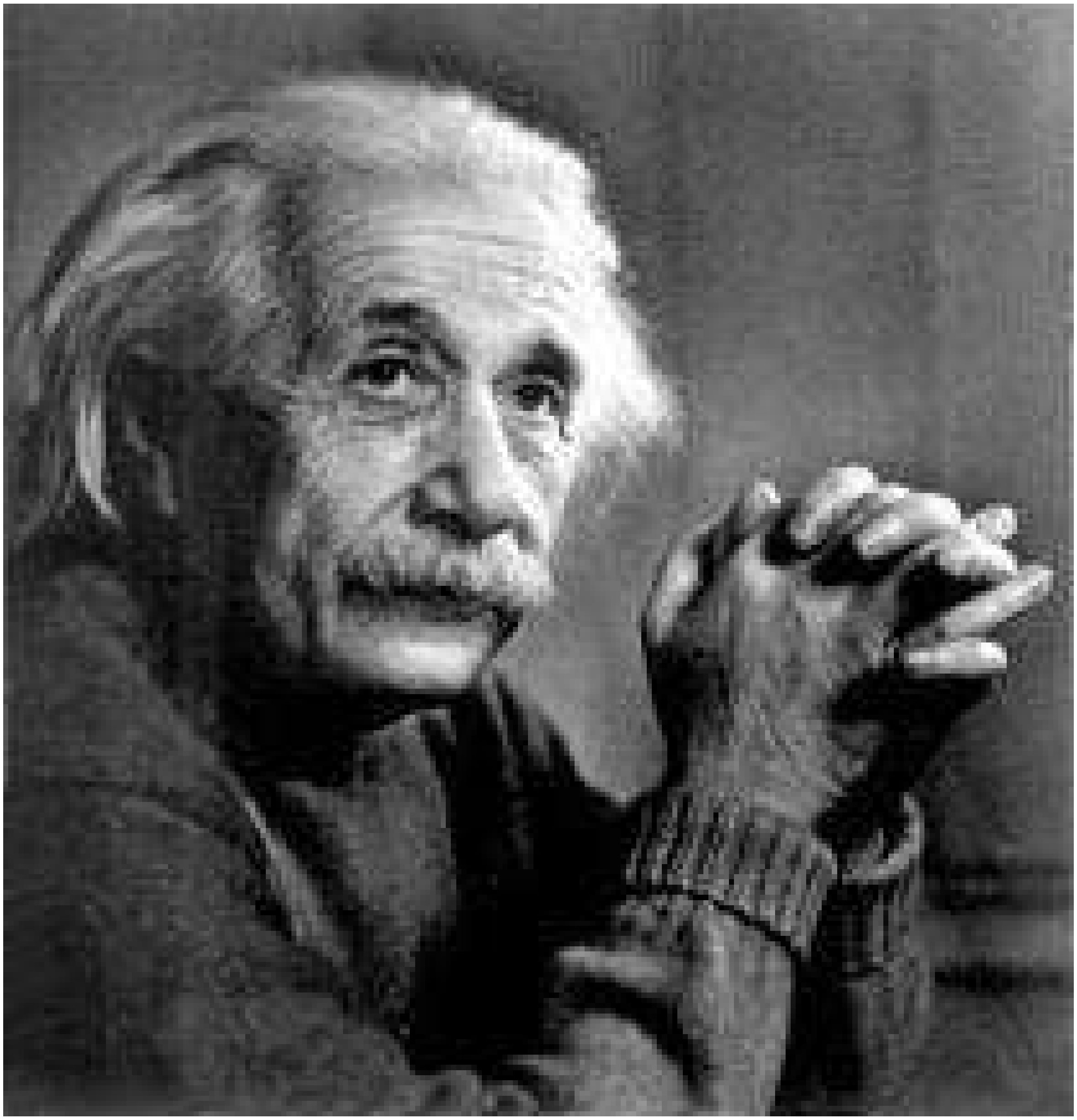

Figure 7.12: **Signing the Russell-Einstein declaration was the last public act of Einstein's life.**

Figure 7.13: **Lord Russell devoted much of the remainder of his life to working for the abolition of nuclear weapons. Here he is seen in 1962 in Trafalgar Square, London, addressing a meeting of the Campaign for Nuclear Disarmament.**

World Affairs, taking their name from the small village in Nova Scotia where the first meeting was held. From the start, the main aim of the meetings was to reduce the danger that civilization would be destroyed in a thermonuclear war.

It can be seen from what has been said that the Pugwash Conferences began during one of the tensest periods of the Cold War, when communication between the Communist and Anti-communist blocks was difficult. During this period, the meetings served the important purpose of providing a forum for informal diplomacy. The participants met, not as representatives of their countries, but as individuals, and the discussions were confidential.

This method of operation proved to be effective, and the initial negotiations for a number of important arms control treaties were aided by Pugwash Conferences. These include the START treaties, the treaties prohibiting chemical and biological weapons, the Nuclear Nonproliferation Treaty (NPT), and the Comprehensive Test Ban Treaty (CTBT).

Former Soviet President Gorbachev has said that discussions with Pugwash scientists helped him to conclude that the policy of nuclear confrontation was too dangerous to be continued.

Over the years, the number of participants attending the annual Pugwash Conference has grown, and the scope of the problems treated has broadened. Besides scientists, the participants now include diplomats, politicians, economists, social scientists and military experts. Normally the number attending the yearly conference is about 150.

Besides plenary sessions, the conferences have smaller working groups dealing with specific problems. There is always a working group aimed at reducing nuclear dangers, and also groups on controlling or eliminating chemical and biological weapons. In addition, there may now be groups on subjects such as climate change, poverty, United Nations reform, and so on.

Invitations to the conferences are issued by the Secretary General to participants nominated by the national groups. The host nation usually pays for the local expenses, but participants finance their own travel.

In addition to the large annual meeting, the Pugwash organization also arranges about ten specialized workshops per year, with 30-40 participants each.

Although attendance at the conferences and workshops is by invitation, everyone is very welcome to join one of the national Pugwash groups. The international organization's website is at www.pugwash.org.

In 1995, the Nobel Peace Prize was awarded jointly to Prof. Joseph Rotblat and to Pugwash Conferences on Science and World Affairs as an organization, "...for their efforts to diminish the part played by nuclear arms in international politics and in the longer run to eliminate such arms." The award was made 50 years after the tragic destruction of Hiroshima and Nagasaki.

In his acceptance speech, Sir Joseph Rotblat (as he soon became) emphasized the same point that has been made by the Russell-Einstein Manifesto - that war itself must be eliminated in order to free civilization from the danger of nuclear destruction. The reason for this is that knowledge of how to make nuclear weapons can never be forgotten. Even if

Figure 7.14: **This photo shows Sir Joseph Rotblat in his London office shortly after he had been informed about the award of the Nobel Peace Prize. The bundles of manuscripts in the background are there because he edited the proceedings of each large yearly Pugwash Conference. The resulting books were then distributed to governments and to decision-makers.**

they were eliminated, these weapons could be rebuilt during a major war. Thus the final abolition of nuclear weapons is linked to a change of heart in world politics and to the abolition of nuclear war.

"The quest for a war-free world", Sir Joseph concluded, "has a basic purpose: survival. But if, in the process, we can learn to achieve it by love rather than by fear, by kindness rather than compulsion; if in the process we can learn to combine the essential with the enjoyable, the expedient with the benevolent, the practical with the beautiful, this will be an extra incentive to embark on this great task. Above all, remember your humanity"

Text of the Russell-Einstein Manifesto

Issued in London, 9 July, 1955

In the tragic situation which confronts humanity, we feel that scientists should assemble in conference to appraise the perils that have arisen as a result of the development of weapons of mass destruction, and to discuss a resolution in the spirit of the appended draft.

We are speaking on this occasion, not as members of this or that nation, continent, or creed, but as human beings, members of the species Man, whose continued existence is in doubt. The world is full of conflicts; and, overshadowing all minor conflicts, the titanic struggle between Communism and anti-Communism.

Almost everybody who is politically conscious has strong feelings about one or more of these issues; but we want you, if you can, to set aside such feelings and consider yourselves only as members of a biological species which has had a remarkable history, and whose disappearance none of us can desire.

We shall try to say no single word which should appeal to one group rather than to another. All, equally, are in peril, and, if the peril is understood, there is hope that they may collectively avert it.

We have to learn to think in a new way. We have to learn to ask ourselves, not what steps can be taken to give military victory to whatever group we prefer, for there no longer are such steps; the question we have to ask ourselves is: what steps can be taken to prevent a military contest of which the issue must be disastrous to all parties?

The general public, and even many men in positions of authority, have not realized what would be involved in a war with nuclear bombs. The general public still thinks in terms of the obliteration of cities. It is understood that the new bombs are more powerful than the old, and that, while one A-bomb could obliterate Hiroshima, one H-bomb could obliterate the largest cities, such as London, New York, and Moscow.

No doubt in an H-bomb war great cities would be obliterated. But this is one of the minor disasters that would have to be faced. If everybody in London, New York, and Moscow were exterminated, the world might, in the course of a few centuries, recover from the blow. But we now know, especially since the

Bikini test, that nuclear bombs can gradually spread destruction over a very much wider area than had been supposed.

It is stated on very good authority that a bomb can now be manufactured which will be 2,500 times as powerful as that which destroyed Hiroshima. Such a bomb, if exploded near the ground or under water, sends radioactive particles into the upper air. They sink gradually and reach the surface of the earth in the form of a deadly dust or rain. It was this dust which infected the Japanese fishermen and their catch of fish.

No one knows how widely such lethal radioactive particles might be diffused, but the best authorities are unanimous in saying that a war with H-bombs might possibly put an end to the human race. It is feared that if many H-bombs are used there will be universal death, sudden only for a minority, but for the majority a slow torture of disease and disintegration.

Many warnings have been uttered by eminent men of science and by authorities in military strategy. None of them will say that the worst results are certain. What they do say is that these results are possible, and no one can be sure that they will not be realized. We have not yet found that the views of experts on this question depend in any degree upon their politics or prejudices. They depend only, so far as our researches have revealed, upon the extent of the particular expert's knowledge. We have found that the men who know most are the most gloomy.

Here, then, is the problem which we present to you, stark and dreadful and inescapable: Shall we put an end to the human race; or shall mankind renounce war? People will not face this alternative because it is so difficult to abolish war.

The abolition of war will demand distasteful limitations of national sovereignty. But what perhaps impedes understanding of the situation more than anything else is that the term "mankind" feels vague and abstract. People scarcely realize in imagination that the danger is to themselves and their children and their grandchildren, and not only to a dimly apprehended humanity. They can scarcely bring themselves to grasp that they, individually, and those whom they love are in imminent danger of perishing agonizingly. And so they hope that perhaps war may be allowed to continue provided modern weapons are prohibited.

This hope is illusory. Whatever agreements not to use H-bombs had been reached in time of peace, they would no longer be considered binding in time of war, and both sides would set to work to manufacture H-bombs as soon as war broke out, for, if one side manufactured the bombs and the other did not, the side that manufactured them would inevitably be victorious.

Although an agreement to renounce nuclear weapons as part of a general reduction of armaments would not afford an ultimate solution, it would serve certain important purposes. First: any agreement between East and West is to the good in so far as it tends to diminish tension. Second: the abolition of

thermonuclear weapons, if each side believed that the other had carried it out sincerely, would lessen the fear of a sudden attack in the style of Pearl Harbor, which at present keeps both sides in a state of nervous apprehension. We should, therefore, welcome such an agreement though only as a first step. Most of us are not neutral in feeling, but, as human beings, we have to remember that, if the issues between East and West are to be decided in any manner that can give any possible satisfaction to anybody, whether Communist or anti-Communist, whether Asian or European or American, whether White or Black, then these issues must not be decided by war. We should wish this to be understood, both in the East and in the West. There lies before us, if we choose, continual progress in happiness, knowledge, and wisdom. Shall we, instead, choose death, because we cannot forget our quarrels? We appeal, as human beings, to human beings: Remember your humanity, and forget the rest. If you can do so, the way lies open to a new Paradise; if you cannot, there lies before you the risk of universal death.

Resolution

We invite this Congress, and through it the scientists of the world and the general public, to subscribe to the following resolution: "In view of the fact that in any future world war nuclear weapons will certainly be employed, and that such weapons threaten the continued existence of mankind, we urge the Governments of the world to realize, and to acknowledge publicly, that their purpose cannot be furthered by a world war, and we urge them, consequently, to find peaceful means for the settlement of all matters of dispute between them."

The document was signed by Max Born, Perry W. Bridgman, Albert Einstein, Leopold Infeld, Frederic Joliot-Curie, Herman J. Muller, Linus Pauling, Cecil F. Powell, Joseph Rotblat, Bertrand Russell, and Hideki Yukawa

7.5 Mairead Corrigan Maguire

Mairead Corrigan was born in 1944. She was the second of eight children of a Catholic family in Belfast, Ireland. In 1976, an event occurred which led Mairead to become a peace activist. Her sister Anne Maguire and three of Anne's children were run over and killed by a car driven by a Provisional Irish Republican Army (PIRA) member who had been fatally shot by British troops while trying to escape. Mairead Corrigan and Betty Williams became leaders of a "virtually spontaneous mass movement" of both Catholic and Protestant women protesting against violence and urging both sides to settle the conflict peacefully.

A march of 10,000 women to the burial place of the three Maguire children, in which

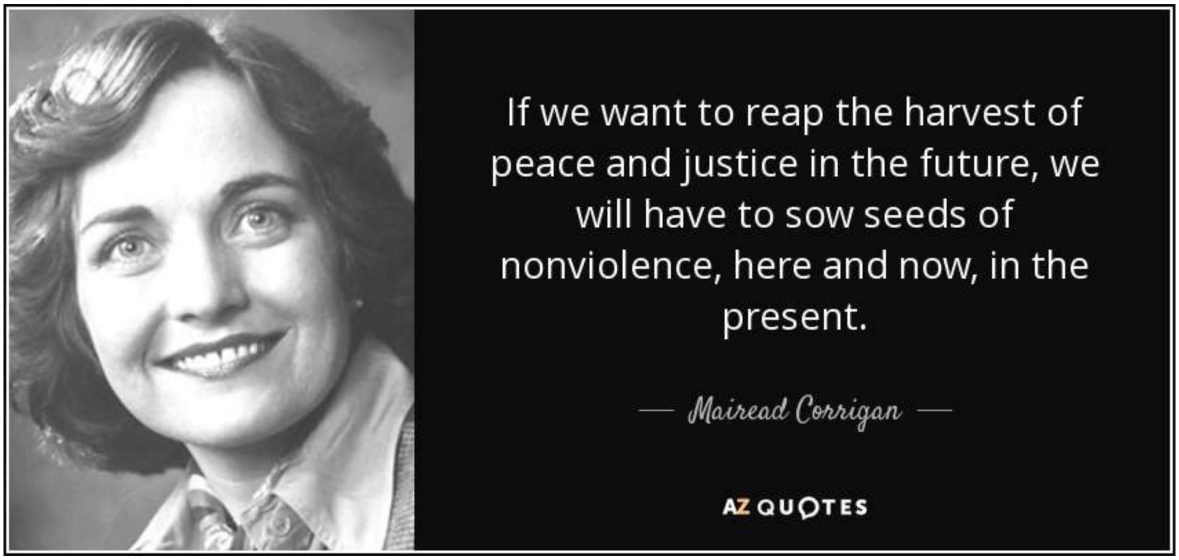

Figure 7.15:

both Catholics and Protestants took part, was physically attacked by members of the PIRA. Later the same month, the movement mobilized 35,000 protesters against violence on the streets of Belfast. The movement was initially called "Women for Peace", but later changed its name to the gender-neutral "Community of Peace People", or simply "Peace People". The movement's two leaders, Betty Williams and Mairead Corrigan, were awarded the 1976 Nobel Peace Prize.

In 1980, after a prolonged struggle with depression following the loss of three of her children, Mairead's sister, Anne Maguire committed suicide. A year and a half later, Mairead Corrigan married her sister's widower, Jackie Maguire.

Although Mairead Corrigan Maguire has continued to work with Peace People until the present, the scope of her work for peace and non-violence has broadened greatly. Here are a few things that Mairead Corrigan Maguire said:

Our common humanity is more important than all the things that divide us.

It's okay to be scared, but fear is different. Fear is when we let being scared prevent us from doing what love requires of us.

We have really got to create a culture in our world today where we recognize that every human life is sacred and precious and we have no right to take another human life.

We frail humans are at one time capable of the greatest good and, at the same time, capable of the greatest evil. Change will only come about when each of us takes up the daily struggle ourselves to be more forgiving, compassionate,

Figure 7.16: **Mairead Corrigan Maguire (born 1944). She and Betty Williams shared the 1976 Nobel Peace Prize for founding and leading Peace People, an organization working for peace in Northern Ireland. Today Maguire's concerns are global. She opposed the Iraq Wars of 1990 and 2003, and the sanctions that caused hundreds of thousands of deaths among the civilians of Iraq. She is critical of US militarism and wars, nuclear weapons wherever they are found, and Israel's occupation of Gaza. At the Russell Tribunal in 2012. she "asked the question that seems to be taboo in the U.S.: Why does President Barack Obama allow Israel to threaten Iran with war when Iran has signed the NPT and Israel has at least 200 nuclear weapons? Why does the president not demand that Israel sign the NPT?" Regarding nuclear weapons, she said "I have for years been speaking out against nuclear weapons. I am actively opposed to nuclear weapons in Britain, in the United States, in Israel, in any country, because nuclear weapons are the ultimate destruction of humankind." Together with Desmond Tutu and Adolfo Pérez Esquivel, Mairead Maguire has also published a letter in support of Chelsea Manning. In 2019, she nominated Julian Assange for the Nobel Peace Prize.**

loving, and above all joyful in the knowledge that, by some miracle of grace, we can change as those around us can change too.

We are all invited to work together for peace. We shall join hands and minds to work for peace through active nonviolence. We shall help one another, encourage one another and learn from one another how to bring peace to our children and to all.

We have to start from the fact that there are always alternatives to violence.

We need radical thinking, creative ideas, and imagination.

I witnessed a lot of violence, and I found myself asking the question: Do you ever use violence to try to bring about political change?

Love for others and respect for their rights and their human dignity, irrespective of who or what they are, no matter what religion - or none - that they choose to follow, will bring about real change and set in motion proper relationships. With such relationships built on equality and trust, we can work together on so many of the threats to our common humanity.

Every day there are people in our world that do absolutely amazing things. People of all ages are very capable of doing tremendous, courageous things in spite of their fear.

Perhaps the greatest contribution that those of us who come from a Christian tradition can make is to throw out the old just-war theory, embrace the nonviolence of Jesus, refuse to kill one another, and truly follow his commandment to "love our enemies".

I believe that hope for the future depends on each of us taking nonviolence into our hearts and minds and developing new and imaginative structures which are nonviolent and life-giving for all.

We need now to build a culture of genuine nonviolence and real democracy.

One great hope lies in the fact that there is a new consciousness in our World, particularly among young people.

Once we link up and network, there will be new institutions, new beginnings, and a change in the economy because capitalism is destroying many people's lives. It's just one leap to think in a different way.

To enable consensus politics to develop we need to empower people where they live. This means devolving financial resources and political power down to the community level. One of the greatest blocks to movement is fear. This fear can only be removed when people feel their voices are being heard by government and when they have a say in their own lives and communities.

...I believe, with Gandhi, that we need to take an imaginative leap forward toward fresh and generous idealism for the sake of all humanity - that we need to renew this ancient wisdom of nonviolence, to strive for a disarmed world, and to create a culture of nonviolence.

I have always been inspired by the American peace movement because it is operating in a very hard and militarist environment.

I believe we are on the edge of a quantum leap into a whole new way of organizing and living as a human family.

When I visited Auschwitz I was horrified. And when I visited Iraq, I thought to myself, 'What will we tell our children in fifty years when they ask what we did when the people in Iraq were dying.'

I think Assange has been very courageous. I've also defended Bradley Manning. I think they've been tremendously courageous in telling the truth, and the public has the right to the truth.

Figure 7.17: **In 1981, Mairead Corrigan married her sister Anne's widower, Jackie Maguire.**

Drop the Just War theory and abolish nuclear weapons

Here are excerpts from a 2016 article by Mairead Corrigan Maguire:[1]

Isn't it strange how war has always found legitimacy by some "thinkers" or "moral" philosophers?

Did you ever hear about just human rights violations? Just genocide? Just poverty? Just gender violence? Just destruction of Nature? Just child labour? - like "if only it's proportional to the challenge we see and we try our best to follow some rules of the fighting it's OK"?

Something very important happened a couple of weeks ago - missed of course by virtually all near-governmental media:

Members of a three day event in Rome co-hosted by the Pontifical Council for Justice and Peace and the International Catholic Peace Movement Organization, Pax Christi, strongly called on Pope Francis:

"To share with the world an encyclical on nonviolence and Just Peace; and on

[1]https://www.pressenza.com/2016/05/drop-just-war-theory-abolish-nuclear-weapons/

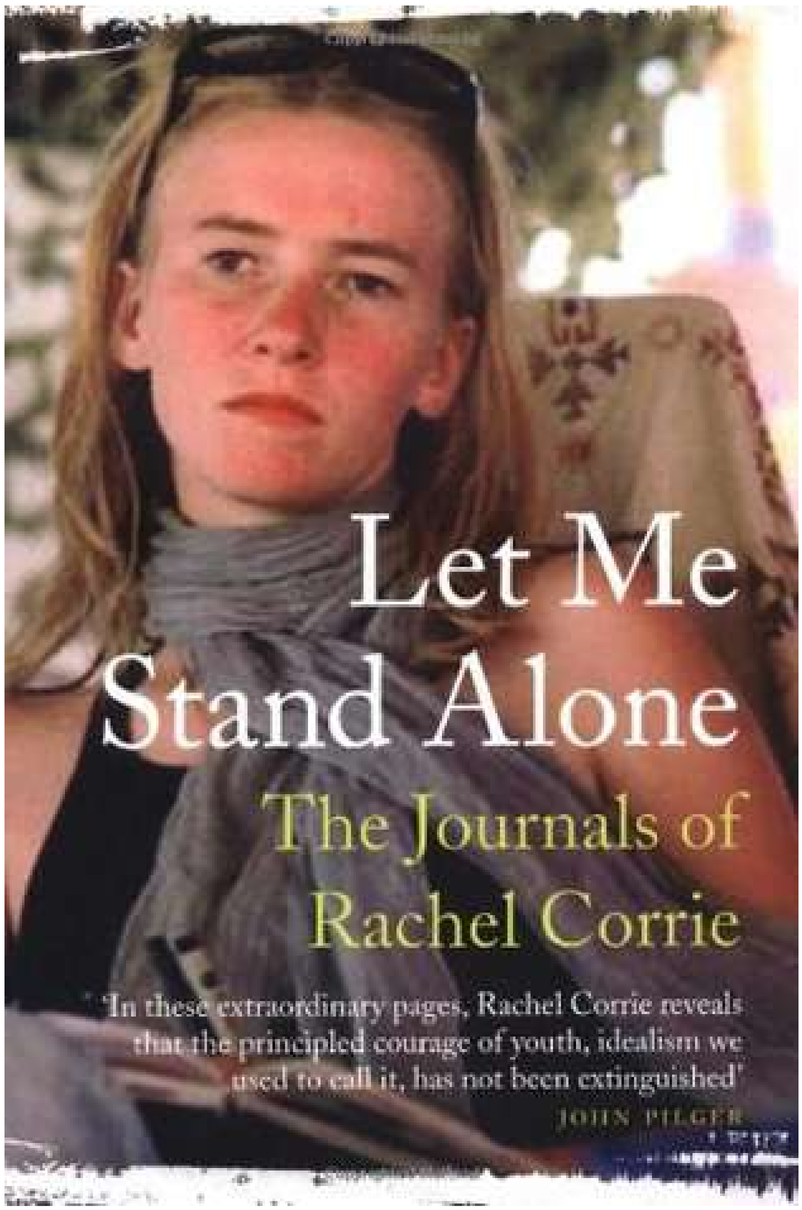

Figure 7.18: **Rachael Corrie was killed when she stood in front of an Israeli bulldozer to prevent it from destroying the houses of Palestinians. The bulldozer driver ran over Rachael repeatedly to make sure that she was dead. Mairead Corrigan Maguire recently sailed on a small ship named after Rachael Corrie in an attempt to break Israel's illegal blockade of Gaza.**

the Church to no longer use or teach 'just war theory'; and continue advocating for the abolition of war and nuclear weapons".

Mrs. Maguire later added the following comments:[2]

I believe the misguided age of 'blessing wars, militarism and killing' must become abolished and the responsibility lies with Pope Francis and religious/spiritual leaders to be true shepherds of Peace and Nonkilling/nonviolence following the command of Jesus to love our enemies and not kill each other.

I hope also that Pope Francis will unambiguously proclaim that 'Violence is always wrong, it is not the way of Jesus' and reject militarism thereby calling upon Catholics not to join armies and take up arms to kill people, thus becoming a true peace church.

The Appeal is now in the hands of Pope Francis, and we can now work, fast, pray, for an Nonkilling/Nonviolence Encyclical - and hope that Pope Francis will continue to show courage, be brave and bold, a true Prophet, a loving Shepherd and a bright light in these dark days for all the human family, which he has so rightly describes as 'this unique and terrible world war in instalments'.

7.6 Daisaku Ikeda and SGI

Soka Gakkai is a large Nichiren Buddhist religious group. Its 12 million members are centered primarily in Japan, but Soka Gakkai International (SGI) has groups in 192 countries. In Japanese, the words "Soka Gakkai" mean "Value-Creating Education". The organization was started by two Japanese educators, Tsunisaburo Makiguchi and Josei Toda, both of whom were imprisoned by their government during World War II because of their opposition to militarism. Makiguchi died as a result of his imprisonment, but Josei Toda went on to found a large and vigorous educational organization dedicated to culture, humanism, world peace and nuclear abolition.

The SGI-International website states that "For most of his life Makiguchi's central concern was to reform the education system that, he felt, discouraged independent thinking and stifled students' happiness and creativity. He believed that education should serve the happiness of the students, rather than the needs of the state. His educational ideas, and his theory of value-creation (soka), which underlies his pedagogy, are explored in his 1930 work *Soka Kyoikugaku Taikei* (The Theory of Value-Creating Pedagogy). Makiguchi's views completely contradicted the logic of the militarist government, which sought to use education to mold obedient, unquestioning servants of the state...

[2]http://blog.transnational.org/2016/04/tff-pressinfo-372-drop-the-just-war-theory-and-abolish-nuclear-weapons/

Figure 7.19: **In 1957, before a cheering audience of 50,000 young Soka Gakkai members, Josei Toda declared nuclear weapons to be an absolute evil. He said that their possession is criminal under all circumstances, and he called on the young people present to work untiringly to rid the world of all nuclear weapons. Source: SGI International**

"Josei Toda (1900-1958) was an educator, publisher and entrepreneur who, as second president of the Soka Gakkai, revived the lay Buddhist organization after World War II, building it into a dynamic, popular movement."

The Toda Declaration and Daisaku Ikeda's Proposals

In 1957, before a cheering audience of 50,000 young Soka Gakkai members, Josei Toda declared nuclear weapons to be an absolute evil. He said that their possession is criminal under all circumstances, and he called the young people present to work untiringly to rid the world of all nuclear weapons.

Toda was the mentor of Daisaku Ikeda, the first president SGI-International. Every year, President Ikeda issues a Peace Proposal, calling for international understanding and dialogue, as well as nuclear abolition, and outlining practical steps by which he believes these goals may be achieved. In his 2013 Peace Proposal, Ikeda, noted that 2015 will be the 70th anniversary of the destruction of Hiroshima, and he proposed that the NPT review conference should take place in Hiroshima, rather that in New York. He proposed that this should be followed by "an expanded global summit for a nuclear-weapon-free world"

Ikeda was born in Tokyo, Japan, on January 2, 1928, the fifth of eight children, to a family of seaweed farmers. The devastation and senseless horror he witnessed as a teenager during World War II gave birth to a lifelong passion to work for peace, rooting out the fundamental causes of human conflict.

Figure 7.20: **Daisaku Ikeda at the age of 19. Josei Toda became his teacher and mentor.**

Figure 7.21: **Daisaku Ikeda (born 1928), President of the 12-million-strong Buddhist organization Soka Gakkai International. Throughout his long life he has worked with courage and dedication for peace and international dialogue.**

In 1947, at the age of 19, he met Josei Toda, educator and leader of the Soka Gakkai. Ikeda found in Toda an open and unaffected person, a man of unshakable conviction with a gift for explaining profound Buddhist concepts in logical, accessible terms. He soon found employment at one of Toda's companies and later completed his education under the tutelage of Toda, who became his mentor in life.

Ikeda was one of the first major Japanese figures to call for normalization of relations with China. His call met with fierce criticism in Japan, but it also caught the attention of those, both in China and in Japan, who sought an easing of tensions between the two countries, including Chinese Premier Zhou Enlai. Today, Ikeda's statement is widely recognized as having played a catalytic role in the process that culminated in the restoration of diplomatic ties between the two countries in 1972.

In the years after normalization, Ikeda engaged in a form of "citizen diplomacy" among the Cold War rivals, particularly between China and the Soviet Union, which at times seemed on the brink of full-scale conflict. During 1974 and 1975, he repeatedly visited China, the USSR and the US, meeting with Soviet Premier Aleksey Kosygin, Chinese Premier Zhou Enlai, US Secretary of State Henry Kissinger and other key figures. Conveying the concerns and aspirations of the leaders of these hostile powers, as well as the yearning for peace he had felt in his encounters with the ordinary citizens of each society, Ikeda worked to defuse tensions and help build the foundations for mutual understanding and dialogue.

Book review: "Hiroshima, August 6, 1945, a Silence Broken"

Why the book is important

The nuclear destruction of Hiroshima was a tragedy in itself, but its larger significance is that it started a nuclear arms race which today threatens to destroy human society and much of the biosphere.

Soka Gakkai

Soka Gakkai is a large Nichiren Buddhist religious group. Its 12 million members are centered primarily in Japan, but Soka Gakkai International (SGI) has groups in 192 countries. In Japanese, the words "Soka Gakkai" mean "Value-Creating Education". The organization was started by two Japanese educators, Tsunisaburo Makiguchi and Josei Toda, both of whom were imprisoned by their government during World War II because of their opposition to militarism. Makiguchi died as a result of his imprisonment, but Josei Toda went on to found a large and vigorous educational organization dedicated to culture, humanism, world peace and nuclear abolition.

The Toda Declaration and Daisaku Ikeda's Proposals

In 1957, before a cheering audience of 50,000 young Soka Gakkai members, Josei Toda declared nuclear weapons to be an absolute evil. He said that their possession is criminal under all circumstances, and he called the young people present to work untiringly to rid the world of all nuclear weapons.

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The Hiroshima Peace Committee and the last remaining hibakushas

In Japanese the survivors of injuries from the nuclear bombing of Hiroshima and Nagasaki are called "hibakushas". Over the years, the Soka Gakkai Hiroshima Peace Committee has published many books containing their testimonies. The most recent of these books, "A Silence Broken", contains the testimonies of 14 men, now all in their late 70's or in their 80's, who are among the last few remaining hibakushas. All 14 of these men have kept silent until now because of the prejudices against hibakushas in Japan, where they and their children are thought to be unsuitable as marriage partners because of the effects of radiation. But now, for various reasons, they have chosen to break their silence. Many have chosen to speak now because of the Fukushima disaster.

The testimonies of the hibakushas give a vivid picture of the hell-like horrors of the nuclear attack on the civilian population of Hiroshima, both in the short term and in the long term. For example, Shigeru Nonoyama, who was 15 at the time of the attack, says: "People crawling out from crumbled houses started to flee. We decided to escape to a safe place on the hill. We saw people with melted ears stuck to their cheeks, chins glued to their shoulders, heads facing in awkward positions, arms stuck to bodies, five fingers joined together and grab nothing. Those were the people fleeing. Not merely a hundred or two, The whole town was in chaos."

"I saw the noodle shop's wife leg was caught under a fallen pole, and a fire was approaching. She was screaming, 'Help me!Help me!' There were no soldiers, no firefighters. I later heard that her husband had cut off his wife's leg with a hatchet to save her."

"Each and every scene was hell itself. I couldn't tell the difference between the men and the women. Everybody had scorched hair, burned hair, and terrible burns. I thought I saw a doll floating in a fire cistern, but it was a baby. A wife trapped under her fallen house was crying, 'Dear, please help me, help me!' Her husband had no choice but to leave her in tears."

"...I hovered between life and death for three months, from August to October. When

Figure 7.22: *It was like a scene from hell. Source: SGI International.*

a fly landed on a festering wound, it would bleed white maggots in a few days. My mother shooed away the flies through the night with a fan through the night. She must have been desperately determined not to lose any more sons or daughters. My dangling skin dried and turned hard, like paper. My mother picked off the dried skin. She made a cream of straw ash and cooking oil, and applied it to my burnt head, face and fingertips, turning me black..."

The testimonies of the other hibakushas are equally horrifying.

The postwar nuclear arms race

On August 29, 1949, the USSR exploded its first nuclear bomb. It had a yield equivalent to 21,000 tons of TNT, and had been constructed from Pu-239 produced in a nuclear reactor. Meanwhile the United Kingdom had begun to build its own nuclear weapons.

The explosion of the Soviet nuclear bomb caused feelings of panic in the United States, and President Truman authorized an all-out effort to build superbombs using thermonuclear reactions - the reactions that heat the sun and stars. On October 31, 1952, the first US thermonuclear device was exploded at Eniwetok Atoll in the Pacific Ocean. It had a yield of 10.4 megatons, that is to say it had an explosive power equivalent to 10,400,000 tons of TNT. Thus the first thermonuclear bomb was five hundred times as powerful as the bombs that had devastated Hiroshima and Nagasaki. The Soviet Union and the United Kingdom were not far behind.

In 1955 the Soviets exploded their first thermonuclear device, followed in 1957 by the UK. In 1961 the USSR exploded a thermonuclear bomb with a yield of 58 megatons. A bomb of this size, two thousand times the size of the Hiroshima bomb, would destroy a city completely even if it missed it by 50 kilometers. France tested a fission bomb in 1966 and a thermonuclear bomb in 1968. In all about thirty nations contemplated building nuclear

Figure 7.23: *Burned beyond recognition. Source: SGI International.*

Figure 7.24: *Memories of August 6. Source: SGI International.*

Figure 7.25: *The effects lasted a lifetime. Source: SGI International.*

Figure 7.26: *After the bombing. Source: SGI International.*

weapons, and many made active efforts to do so.

Because the concept of deterrence required an attacked nation to be able to retaliate massively even though many of its weapons might be destroyed by a preemptive strike, the production of nuclear warheads reached insane heights, driven by the collective paranoia of the Cold War. More than 50,000 nuclear warheads were produced worldwide, a large number of them thermonuclear. The collective explosive power of these warheads was equivalent to 20,000,000,000 tons of TNT, i.e., 4 tons for every man, woman and child on the planet, or, expressed differently, a million times the explosive power of the bomb that destroyed Hiroshima. Today, the collective explosive power of all the nuclear weapons in the world is about half that much, but still enough to destroy human society.

There are very many cases on record in which the world has come very close to a catastrophic nuclear war. One such case was the Cuban Missile Crisis. Robert McNamara, who was the US Secretary of Defense at the time of the crisis, had this to say about how close the world came to a catastrophic nuclear war: "I want to say, and this is very important: at the end we lucked out. It was luck that prevented nuclear war. We came that close to nuclear war at the end. Rational individuals: Kennedy was rational; Khrushchev was rational; Castro was rational. Rational individuals came that close to total destruction of their societies. And that danger exists today."

A number of prominent political and military figures (many of whom have ample knowledge of the system of deterrence, having been part of it) have expressed concern about the danger of accidental nuclear war. Colin S. Gray, Chairman, National Institute for Public Policy, expressed this concern as follows: "The problem, indeed the enduring problem, is that we are resting our future upon a nuclear deterrence system concerning which we cannot tolerate even a single malfunction". Bruce G. Blair (Brookings Institute) has remarked that "It is obvious that the rushed nature of the process, from warning to decision to action, risks causing a catastrophic mistake"... "This system is an accident waiting to happen."

As the number of nuclear weapon states grows larger, there is an increasing chance that a revolution will occur in one of them, putting nuclear weapons into the hands of terrorist groups or organized criminals. Today, for example, Pakistan's less-than-stable government might be overthrown, and Pakistan's nuclear weapons might end in the hands of terrorists. The weapons might then be used to destroy one of the world's large coastal cities, having been brought into the port by one of numerous container ships that dock every day, a number far too large to monitored exhaustively. Such an event might trigger a large-scale nuclear conflagration.

Recent research has shown that a large-scale nuclear war would be an ecological catastrophe of enormous proportions, producing very large-scale famine through its impact on global agriculture, and making large areas of the world permanently uninhabitable through long-lived radioactive contamination.

How do these dangers look in the long-term perspective? Suppose that each year there is a certain finite chance of a nuclear catastrophe, let us say 1 percent. Then in a century the chance of a disaster will be 100 percent, and in two centuries, 200 percent, in three centuries, 300 percent, and so on. Over many centuries, the chance that a disaster will take place will become so large as to be a certainty. Thus by looking at the long-term future, we can see that if nuclear weapons are not entirely eliminated, civilization will not survive.

We will do well to remember Josei Toda's words: "Nuclear weapons are an absolute evil. Their possession is criminal under all circumstances"

Book review: Aurelio Pecci and Daisaku Ikeda, "Before It's Too Late"

This book was published in 1984 in English, French, German, Italian and Japanese. Far from being our of date, it is even more urgently relevant today than when it was published. It is a dialogue between two great men, Aurelio Peccei and Daisaku Ikeda. Their greatness is both moral and intellectual.

Aurelio Peccei (1908-1984) was the principal founder of the Club of Rome, an organization whose 1972 report, "Limits to Growth" first called to the world's attention the impossibility of constantly-increasing economic growth on a finite planet.

The second author, Daisaku Ikeda (1928-), is the founding President of Soka Gakkai International (SGI), a 12-million-strong lay Buddhist organization with members in 192 countries or regions.

The Japanese words "Soka Gakkai" mean "Value-Creating Education", and the members of SGI are strongly committed to working for peace, international understanding, and the complete abolition of nuclear weapons.

"Before It Is Too Late" is a comprehensive discussion of the urgent need to re-establish human respect for nature, and harmony with nature.

It is even more clear today than it was 30 years ago that, unless it is checked, unrestrained commercial exploitation of the environment, will lead to an environmental mega-catastrophe.

Today there is unequivocal scientific evidence that if the use of fossil fuels is not replaced by 100% renewable energy within the next few decades, we will pass a tipping point.

Beyond this point, feed-back mechanisms for global warming will take over and lead us uncontrollably to catastrophic climate change.

There is a danger that human actions will produce a 6th extinction event comparable to five largest events that are found in the geological record. During each of these, more than half the species of living organisms became extinct.

Although Aurelio Peccei and Daisaku Ikeda did not have this new scientific information available when they were writing their important dialogue, they nevertheless were acutely aware of the environmental damage caused by the unrestrained activities of industrial civilization.

An initial statement by Aurelio Pecci

Here are some quotations from Peccei's introductory remarks:

"Paradoxically, man has never been so much in danger as he is now, at the peak of his power. .. Mesmerized by our own power, we do what we can do, not what we ought to do...

"The consequences of our misjudgement and our irresponsible behaviour are quite evident. We have vanquished so many diseases without reducing our reproductive fertility, with the result that the world population is multiplying phenomenally...

"Today, in a time of quarrelsome so-called sovereign states that lose no opportunity to arm themselves to the teeth, the way we have enormously developed military technologies means that humanity is actually playing with fire...

"Hurtling on full speed ahead and indulging our propensity for material possessions and consumption, we have dramatically swelled the global demand for goods, foods and services...

"We have created artificial needs, artfully expanding the range of what is considered indespensible by constantly renewing fashions, and designing products with built-in technological obsolescence.

"The only way we have devised to meet the surging waves of our rampant militarism and consumerism is to draw increasingly on the natural environment and to exploit, indiscriminately, the most accessible mineral and fuel deposits and all living resources we can lay our hands on...

"Such actions irreversibly impoverish our unique, irreplaceable world, whose bounty and generosity are not infinite. Even if all other adverse situations in which we find ourselves today were to be alleviated, in itself, out high-handed treatment of Nature can bring about our doom."

President Daisaku Ikeda replies

In the dialogue, President Ikeda supports Peccei's analysis and adds:

"While striving to reduce the numbers of their unemployed, increase their military arsenals, and stimulate industry in their own lands, politicians continue to hold out to their own peoples the dream of a richer society. Economists continue to try to invigorate economic growth, probably because development and growth in business are directly linked with support of their own social positions. Technocrats follow a similar course,,,

"Sympathizers with the stands of overly optimistic politicians, economists and technicians condemn indications of the gravity of the situation on the grounds that they weaken people's will to grow and develop. In Japan, this attitude has led the Ministry of Education to request publishers of primary and middle-school textbooks to delete pictures of the atomic bombings as intolerable horrible, and to change articles about industries that pollute the environment.

"The ministry is guilty of putting the cart before the horse. What it should be insisting on is the prevention of production, stockpiling and use of the nuclear weapons responsible for the horrors that it deplores in the textbook illustrations. People who assume an optimistic stance in connection with polluting industries and reckless consumption of the world's natural resources are guilty of similar folly."

A Human Revolution

Both authors agree that, in order to avoid the dangers of ecological, economic or thermonuclear catastrophe, a Human Revolution is necessary. By this they mean a revolution in the way that humans think of themselves.

The two authors agree that this will require a reform of current educational systems. President Ikeda, who has spent many years establishing reformed educational institutions throughout the world, is extremely well qualified to discuss this issue.

The reader will find much in this book that is vitally important to our current situation.

It is like a musical composition which constantly returns to the theme of harmony between humans and Nature and between humans and other humans, with a richness of variations on these themes that progressively builds up our understanding.

SGI Denmark

For many years I have worked with the Danish National Group of Pugwash Conferences on Science and World Affairs. In 2007 we arranged for Dr. Tadatoshi Akeba, the Mayor of Hiroshima, to visit Copenhagen and meet Copenhagen's Lord Mayor, Ritt Bjergaard. The meeting was a great success, and, as we had hoped, Copenhagen joined the Mayors

Figure 7.27: **In 2007, we decided to invite Dr. Tadatoshi Akeba, the Mayor of Hiroshima, to visit Copenhagen.**

for Peace organization, despite a Danish regulation that forbids mayors from expressing themselves on foreign policy issues.

One of the greatest benefits of Dr. Akiba's visit was that it brought us into contact with the Danish branch of SGI. Getting to know and cooperate with SGI Denmark and its leaders, Jan Møller and Mark Kamio, as well as many others in the organization, has been a great joy to me personally, and it has greatly helped the work for peace of our Danish Pugwash Group. Like the Quakers, and a few other religious groups, SGI is dedicated to working courageously and actively for peace, international understanding, and the total abolition of nuclear weapons.

We soon found that it was convenient to have our Pugwash meetings at SGI Denmark's beautiful Nordic Cultural Center, enjoying the wonderful hospitality of Jan and Mark and the others. I also began the practice of traveling to Askov College in Jutland twice a year to lecture about nuclear dangers to visiting students from the Soka University, Tokyo. Also, for three years in a row, I had the privilege of being invited to give a half-hour speech on Hiroshima Day (August 6) at SGI Denmark's annual summer course. It was an enormous pleasure to speak to the 400 or so enthusiastic SGI members assembled for the course.

Figure 7.28: **We arranged for survivors of the destruction of Hiroshima to meet Copenhagen's Cultural Mayor, Pia Allerslev.**

Figure 7.29: **SGI's beautiful Nordic Cultural Center, at A.F. Kriegersvej 3, Copenhagen.**

Figure 7.30: **An SGI event in which I participated. On the right are Jan Møller. President of SGI Denmark, and the famous Danish actress Mia Lyhne.**

Figure 7.31: **Another SGI event: Hiroshima Day at Askov College. In the front row, from left to right, we see the Japanese Ambassador and his wife, Tom Børsen, myself, Maj Britt Theorin President of the International Peace Bureau, Caecilie Buhmann, and Maj Britt's husband. On the far right are Jens Junghans, Mark Kamio and Jan Møller. Holger Terp can be seen just behind Maj Britt Theorin.**

Figure 7.32: **One of the wonderful students from Soka University in Tokyo. Two times a year for many years I lectured to them on the history of Pugwash Conferences, and the current situation in the struggle to abolish nuclear weapons.**

Figure 7.33: **A meeting between President Daisaku Ikeda and Sir Joseph Rotblat.**

Full List of Published Dialogues of Daisaku Ikeda

1. **“Civilization, East and West”, with Richard Coudenhove-Kalergi, Japanese, (1972)**

2. **“On the Japanese Classics”, with Makoto Nemoto English, Japanese (1974), Portuguese, Thai**

3. **“Choose Life: A Dialogue” with Arnold J. Toynbee, Bengali, Bulgarian, Chinese (simplified and traditional), Czech, Dutch, English, Filipino, French, German, Hindi, Hungarian, Indonesian, Italian, Japanese (1975), Korean, Laotian, Malay, Nepali, Polish, Portuguese, Russian, Serbian, Sinhalese, Spanish, Swahili, Thai, Turkish, Urdu, Vietnamese**

4. **”On Living”, with Konosuke Matsushita, Chinese (simplified and traditional), Korean, Japanese (1975)**

5. **“Changes Within: Human Revolution vs. Human Condition”, with André Malraux, Japanese (1976)**

6. **“Letters of Four Seasons”, with Yasushi Inoue, Chinese (simplified), English, French, Japanese (1977), Malay, Thai**

7. **“Dawn After Dark”, with René Huyghe, Chinese (simplified), English, French (1980), Japanese, Portuguese, Spanish, Thai**

8. **“Before It Is Too Late”, with Aurelio Peccei, Bulgarian, Chinese (simplified and traditional), Danish, English, French, German, Indonesian,**

Italian, Japanese (1984), Korean, Malay, Portuguese, Spanish, Swedish, Thai, Vietnamese

9. "Human Values in a Changing World", with Bryan Wilson, Chinese (simplified and traditional), English, French, Italian, Japanese (1985), Portuguese, Spanish, Thai

10. "The Third Rainbow Bridge", with Anatoli A. Logunov, Chinese (simplified), Japanese (1987), Russian

11. "Philosophy of Human Peace", with Henry Kissinger, Japanese (1987)

12. "Humanity at the Crossroads", with Karan Singh, English, Japanese (1988), Thai

13. "Search for a New Humanity", with Josef Derbolav, Chinese (simplified), English, German (1988), Japanese, Thai

14. "A Lifelong Quest for Peace", with Linus Pauling, Chinese (simplified and traditional), English, Filipino, French, Japanese (1990), Korean, Malay, Russian, Spanish, Vietnamese

15. "The Radiance of Dunhuang: On Beauty and Life", with Chang Shuhong, Chinese (simplified and traditional), Japanese (1990)

16. "Dialogue Between Citizens of the World", with Norman Cousins, Japanese (1991)

17. "The Sun and the Good Earth: An Ode to Pioneering Japanese Immigrants", with Ryoichi Kodama, Japanese(1991), Kyrgyz, Portuguese

18. "Ode to the Grand Spirit", with Chingiz Aitmatov, English, German, Japanese (1991), Kyrgyz, Russian

19. "Dialogue on Humanity and Culture", with Kenji Doi, Japanese (1991)

20. "Space and Eternal Life", with Chandra Wickramasinghe, English, Japanese (1992), Portuguese

21. "Science and Religion", with Anatoli A. Logunov, Japanese (1994) , Russian

22. "Human Rights in the Twenty-First Century", with Austregésilo de Athayde, English, Japanese (1995), Portuguese

23. "Choose Peace", with Johan Galtung, English, Italian, Japanese (1995), Korean, Thai

24. **"Moral Lessons of the Twentieth Century", with Mikhail Gorbachev, Chinese (simplified and traditional), English, French, German, Greek, Icelandic, Italian, Japanese (1996), Korean, Russian, Slovakian**

25. **"Dawn of the Pacific", with Patricio Aylwin Azócar, Japanese (1997), Spanish**

26. **"The Tempestuous Life of Napoleon", with Philippe Moine, Patrice Morlat and Tadashige Takamura, Japanese (1997)**

27. **"Compassionate Light in Asia", with Jin Yong, Chinese (simplified and traditional), English, Japanese (1998)**

28. **"The Path to the Land of Children", with Albert A. Likhanov, Chinese (simplified and traditional), Japanese (1998), Russian**

29. **"A Lion's Heart", with Axinia Djourova, Bulgarian, Japanese (1999)**

30. **"On Being Human: Where Ethics, Medicine and Spirituality Converge", with René Simard and Guy Bourgeault, Chinese (traditional), English, French, Italian, Japanese (2000), Vietnamese**

31. **"Global Civilization: A Buddhist-Islamic Dialogue", with Majid Tehranian, Arabic, Chinese (traditional), Dutch, English, French, Hebrew, Indonesian, Italian, Japanese (2000), Malay, Persian, Thai**

32. **"José Martí, Cuban Apostle", with Cintio Vitier, English, Japanese (2001), Spanish**

33. **"Choose Hope", with David Krieger, English, Italian, Japanese (2001)**

34. **"Distinct Encounters", with Rogelio M. Quiambao, English, Japanese (2001)**

35. **"Dialogue on World Literature", with Tadashige Takamura and Philippe Moine; Kentaro Nishihara and Rogelio M. Quiambao; Ryohei Tanaka and Hirotomo Teranishi; Tadashige Takamura and Henry Indangasi, Japanese (2001)**

36. **"Beyond the Century: Dialogue on Education and Society", with Victor A. Sadovnichy, Chinese (traditional), Japanese (2002), Russian**

37. **"Dialogue on Oriental Wisdom", with Ji Xianlin and Jiang Zhongxin, Chinese (simplified and traditional), Japanese (2002)**

38. **"Buddhism: A Way of Values", with Lokesh Chandra, English, Korean, Japanese (2002)**

39. **“The Bridge toward a Century of Hope”, with Cho Moon Boo, Korean, Japanese (2002)**

40. **“Planetary Citizenship”, with Hazel Henderson, Chinese (simplified and traditional), English, French, Italian, Japanese (2002), Portuguese**

41. **“The Illuminating Power of Learning”, with Victor A. Sadovnichy, Chinese (traditional), Japanese (2004)**

42. **“The Cosmos, Earth and Human Beings”, with Alexander Serebrov, Japanese (2004), Korean, Russian**

43. **“A Rainbow Bridge of Humanity and Culture”, with Cho Moon Boo, Japanese (2005)**

44. **“Our World To Make: Buddhism and the Rise of Global Civil Society”, with Ved Prakash Nanda, English, Japanese (2005)**

45. **“Toward Creating an Age of Humanism”, with John Kenneth Galbraith, Japanese (2005)**

46. **“A Dialogue Between East and West: Looking to a Human Revolution”, with Ricardo Díez-Hochleitner, English, Japanese (2005), Malay, Spanish**

47. **“Into Full Flower: Making Peace Cultures Happen”, with Elise Boulding, English, Japanese (2006)**

48. **“Revolutions: to green the environment, to grow the human heart”, with M. S. Swaminathan, English (2005), Italian, Japanese, Vietnamese**

49. **“A Quest for Global Peace”, with Joseph Rotblat, Chinese (traditional), English, German, Italian, Japanese (2006)**

50. **“Creating Waldens: An East-West Conversation on the American Renaissance”, with Ronald A. Bosco and Joel Myerson, English, Japanese (2006)**

51. **“New Horizons in Eastern Humanism: Buddhism, Confucianism and the Quest for Global Peace”, with Tu Weiming, Chinese (simplified and traditional), English, Japanese (2007)**

52. **“The Humanist Principle: On Compassion and Tolerance”, with H. C. Felix Unger, English, Italian, Japanese (2007)**

53. **“A Passage to Peace: Global Solutions from East and West” with Nur Yalman, English, Japanese (2007), Malay**

54. **"Grand Steppes of Friendship", with Dojoogiin Tsedev, Japanese (2007), Mongolian**

55. **"The Persistence of Religion: Comparative Perspectives on Modern Spirituality", with Harvey Cox, Chinese (traditional), English, Japanese (2008)**

56. **"Walking with the Mahatma: Gandhi for Modern Times", with Neelakanta Radhakrishnan, English, Chinese (traditional), Japanese (2009), Malayalam, Tamil**

57. **"A Journey on the Path of Culture and the Arts", with Jao Tsung-I, Chinese (simplified and traditional), Japanese (2009)**

58. **"A Dialogue on Astronomy and Buddhism", with Ronaldo Rogério de Freitas Mouráo, Chinese (traditional), Japanese (2009), Portuguese**

59. **"A Message to the Century of Human Rights", with Adolfo Pérez Esquivel, Italian, Japanese (2009), Spanish**

60. **"Shaping the Future: The Sacred Task of Education", with Hans Henningsen, Danish, Japanese (2009)**

61. **"The Noble Path of Education and Culture", with Chang Jen Hu, Chinese (traditional), Japanese (2010)**

62. **"The Wisdom of Tolerance: A Philosophy of Generosity and Peace", with Abdurrahman Wahid, English, Indonesian, Japanese (2010)**

63. **"An Epoch of Human Triumph: A Dialogue on History, Life and Education", with Zhang Kaiyuan, Chinese (simplified and traditional), Japanese (2010)**

64. **"The Inner Philosopher: Conversations on Philosophy's Transformative Power", with Lou Marinoff, Chinese (simplified), English, Italian, Japanese (2011)**

65. **"The Great Light of Education toward the Dawn of Peace: Ukraine-Japan Friendship", with Michael Z. Zgurovsky, Japanese (2011), Russian, Ukrainian**

66. **"Creating a New Global Society–A Discourse on the United Nations and a Culture of Peace", with Anwarul K. Chowdhury, Chinese (traditional), Japanese (2011)**

67. **"Napoléon of the Twenty-first Century: A Conversation on the Spirit of Creating History", with Charles Napoléon, Japanese (2011)**

68. "Connecting the World through the Power of Culture", with Gao Zhanxiang, Chinese (simplified) (2012), Japanese

69. "Humanistic Education, A Bridge to Peace", with Gu Mingyuan, Chinese (simplified), Japanese (2012)

70. "America Will Be! : Conversations on Hope, Freedom, and Democracy", with Vincent Harding, English, French, Japanese (2012)

71. "Reaching Beyond: Improvisations on Jazz, Buddhism, and a Joyful Life", with Herbie Hancock and Wayne Shorter, English, Japanese (2013)

72. "The Mission of Education in Tomorrow's World–Thoughts on Humanity in the 21st Century", with Victor Sadovnichy, Japanese (2013)

73. "The Art of True Relations: Conversations on the Poetic Heart of Human Possibility", with Sarah Wider, English, Italian, Japanese (2013)

74. "Living As Learning: John Dewey in the 21st Century", with Jim Garrison and Larry Hickman, English, Japanese (2014)

75. "Peace, Justice and the Poetic Mind: Conversations on the Path of Nonviolence", with Stuart Rees, English, Japanese (2014)

76. "Knowing Our Worth–Conversation on Energy and Sustainability", with Ernst Ulrich von Weizsäcker, English, German, Italian, Japanese (2014)

77. "The Light of Life Songs of Mothers", with Jutta Unkart-Seifert, Japanese (2015)

78. "Global Citizenship: Toward a Civilization of Wisdom, Love and Peace", with José Veloso Abueva, English, Japanese (2015)

79. "Shaping a New Society: Conversations on Economics, Education, and Peace", with Lawrence J. Lau, Chinese (traditional), English, Japanese (2015)

80. "Song for a New Global Civilization: Conversations on Tagore and World Citizens", with Bharati Mukherjee, English, Japanese (2016)

81. "Toward a Century of Peace: A Dialogue on the Role of Civil Society in Peacebuilding", with Kevin Clements, English, Japanese (2016)

82. "A Philosophy of Life for Future Generations: Learning from Literature and People", with Wang Meng, Chinese (simplified and traditional), Japanese (2017)

7.7 ICAN

What is ICAN?

The International Campaign to Abolish Nuclear Weapons, abbreviated ICAN, is a coalition of 468 NGO's in 101 countries. The purpose of ICAN is to change the focus in the disarmament debate to "the the humanitarian threat posed by nuclear weapons, drawing attention to their unique destructive capacity, their catastrophic health and environmental consequences, their indiscriminate targeting, the debilitating impact of a detonation on medical infrastructure and relief measures, and the long-lasting effects of radiation on the surrounding area."

ICAN was founded in 2007 by the International Physicians for the Prevention of Nuclear War, an organization which itself received a Nobel Peace Prize in 1985. IPPNW was inspired by the success of the campaign that achieved the Ottawa Treaty in 1997, a treaty which banned antipersonnel land-mines against bitter opposition from the worst offenders. Thus, from the start. ICAN envisioned a treaty passed and without the participation or signatures of the nuclear weapons states. ICAN believed that such a treaty would have the great value of unambiguously underlining the illegality, immorality and omnicidal nature of nuclear weapons. Nuclear weapons states would eventually be forced to yield to the will of the vast majority of humankind.

On July 7, 2017, the Treaty on the Prohibition of Nuclear Weapons was adopted by an overwhelming majority, 122 to 1, by the United Nations General Assembly. The adoption of the treaty, a milestone in humanity's efforts to rid itself of nuclear insanity, was to a large extent due to the efforts of ICAN's participating organizations.

On December 10, 2017 ICAN's efforts were recognized by the award of the Nobel Peace Prize. Part of the motivation for the award was the fact that the threat of a thermonuclear global catastrophe is higher today than it has been at any time since the Cuban Missile Crisis. Because of the belligerent attitudes and mental instability of Donald Trump and Kim Jong Un, the end of human civilization and much of the biosphere is, in the words of Beatrice Fihn, "only a tantrum away".

Figure 7.34: *From left to right: Berit Reiss-Andersen, Chairman of the Norwegian Nobel Committee, Setsuko Thurlow, an 85-year-old survivor of the 1945 atomic bombing of Hiroshima, and ICAN Executive Director Beatrice Fihn.*

Figure 7.35: *Celebrating the award.*

The ICAN Nobel Lecture by Beatrice Fihn

Your Majesties, Members of the Norwegian Nobel Committee, Esteemed guests,

Today, it is a great honour to accept the 2017 Nobel Peace Prize on behalf of thousands of inspirational people who make up the International Campaign to Abolish Nuclear Weapons.

Together we have brought democracy to disarmament and are reshaping international law.

We most humbly thank the Norwegian Nobel Committee for recognizing our work and giving momentum to our crucial cause.

We want to recognize those who have so generously donated their time and energy to this campaign.

We thank the courageous foreign ministers, diplomats, Red Cross and Red Crescent staff, UN officials, academics and experts with whom we have worked in partnership to advance our common goal.

And we thank all who are committed to ridding the world of this terrible threat.

At dozens of locations around the world - in missile silos buried in our earth, on submarines navigating through our oceans, and aboard planes flying high in our sky - lie 15,000 objects of humankind's destruction.

Perhaps it is the enormity of this fact, perhaps it is the unimaginable scale of the consequences, that leads many to simply accept this grim reality. To go about our daily lives with no thought to the instruments of insanity all around us.

For it is insanity to allow ourselves to be ruled by these weapons. Many critics of this movement suggest that we are the irrational ones, the idealists with no grounding in reality. That nuclear-armed states will never give up their weapons.

But we represent the only rational choice. We represent those who refuse to accept nuclear weapons as a fixture in our world, those who refuse to have their fates bound up in a few lines of launch code.

Ours is the only reality that is possible. The alternative is unthinkable.

The story of nuclear weapons will have an ending, and it is up to us what that ending will be.

Will it be the end of nuclear weapons, or will it be the end of us?

One of these things will happen.

The only rational course of action is to cease living under the conditions where our mutual destruction is only one impulsive tantrum away.

Today I want to talk of three things: fear, freedom, and the future.

By the very admission of those who possess them, the real utility of nuclear weapons is in their ability to provoke fear. When they refer to their "deterrent" effect, proponents of nuclear weapons are celebrating fear as a weapon of war.

They are puffing their chests by declaring their preparedness to exterminate, in a flash, countless thousands of human lives.

Nobel Laureate William Faulkner said when accepting his prize in 1950, that "There is only the question of 'when will I be blown up?'" But since then, this universal fear has given way to something even more dangerous: denial.

Gone is the fear of Armageddon in an instant, gone is the equilibrium between two blocs that was used as the justification for deterrence, gone are the fallout shelters.

But one thing remains: the thousands upon thousands of nuclear warheads that filled us up with that fear.

The risk for nuclear weapons use is even greater today than at the end of the Cold War. But unlike the Cold War, today we face many more nuclear armed states, terrorists, and cyber warfare. All of this makes us less safe.

Learning to live with these weapons in blind acceptance has been our next great mistake.

Fear is rational. The threat is real. We have avoided nuclear war not through prudent leadership but good fortune. Sooner or later, if we fail to act, our luck will run out.

A moment of panic or carelessness, a misconstrued comment or bruised ego, could easily lead us unavoidably to the destruction of entire cities. A calculated military escalation could lead to the indiscriminate mass murder of civilians.

If only a small fraction of today's nuclear weapons were used, soot and smoke from the firestorms would loft high into the atmosphere - cooling, darkening and drying the Earth's surface for more than a decade.

It would obliterate food crops, putting billions at risk of starvation.

Yet we continue to live in denial of this existential threat.

But Faulkner in his Nobel speech also issued a challenge to those who came after him. Only by being the voice of humanity, he said, can we defeat fear; can we help humanity endure.

ICAN's duty is to be that voice. The voice of humanity and humanitarian law; to speak up on behalf of civilians. Giving voice to that humanitarian perspective is how we will create the end of fear, the end of denial. And ultimately, the end of nuclear weapons.

That brings me to my second point: freedom.

As the International Physicians for the Prevention of Nuclear War, the first ever anti-nuclear weapons organization to win this prize, said on this stage in 1985:

"We physicians protest the outrage of holding the entire world hostage. We protest the moral obscenity that each of us is being continuously targeted for extinction."

Those words still ring true in 2017.

We must reclaim the freedom to not live our lives as hostages to imminent annihilation.

Man - not woman! - made nuclear weapons to control others, but instead we are controlled by them.

They made us false promises. That by making the consequences of using these weapons so unthinkable it would make any conflict unpalatable. That it would keep us free from war.

But far from preventing war, these weapons brought us to the brink multiple times throughout the Cold War. And in this century, these weapons continue to escalate us towards war and conflict.

In Iraq, in Iran, in Kashmir, in North Korea. Their existence propels others to join the nuclear race. They don't keep us safe, they cause conflict.

As fellow Nobel Peace Laureate, Martin Luther King Jr, called them from this very stage in 1964, these weapons are "both genocidal and suicidal".

They are the madman's gun held permanently to our temple. These weapons were supposed to keep us free, but they deny us our freedoms.

It's an affront to democracy to be ruled by these weapons. But they are just weapons. They are just tools. And just as they were created by geopolitical context, they can just as easily be destroyed by placing them in a humanitarian context.

That is the task ICAN has set itself - and my third point I wish to talk about, the future.

I have the honour of sharing this stage today with Setsuko Thurlow, who has made it her life's purpose to bear witness to the horror of nuclear war.

She and the hibakusha were at the beginning of the story, and it is our collective challenge to ensure they will also witness the end of it.

They relive the painful past, over and over again, so that we may create a better future.

There are hundreds of organizations that together as ICAN are making great strides towards that future.

There are thousands of tireless campaigners around the world who work each day to rise to that challenge.

There are millions of people across the globe who have stood shoulder to shoulder with those campaigners to show hundreds of millions more that a different future is truly possible.

Those who say that future is not possible need to get out of the way of those making it a reality.

As the culmination of this grassroots effort, through the action of ordinary people, this year the hypothetical marched forward towards the actual as 122 nations negotiated and concluded a UN treaty to outlaw these weapons of mass destruction.

The Treaty on the Prohibition of Nuclear Weapons provides the pathway forward at a moment of great global crisis. It is a light in a dark time.

And more than that, it provides a choice.

A choice between the two endings: the end of nuclear weapons or the end of us.

It is not naive to believe in the first choice. It is not irrational to think nuclear states can disarm. It is not idealistic to believe in life over fear and destruction; it is a necessity.

All of us face that choice. And I call on every nation to join the Treaty on the Prohibition of Nuclear Weapons.

The United States, choose freedom over fear. Russia, choose disarmament over destruction. Britain, choose the rule of law over oppression. France, choose human rights over terror. China, choose reason over irrationality. India, choose sense over senselessness. Pakistan, choose logic over Armageddon. Israel, choose common sense over obliteration. North Korea, choose wisdom over ruin.

To the nations who believe they are sheltered under the umbrella of nuclear weapons, will you be complicit in your own destruction and the destruction of others in your name?

To all nations: choose the end of nuclear weapons over the end of us!

This is the choice that the Treaty on the Prohibition of Nuclear Weapons represents. Join this Treaty.

We citizens are living under the umbrella of falsehoods. These weapons are not keeping us safe, they are contaminating our land and water, poisoning our bodies and holding hostage our right to life.

To all citizens of the world: Stand with us and demand your government side with humanity and sign this treaty. We will not rest until all States have joined, on the side of reason.

No nation today boasts of being a chemical weapon state. No nation argues that it is acceptable, in extreme circumstances, to use sarin nerve agent. No nation proclaims the right to unleash on its enemy the plague or polio.

That is because international norms have been set, perceptions have been changed.

And now, at last, we have an unequivocal norm against nuclear weapons.

Monumental strides forward never begin with universal agreement.

With every new signatory and every passing year, this new reality will take hold.

This is the way forward. There is only one way to prevent the use of nuclear weapons: prohibit and eliminate them.

Nuclear weapons, like chemical weapons, biological weapons, cluster munitions and land mines before them, are now illegal. Their existence is immoral. Their abolishment is in our hands.

The end is inevitable. But will that end be the end of nuclear weapons or the end of us? We must choose one.

We are a movement for rationality. For democracy. For freedom from fear.

We are campaigners from 468 organizations who are working to safeguard the future, and we are representative of the moral majority: the billions of people who choose life over death, who together will see the end of nuclear weapons.

Thank you.

The Nobel Lecture continued by Setsuko Thurlow

Your Majesties, Distinguished members of the Norwegian Nobel Committee, My fellow campaigners, here and throughout the world, Ladies and gentlemen,

It is a great privilege to accept this award, together with Beatrice, on behalf of all the remarkable human beings who form the ICAN movement. You each give me such tremendous hope that we can - and will - bring the era of nuclear weapons to an end.

I speak as a member of the family of hibakusha - those of us who, by some miraculous chance, survived the atomic bombings of Hiroshima and Nagasaki. For more than seven decades, we have worked for the total abolition of nuclear weapons.

We have stood in solidarity with those harmed by the production and testing of these horrific weapons around the world. People from places with long-forgotten names, like Moruroa, Ekker, Semipalatinsk, Maralinga, Bikini. People whose lands and seas were irradiated, whose bodies were experimented upon, whose cultures were forever disrupted.

We were not content to be victims. We refused to wait for an immediate fiery end or the slow poisoning of our world. We refused to sit idly in terror as the so-called great powers *took us past nuclear dusk and brought us recklessly close to nuclear midnight. We rose up. We shared our stories of survival. We said: humanity and nuclear weapons cannot coexist.*

Today, I want you to feel in this hall the presence of all those who perished in Hiroshima and Nagasaki. I want you to feel, above and around us, a great cloud of a quarter million souls. Each person had a name. Each person was loved by someone. Let us ensure that their deaths were not in vain.

I was just 13 years old when the United States dropped the first atomic bomb, on my city Hiroshima. I still vividly remember that morning. At 8:15, I saw a blinding bluish-white flash from the window. I remember having the sensation of floating in the air.

As I regained consciousness in the silence and darkness, I found myself pinned by the collapsed building. I began to hear my classmates' faint cries: "Mother, help me. God, help me."

Then, suddenly, I felt hands touching my left shoulder, and heard a man saying: "Don't give up! Keep pushing! I am trying to free you. See the light coming through that opening? Crawl towards it as quickly as you can." As I crawled out, the ruins were on fire. Most of my classmates in that building were burned to death alive. I saw all around me utter, unimaginable devastation.

Processions of ghostly figures shuffled by. Grotesquely wounded people, they were bleeding, burnt, blackened and swollen. Parts of their bodies were missing. Flesh and skin hung from their bones. Some with their eyeballs hanging in their hands. Some with their bellies burst open, their intestines hanging out. The foul stench of burnt human flesh filled the air.

Thus, with one bomb my beloved city was obliterated. Most of its residents were civilians who were incinerated, vaporized, carbonized - among them, members of my own family and 351 of my schoolmates.

In the weeks, months and years that followed, many thousands more would die, often in random and mysterious ways, from the delayed effects of radiation. Still to this day, radiation is killing survivors.

Whenever I remember Hiroshima, the first image that comes to mind is of my four-year-old nephew, Eiji - his little body transformed into an unrecognizable melted chunk of flesh. He kept begging for water in a faint voice until his death released him from agony.

To me, he came to represent all the innocent children of the world, threatened as they are at this very moment by nuclear weapons. Every second of every day, nuclear weapons endanger everyone we love and everything we hold dear. We must not tolerate this insanity any longer.

Through our agony and the sheer struggle to survive - and to rebuild our lives from the ashes - we hibakusha became convinced that we must warn the world about these apocalyptic weapons. Time and again, we shared our testimonies.

But still some refused to see Hiroshima and Nagasaki as atrocities - as war crimes. They accepted the propaganda that these were "good bombs" that had ended a "just war". It was this myth that led to the disastrous nuclear arms race - a race that continues to this day.

Nine nations still threaten to incinerate entire cities, to destroy life on earth, to make *our beautiful world uninhabitable for future generations. The development of nuclear weapons signifies not a country's elevation to greatness, but its descent to the darkest depths of depravity. These weapons are not a necessary evil; they are the ultimate evil.*

On the seventh of July this year, I was overwhelmed with joy when a great majority of the world's nations voted to adopt the Treaty on the Prohibition of Nuclear Weapons. Having witnessed humanity at its worst, I witnessed, that day, humanity at its best. We hibakusha had been waiting for the ban for seventy-two years. Let this be the beginning of the end of nuclear weapons.

All responsible leaders will sign this treaty. And history will judge harshly those who reject it. No longer shall their abstract theories mask the genocidal reality of their practices. No longer shall "deterrence" be viewed as anything but a deterrent to disarmament. No longer shall we live under a mushroom cloud of fear.

To the officials of nuclear-armed nations - and to their accomplices under the so-called "nuclear umbrella" - I say this: Listen to our testimony. Heed our warning. And know that your actions are consequential. You are each an integral part of a system of violence that is endangering humankind. Let us all be alert to the banality of evil.

To every president and prime minister of every nation of the world, I beseech you: Join this treaty; forever eradicate the threat of nuclear annihilation.

When I was a 13-year-old girl, trapped in the smouldering rubble, I kept pushing. I kept moving toward the light. And I survived. Our light now is the ban treaty. To all in this hall and all listening around the world, I repeat those words that I heard called to me in the ruins of Hiroshima: "Don't give up! Keep pushing! See the light? Crawl towards it."

Tonight, as we march through the streets of Oslo with torches aflame, let us follow each other out of the dark night of nuclear terror. No matter what obstacles we face, we will keep moving and keep pushing and keep sharing this light with others. This is our passion and commitment for our one precious world to survive.

7.8 Helen Keller

Childhood

Helen Keller was born in 1880, in Tuscumbia, Alabama. Her father had served as a captain in the Confederate Army during the American Civil War, and her mother, Kate Adams, was the daughter of a Confederate general. She was also related to Robert E. Lee, so by birth she was certainly a Southerner. Today Helen Keller Day is celebrated each year in Alabama following a 1980 proclamation by President Jimmy Carter.

Helen was a normal child until the age of 19 months, when she contracted an illness which may have been scarlet fever or meningitis. It left her both deaf and blind. When Helen was 6 years old, her parents followed the advice of Alexander Graham Bell and contacted the Perkins Institute for the Blind. The Perkins Institute recommended their recent graduate Annie Sullivan, who became Helen's teacher.

Annie Sullivan, who was 20 years old at that time and also blind, began to work with

Figure 7.36: *A portrait of Helen Keller (public domain).*

Helen, spelling out words on the palm of Helen's hand. This method was unsuccessful at first, but one day, when Annie Sullivan was spelling out "water" on one of Helen's hands while water was running over the other, Helen suddenly realized that the letters were a symbol for water. For the next many days, the child almost wore her teacher out by demanding the spelling of hundreds of other things within her experience. Annie Sullivan later became Helen's lifelong friend and companion.

Victory over a triple handicap

Starting in 1888, Helen Keller began her formal education, at first at the Perkins Institute, then at a succession of other schools. Finally, at the age of 24, with financial help from a wealthy friend of Mark Twain. Helen graduated from Radcliffe College. She was the first blind and deaf person to obtain a BA degree. On the way to this triumph, Helen had taught herself to speak normally, and she could understand what other people were saying by placing her hand on their lips.

Helen Keller quickly developed into a popular lecturer and author. She spoke and wrote to advocate many social reforms, including woman's suffrage, labour rights, socialism and antimilitarism.

The story of Helen Keller and Annie Sullivan, as told in Helen's *Autobiography*, became known to a very wide public through the drama *The Miracle Worker*, which was first produced as a radio broadcast, then as a television drams, then as a Broadway play and finally as a succession of films.

Here is a newspaper account of one of Helen Keller's lectures:

"The wonderful girl who has so brilliantly triumphed over the triple afflictions of blindness, dumbness and deafness, gave a talk with her own lips on 'Happiness,' and it will be remembered always as a piece of inspired teaching by those who heard it.

"According to those who attended, Helen Keller spoke of the joy that life gave her. She was thankful for the faculties and abilities that she did possess and stated that the most productive pleasures she had were curiosity and imagination. Keller also spoke of the joy of service and the happiness that came from doing things for others ... Keller imparted that 'helping your fellow men is one's only excuse for being in this world and in the doing of things to help one's fellows lay the secret of lasting happiness.' She also told of the joys of loving work and accomplishment and the happiness of achievement. Although the entire lecture lasted only a little over an hour, the lecture had a profound impact on the audience."

A few things that Helen Keller said

Strike against war, for without you no battles can be fought! Strike against manufacturing shrapnel and gas bombs and all other tools of murder! Strike against preparedness that means death and misery to millions of human beings! Be not dumb, obedient slaves in an army of destruction! Be heroes in an army

of construction.

The best and most beautiful things in the world cannot be seen or even touched - they must be felt with the heart.

Believe. No pessimist ever discovered the secrets of the stars or sailed to an uncharted land or opened a new heaven to the human spirit

Alone we can do so little. Together we can do so much!

It is for us to pray not for tasks equal to our powers, but for powers equal to our tasks, to go forward with a great desire forever beating at the door of our hearts as we travel toward our distant goal

When one door of happiness closes, another opens; but often we look so long at the closed door that we do not see the one which has been opened for us.

To keep our faces toward change, and behave like free spirits in the presence of fate, is strength undefeatable.

Self-pity is our worst enemy and if we yield to it, we can never do anything wise in the world.

Security is mostly a superstition. It does not exist in nature, nor do the children of men as a whole experience it. Avoiding danger is no safer in the long run than outright exposure. Life is either a daring adventure or nothing

I do not want the peace that passeth understanding. I want the understanding which bringeth peace.

Helen Keller, who although deaf and blind, could see injustice clearly, who could hear the voices of victims of war, and who spoke eloquently for social reform, we need your voice today!

7.9 Archbishop Desmond Tutu

Desmond Tutu, who famously said "If you are neutral in situations of injustice, you have chosen the side of the oppressor", died on Sunday, December 26 at the age of 90. He will be greatly missed, but we can honor his legacy by acting as he would have acted. We must oppose oppression wherever we find it, also remembering that forgiveness and reconciliation are necessary for peace. It is to a large extent due to Archbishop Tutu's work on the Truth and Reconciliation Commission that South Africa made a peaceful transition from apartheid to democracy. Tutu was a fierce critic of capitalism, of Israeli apartheid, and of US and British wars of aggression. Here excerpts from Archbishop Desmond Tutu's Nobel Lecture. December 11, 1984:

Before I left South Africa, a land I love passionately, we had an emergency meeting of the Executive Committee of the South African Council of Churches with the leaders of our member churches. We called the meeting because of the deepening crisis in our land, which has claimed nearly 200 lives this year alone. We visited some of the trouble-spots on the Witwatersrand. I went with others to the East Rand. We visited the home of an old lady. She told us that she looked after her grandson and the children of neighbors while their parents were at work. One day the police chased some pupils who had been boycotting classes, but they disappeared between the township houses. The police drove down the old lady's street. She was sitting at the back of the house in her kitchen, whilst her charges were playing in the front of the house in the yard. Her daughter rushed into the house, calling out to her to come quickly. The old lady dashed out of the kitchen into the living room. Her grandson had fallen just inside the door, dead. He had been shot in the back by the police. He was 6 years old. A few weeks later, a white mother, trying to register her black servant for work, drove through a black township. Black rioters stoned her car and killed her baby of a few months old, the first white casualty of the current unrest in South Africa. Such deaths are two too many. These are part of the high cost of apartheid.

Everyday in a squatter camp near Cape Town, called K.T.C., the authorities have been demolishing flimsy plastic shelters which black mothers have erected because they were taking their marriage vows seriously. They have been reduced to sitting on soaking mattresses, with their household effects strewn round their feet, and whimpering babies on their laps, in the cold Cape winter rain. Everyday the authorities have carried out these callous demolitions. What heinous crime have these women committed, to be hounded like criminals in this manner? All they have wanted is to be with their husbands, the fathers of their children. Everywhere else in the world they would be highly commended, but in South Africa, a land which claims to be Christian, and which boasts a public holiday called Family Day, these gallant women are treated so inhumanely, and yet all they want is to have a decent and stable family life. Unfortunately, in the land of their birth, it is a criminal offense for them to live happily with their husbands and the fathers of their children. Black family life is thus being undermined, not accidentally, but by deliberate Government policy. It is part of the price human beings, God's children, are called to pay for apartheid. An unacceptable price.

I come from a beautiful land, richly endowed by God with wonderful natural resources, wide expanses, rolling mountains, singing birds, bright shining stars out of blue skies, with radiant sunshine, golden sunshine. There is enough of the good things that come from God's bounty, there is enough for everyone, but apartheid has confirmed some in their selfishness, causing them to grasp greedily a disproportionate share, the lion's share, because of their power. They have taken 87 of the land, though being only about 20 of our population. The rest have had to make do with the remaining 13. Apartheid has decreed the politics of exclusion. 73 of the population is excluded from any meaningful participation in the *political decision-making processes of the land of their birth. The new constitution, making provision of three chambers, for whites, coloreds, and Indians, mentions blacks only once, and thereafter ignores them completely. Thus this new constitution, lauded in parts of the West as a step in the right direction, entrenches racism and ethnicity. The constitutional committees are composed in the ratio of 4 whites to 2 coloreds and 1 Indian. 0 black. 2 + 1 can never equal, let alone be more than, 4. Hence this constitution perpetuates by law and entrenches white minority rule. Blacks are expected to exercise their political ambitions in unviable, poverty-stricken, arid, bantustan homelands, ghettoes of misery, inexhaustible reservoirs of cheap black labor, bantustans into which South Africa is being balkanized. Blacks are systematically being stripped of their South African citizenship and being turned into aliens in the land of their birth. This is apartheid's final solution, just as Nazism had its final solution for the Jews in Hitler's Aryan madness. The South African Government is smart. Aliens can claim but very few rights, least of all political rights.*

In pursuance of apartheid's ideological racist dream, over 3.000.000 of God's children have been uprooted from their homes, which have been demolished, whilst they have then been dumped in the bantustan homeland resettlement camps. I say dumped advisedly: only things or rubbish is dumped, not human beings. Apartheid has, however, ensured that God's children, just because they are black, should be treated as if they were things, and not as of infinite value as being created in the image of God. These dumping grounds are far from where work and food can be procured easily. Children starve, suffer from the often irreversible consequences of malnutrition - this happens to them not accidentally, but by deliberate Government policy. They starve in a land that could be the bread basket of Africa, a land that normally is a net exporter of food.

The father leaves his family in the bantustan homeland, there eking out a miserable existence, whilst he, if he is lucky, goes to the so-called white man's town as a migrant, to live an unnatural life in a single sex hostel for 11 months of the year, being prey there to prostitution, drunkenness, and worse. This migratory labor policy is declared Government policy, and has been condemned, even by the white Dutch Reformed Church,1 not noted for being quick to criticize the Government, as a cancer in our society. This cancer, eating away at the vitals of black family life, is deliberate Government policy. It is part of the cost of apartheid, exorbitant in terms of human suffering.

apartheid has spawned discriminatory education, such as Bantu Education, education for serfdom, ensuring that the Government spends only about one tenth on one black child per annum for education what it spends on a white child. It is education that is decidedly separate and unequal. It is to be wantonly wasteful of human resources, because so many of God's children are prevented, by deliberate Government policy, from attaining to their fullest potential. South Africa is paying a heavy price already for this iniquitous policy because there is a desperate shortage of skilled manpower, a direct result of the short-sighted schemes of the racist regime. It is a moral universe that we inhabit, and good and right equity matter in the universe of the God we worship. And so, in this matter, the South African Government and its supporters are being properly hoisted with their own petard.

Apartheid is upheld by a phalanx of iniquitous laws, such as the Population Registration Act, which decrees that all South Africans must be classified ethnically, and duly registered *according to these race categories. Many times, in the same family one child has been classified white whilst another, with a slightly darker hue, has been classified colored, with all the horrible consequences for the latter of being shut out from membership of a greatly privileged caste. There have, as a result, been several child suicides. This is too high a price to pay for racial purity, for it is doubtful whether any end, however desirable, can justify such a means. There are laws, such as the Prohibition of Mixed Marriages Act, which regard marriages between a white and a person of another race as illegal. Race becomes an impediment to a valid marriage. Two persons who have fallen in love are prevented by race from consummating their love in the marriage bond. Something beautiful is made to be sordid and ugly. The Immorality Act decrees that fornication and adultery are illegal if they happen between a white and one of another race. The police are reduced to the level of peeping Toms to catch couples red-handed. Many whites have committed suicide rather than face the disastrous consequences that follow in the train of even just being charged under this law. The cost is too great and intolerable...*

I have spoken extensively about South Africa, first because it is the land I know best, but because it is also a microcosm of the world and an example of what is to be found in other lands in differing degree - when there is injustice, invariably peace becomes a casualty. In El Salvador, in Nicaragua, and elsewhere in Latin America, there have been repressive regimes which have aroused opposition in those countries. Fellow citizens are pitted against one another, sometimes attracting the unhelpful attention and interest of outside powers, who want to extend their spheres of influence. We see this in the Middle East, in Korea, in the Philippines, in Kampuchea, in Vietnam, in Ulster, in Afghanistan, in Mozambique, in Angola, in Zimbabwe, behind the Iron Curtain.

Because there is global insecurity, nations are engaged in a mad arms race, spending billions of dollars wastefully on instruments of destruction, when millions are starving. And yet, just a fraction of what is expended so obscenely on defense budgets would make the difference in enabling God's children to fill their stomachs, be educated, and given the chance to lead fulfilled and happy lives. We have the capacity to feed ourselves several times over, but we are daily haunted by the spectacle of the gaunt dregs of humanity shuffling along in endless queues, with bowls to collect what the charity of the world has provided, too little too late. When will we learn, when will the people of the world get up and say, Enough is enough. God created us for fellowship. God created us so that we should form the human family, existing together because we were made for one another. We are not made for an exclusive self-sufficiency but for interdependence, and we break the law of our being at our peril. When will we learn that an escalated arms race merely escalates global insecurity? We are now much closer to a nuclear holocaust than when our technology and our spending were less.

Unless we work assiduously so that all of God's children, our brothers and sisters, members of our one human family, all will enjoy basic human rights, the right to a fulfilled life, the right of movement, of work, the freedom to be fully human, with a humanity measured by nothing less than the humanity of Jesus Christ Himself, then we are on the road inexorably to self-destruction, we are not far from global suicide; and yet it could be so different...

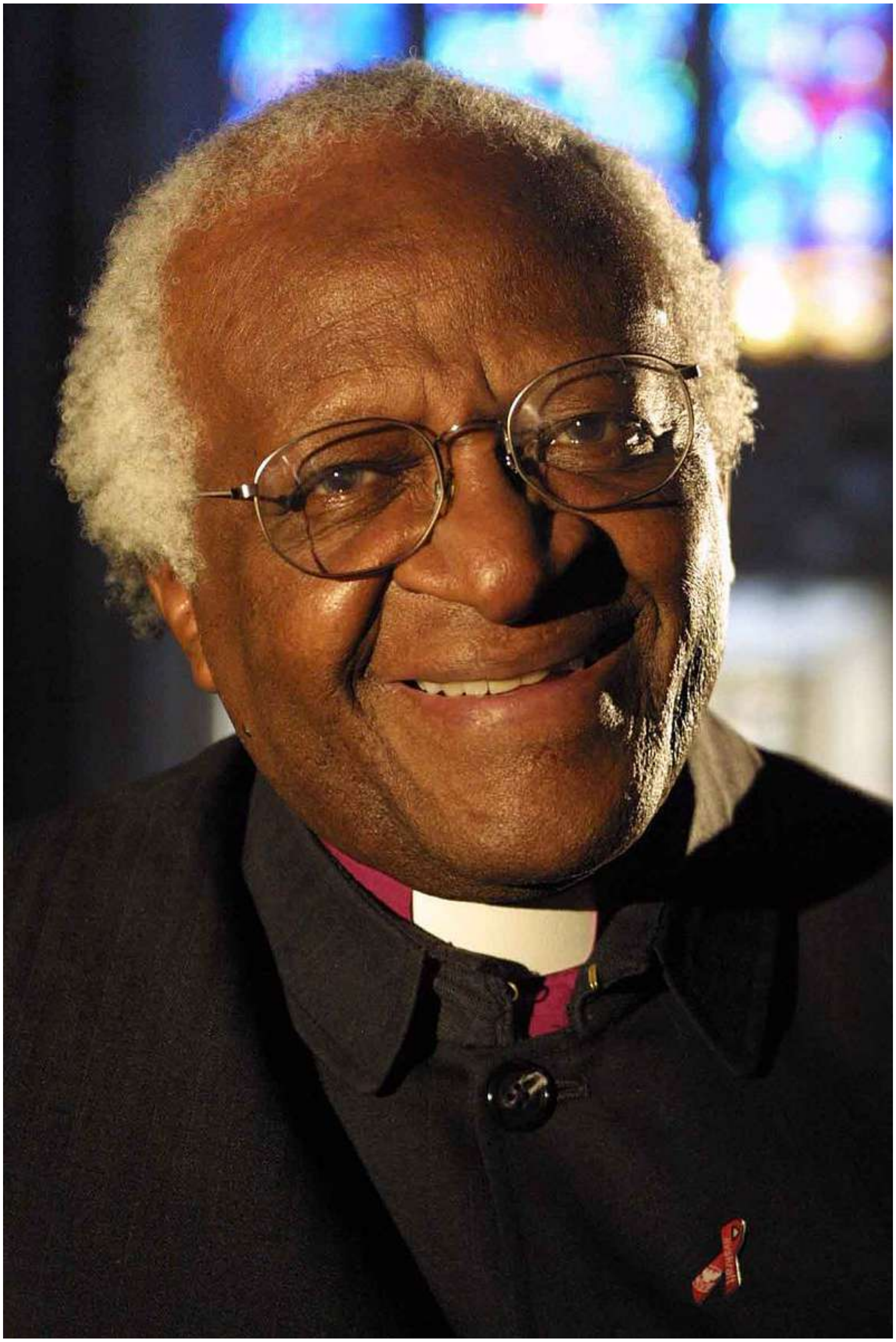

Figure 7.37: **Archbishop Desmond Tutu (1931-2021).**

Figure 7.38: **Tutu welcomed Mandela (pictured) to Bishopscourt when the latter was released from prison and later organized the religious component of his presidential inauguration ceremony.).**

Figure 7.39: **The 14th Dalai Lama and Archbishop Desmond Tutu, both Nobel Peace Prize laureates, in Vancouver, British Columbia, in 2004.).**

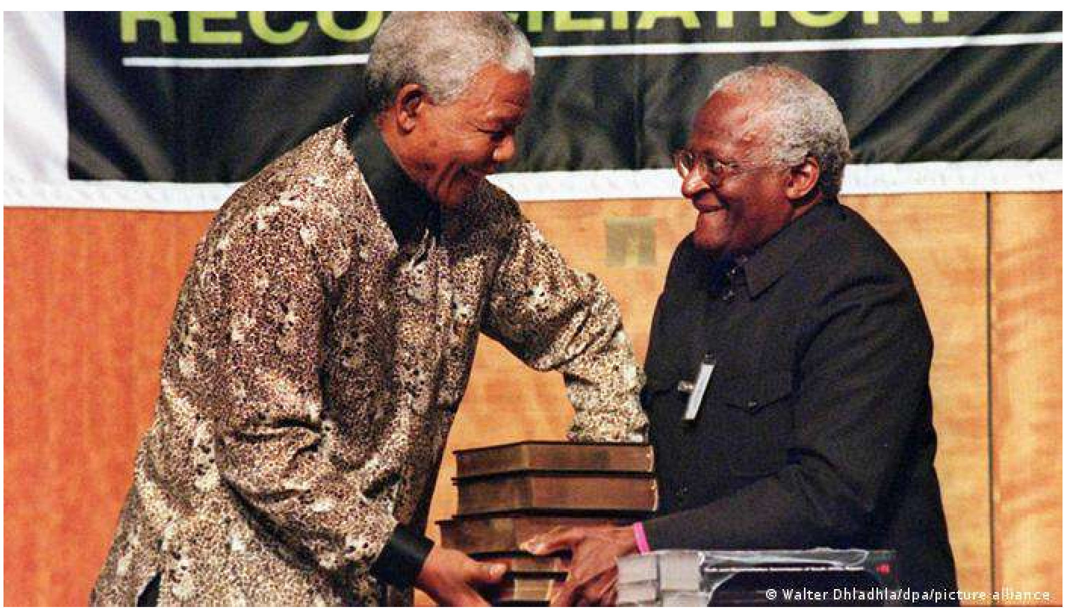

Figure 7.40: **South African President Nelson Mandela (left) received the five volumes of the Truth and Reconciliation Commission final report from Archbishop Desmond Tutu in 1998.**

7.10 Joan Baez

Joan Baez is an American folk-singer and activist who has been highly influential since her breakthrough 60 years ago. Her father was a Mexican-American physicist who is credited with inventing the X-ray microscope. While her father was working at MIT, Joan Baez gave her first concert in 1958 at Club 47 in Cambridge. In 1959, Bob Gibson invited Baez to perform at the Newport Folk Festival, where her astonishingly clear and expressive voice produced a sensation. Joan Baez promoted the career of Bob Dylan, at a time when she was a star while he was unknown, by inviting him to join her on the stage for duets. Wholeheartedly engaged in many anti-war, human rights and environmental causes, including opposition to the Viet Nam and Iraq wars, she regards her activism as more important than her singing. In 2011, Amnesty International introduced the yearly Joan Baez Award for outstanding service to human rights, giving the first award to Baez herself.

A few things that Joan Baez said

I would say that I'm a nonviolent soldier. In place of weapons of violence, you have to use your mind, your heart, your sense of humor, every faculty available to you...because no one has the right to take the life of another human being.

Action is the antidote to despair.

You don't get to choose how you're going to die, or when. You can only decide how you're going to live. Now.

I went to jail for 11 days for disturbing the peace; I was trying to disturb the war.

I think music has the power to transform people, and in doing so, it has the power to transform situations - some large and some small.

To sing is to love and affirm, to fly and to soar, to coast into the hearts of the people who listen to tell them that life is to live, that love is there, that nothing is a promise, but that beauty exists, and must be hunted for and found.

The easiest kind of relationship for me is with ten thousand people. The hardest is with one.

I have hope in people, in individuals. Because you don't know what's going to rise from the ruins.

As long as one keeps searching, the answers will come.

Only you and I can help the sun rise each coming morning. If we don't, it may drench itself out in sorrow.

All of us are survivors, but how many of us transcend survival?

If you don't have music, you have silence. There is power in both.

To sing is to praise God and the daffodils, and to praise God is to thank Him, in every note within my small range, and every color in the tones of my voice, with every look into the eyes of my audience, to thank Him. Thank you, God, for letting me be born, for giving me eyes to see the daffodils lean in the wind, all my brothers, all my sisters, for giving me ears to hear crying, legs to come running, hands to smooth damp hair, a voice to laugh with and to sing with...to sing to you and the daffodils.

The point on nonviolence is to build a floor, a strong new floor, beneath which we can no longer sink.

There's a consensus out that it's OK to kill when your government decides who to kill. If you kill inside the country you get in trouble. If you kill outside the country, right time, right season, latest enemy, you get a medal.

If you're going to sing meaningful songs, you have to be committed to living a life that backs that up.

Instead of getting hard ourselves and trying to compete, women should try and give their best qualities to men - bring them softness, teach them how to cry.

We're not really pacifists, we're nonviolent soldiers.

If it's natural to kill, how come men have to go into training to learn how?

If people have to put labels on me, I'd prefer the first label to be human being, the second label to be pacifist, and the third to be folk singer.

You may not know it, but at the far end of despair, there is a white clearing where one is almost happy.

I don't think of myself as a symbol of the sixties, but I do think of myself as a symbol of following through on your beliefs.

Figure 7.41: **Joan Baez (born 1941) on the 1962 cover of Time Magazine.**

What have they done to the rain?

Just a little rain falling all around
The grass lifts its head to the heavenly sound
Just a little rain, just a little rain
What have they done to the rain
Just a little boy standing in the rain
The gentle rain that falls for years
And the grass is gone, the boy disappears
And rain keeps falling like helpless tears
And what have they done to the rain
Just a little breeze out of the sky
The leaves nod their head as the breeze blows by
Just a little breeze with some smoke in its eye
What have they done to the rain

Just a little boy standing in the rain
The gentle rain that falls for years
And the grass is gone, the boy disappears
And rain keeps falling like helpless tears
And what have they done to the rain
What have they done to the rain

We shall overcome

We shall overcome,
We shall overcome,
We shall overcome, some day.

Oh, deep in my heart,
I do believe
We shall overcome, some day.

We'll walk hand in hand,
We'll walk hand in hand,
We'll walk hand in hand, some day.

Oh, deep in my heart,
I do believe
We'll walk hand in hand, some day.

We shall live in peace,

We shall live in peace,
We shall live in peace, some day.

Oh, deep in my heart,
I do believe
We shall live in peace, some day.

We shall all be free,
We shall all be free,
We shall all be free, some day.

Oh, deep in my heart,
I do believe
We shall all be free, some day.

We are not afraid,
We are not afraid,
We are not afraid, today.

Oh, deep in my heart,
I do believe
We are not afraid, today.

We shall overcome,
We shall overcome,
We shall overcome, some day.

Oh, deep in my heart,
I do believe
We shall overcome, some day.

7.11 Bob Dylan

An outstanding influence on music, poetry and the anti-war movement over six decades, Bob Dylan was awarded the Nobel Prize for Literature in 2016.

Bob Dylan was born in 1941 into a Jewish immigrant family named Zimmerman. He later changed his name to Dylan because of his admiration for the Welsh poet, Dylan Thomas. As a highschool student Bob Dylan initially formed a rock and roll band, but later realized that folk music was much more meaningful. Explaining this change, he said “The thing about rock’n’roll is that for me anyway it wasn’t enough... There were great catch-phrases and driving pulse rhythms... but the songs weren’t serious or didn’t reflect life in a realistic way. I knew that when I got into folk music, it was more of a serious type of thing. The songs are filled with more despair, more sadness, more triumph, more faith in the supernatural, much deeper feelings."

Bob Dylan greatly admired folk singer Woodie Guthrie. Describing Guthrie's influence, he wrote: "The songs themselves had the infinite sweep of humanity in them... [He] was the true voice of the American spirit. I said to myself I was going to be Guthrie's greatest disciple."

Wikipedia states that "Many early songs reached the public through more palatable versions by other performers, such as Joan Baez, who became Dylan's advocate as well as his lover. Baez was influential in bringing Dylan to prominence by recording several of his early songs and inviting him on stage during her concerts. 'It didn't take long before people got it, that he was pretty damned special,' says Baez."

Here are a few things that Bob Dylan said:

Behind every beautiful thing, there's some kind of pain.

I accept chaos, I'm not sure whether it accepts me.

Don't criticize what you can't understand.

Sometimes it's not enough to know what things mean, sometimes you have to know what things don't mean.

I think women rule the world and that no man has ever done anything that a woman either hasn't allowed him to do or encouraged him to do.

People seldom do what they believe in. They do what is convenient, then repent.

Gonna change my way of thinking, make myself a different set of rules. Gonna put my good foot forward and stop being influenced by fools.

When you've got nothing, you've got nothing to lose.

You can never be wise and be in love at the same time.

When you feel in your gut what you are and then dynamically pursue it - don't back down and don't give up - then you're going to mystify a lot of folks.

It frightens me, the awful truth, of how sweet life can be...

Blowin' in the wind

How many roads must a man walk down
Before you call him a man?
How many seas must a white dove sail
Before she sleeps in the sand?
Yes, and how many times must the cannonballs fly
Before they're forever banned?

The answer, my friend, is blowin' in the wind
The answer is blowin' in the wind

Yes, and how many years can a mountain exist
Before it's washed to the sea?
Yes, and how many years can some people exist
Before they're allowed to be free?
Yes, and how many times can a man turn his head
And pretend that he just doesn't see?

The answer, my friend, is blowin' in the wind
The answer is blowin' in the wind

Yes, and how many times must a man look up
Before he can see the sky?
Yes, and how many ears must one man have
Before he can hear people cry?
Yes, and how many deaths will it take 'til he knows
That too many people have died?

The answer, my friend, is blowin' in the wind
The answer is blowin' in the wind

Figure 7.42: **One of Bob Dylan's paintings**

Figure 7.43: **Another Dylan painting. His work has been exhibited by major museums.**

7.12 Pete Seeger

Here are a few things that Pete Seeger said:

Do you know the difference between education and experience? Education is when you read the fine print; experience is what you get when you don't.

Any darn fool can make something complex; it takes a genius to make something simple.

If it can't be reduced, reused, repaired, rebuilt, refurbished, refinished, resold, recycled or composted, then it should be restricted, redesigned or removed from production.

Participation - that's what's gonna save the human race.

Well, normally I'm against big things. I think the world is going to be saved by millions of small things. Too many things can go wrong when they get big.

Once upon a time, wasn't singing a part of everyday life as much as talking, physical exercise, and religion? Our distant ancestors, wherever they were in this world, sang while pounding grain, paddling canoes, or walking long journeys. Can we begin to make our lives once more all of a piece? Finding the right songs and singing them over and over is a way to start. And when one person taps out a beat, while another leads into the melody, or when three people discover a harmony they never knew existed, or a crowd joins in on a chorus as though to raise the ceiling a few feet higher, then they also know there is hope for the world.

I've never sung anywhere without giving the people listening to me a chance to join in - as a kid, as a lefty, as a man touring the U.S.A. and the world, as an oldster. I guess it's kind of a religion with me. Participation. That's what's going to save the human race.

It's a very important thing to learn to talk to people you disagree with.

This banjo surrounds hate and forces it to surrender.

Singing with children in the schools has been the most rewarding experience of my life.

The key to the future of the world, is finding the optimistic stories and letting them be known.

The nice thing about poetry is that you're always stretching the definitions of words. Lawyers and scientists and scholars of one sort or another try to restrict the definitions, hoping that they can prevent people from fooling each other. But that doesn't stop people from lying.

Cezanne painted a red barn by painting it ten shades of color: purple to yellow. And he got a red barn. Similarly, a poet will describe things many different ways, circling around it, to get to the truth.

My father also had a nice little simile. He said, "The truth is a rabbit in a bramble patch. And you can't lay your hand on it. All you do is circle around and point, and say, 'It's in there somewhere'."

Keep your sense of humor. There is a 50-50 chance the world can be saved. You - yes you - might be the grain of sand that tips the scales the right way.

The world is like a seesaw out of balance: on one side is a box of big rocks, tilting it its way. On the other side is a box, and a bunch of us with teaspoons, adding a little sand at a time. One day, all of our teaspoons will add up, and the whole thing will tip, and people will say, 'How did it happen so fast?'

Our technology and our economic system seem to produce the present bad situation: millions of people feel themselves poor and powerless; millions feel that music is something to be made only by experts.

It all boils down to what I would most like to do as a musician. Put songs on people's lips instead of just in their ears.

Where have all the flowers gone?

Where have all the flowers men gone,
Long time passing,
Where have all the flowers men gone,
Long time ago,
Where have all the flowers men gone,
Young girls picked them every one,
When will they ever learn?
When will they ever learn?

Where have all the young girls gone,
Long time passing,
Where have all the young girls gone,
Long time ago,

Where have all the young girls gone,
Gone to husbands every one,
When will they ever learn?
When will they ever learn?

Where have all the young men gone,
Long time passing,
Where have all the young men gone,
Long time ago,
Where have all the young men gone,
Gone to soldiers every one,
When will they ever learn?
When will they ever learn?

Where have all the soldiers gone,
Long time passing,
Where have all the soldiers gone,
Long time ago,
Where have all the soldiers gone,
They've gone to graveyards every one,
When will they ever learn?
When will they ever learn?

Where have all the graveyards gone,
Long time passing,
Where have all the graveyards gone,
Long time ago,
Where have all the graveyards gone,
Gone to flowers every one,
When will we ever learn?
When will we ever learn?

What did you learn in school today?

What did you learn in school today,
Dear little boy of mine?
What did you learn in school today,
Dear little boy of mine?

I learned that Washington never told a lie.
I learned that soldiers seldom die.
I learned that everybody's free,

And that's what the teacher said to me.

I learned our Government must be strong;
It's always right and never wrong;
Our leaders are the finest men
And we elect them again and again.

I learned that war is not so bad;
I learned about the great ones we have had;
We fought in Germany and in France
And someday I might get my chance.

That's what I learned in school today,
That's what I learned in school.

Die gedanken sind frei

Die gedanken sind frei
My thoughts freely flower
Die gedanken sind frei
My thoughts give me power
No scholar can map them
No hunter can trap them
No man can deny
Die gedanken sind frei

I think as I please
And this gives me pleasure
My conscience decrees
This right I must treasure
My thoughts will not cater
To duke or dictator
No man can deny
Die gedanken sind frei

Tyrants can take me
And throw me in prison
My thoughts will burst forth
Like blossoms in season
Foundations may crumble
And structures may tumble
But free men shall cry

Figure 7.44: **Pete Seeger entertaining Eleanor Roosevelt (center), honored guest at a racially integrated Valentine's Day party marking the opening of a Canteen of the United Federal Labor, CIO, in then-segregated Washington, D.C., 1944.**

Die gedanken sind frei

We will love, or we will perish

We will love or we will perish
We will learn the rainbow to cherish

Dare to struggle, dare to danger
Dare to touch the hand of a stranger

Figure 7.45: **Pete Seeger in 1979.**

Figure 7.46: **Pete Seeger at the Ckearwater Festival in June, 2007.**

Index