

A Short History of Occupational Health

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INDUSTRIAL hygiene is one of the most important topics in preventive medicine and hygiene, as it deals with the health, the welfare and the human rights of the vast majority of the adult population. Industrial hygiene is a subject in which the medical, economic and sociologic aspects are closely interwoven, and it requires a broad grasp, as well as an intimate knowledge of the conditions to avoid the dangers and correct the injustices to which people who work are subjected. The questions of industrial hygiene strike at the very root of our social system; they deal with the relation of capital and labor, and the relation of man to his fellow men. The employee must largely accept conditions as he finds them and is frequently denied many advantages, even necessities. As the power of the employee is limited, he needs the protection of the state to correct the unreasonable demands which capital has ever exacted of labor. Human rights for work people have been wrested from unwilling hands. In recent years, however, there has been a brightening trend towards voluntary profit-sharing and cooperation in industry. The situation has also been improved somewhat through organized labor, which has exerted an influence in limiting the avarice of the employer, in shortening the hours of work, in obtaining a better wage, in improving sanitary conditions, and in exacting a modicum of human consideration. The pressure of society as well as legislation have been potent factors (Rosenau, 1935).

In 1848, Rudolf Virchow, a young physician, was sent by the Prussian government to investigate an epidemic of typhus among the coal mining population of Silesia. He was so shocked by the appalling living and working conditions of the miners and their families that, on his return, he wrote a scathing report criticizing the industry and govern-

ment. Nothing but prosperity, culture, and freedom could bring about improvement, and these could only be achieved upon the basis of “complete and unrestricted democracy.” His report closed with the following:

All the world knows that the proletariat of our day has been mainly brought into existence by the introduction and improvement of machinery; that in proportion as (industry) through the perfectionment of apparatus, acquired an unprecedented extension, man-power has completely lost its autonomy, and human beings have become incorporated as mere cog-wheels in machine enterprise—living cog-wheels, indeed, but treated as of no more value than dead matter. The human instruments are regarded as mere ‘hands’! Is that to be the ultimate significance of machinery in the history of civilization? Are the triumphs of human genius to lead only to this, that the human race shall become more miserable? Unquestionably not. . . . Man should only work as much as is needful . . . but he should not waste his best energies in producing capital. Capital is a title to enjoyment; but why should this title be increased to a degree beyond all reason? . . . The French republic has already recognized this principle in its motto of fraternity; . . . At least, capital and labour power must have equal rights, and living energies must no longer be subordinated to dead capital. (Sigerist, 1933)

Virchow suffered for his advanced political views. His salary was cut off at the Charité Hospital, and he had to move out of his office. However, this did not discourage him from campaigning for medical reform and for the reduction of work hours for manual workers. Later, he pioneered the concept of cellular pathology and, subsequently, became one of the great medical scientists.

The setting was the Industrial Revolution in Western Europe and England, as well as the German social revolution of 1848. Engels had published *The Condition of the English Laboring Class in 1845*. In 1847, he and Karl Marx published *The Communist Manifesto*.

In 1831, Charles Turner Thackrah published his seminal work, *The Effects of the Principal Arts, Trades and Professions, and of Civic States and Habits of Living, on Health and Longevity, with Suggestions for the Removal of Many of the Agents Which Produce Disease and Threaten the Duration of Life*, in which he wrote, “Evils are suffered to exist, even where the means of correction are known and eas-

ily applied.” Shortly after the publication of Thackrah’s book, Chadwick (1842) published *The Sanitary Condition of the Labouring Population of Great Britain*. Both books were indictments of the conditions of the working class.

Nascent capitalism had emerged from feudalism, and serfs had been liberated from baronial control. This permitted them to leave the land and go into factories in the burgeoning cities. Slavery was at its peak in the south of the United States, even as Irish and other immigrants flooded into the country looking for work on the railroads and in the textile plants.

In 1836, nearly 300,000 workers in the United States belonged to unions. The Medical Society of the State of New York took notice. In 1835, it proposed as a subject for its annual prize essay, “The influences of trades, professions and occupations in the United States in the production of disease.” In 1837, \$50 was awarded to 23-year-old Benjamin W. McReady, M.D. of New York City, for his 60-page essay. In this first American publication on the subject, McReady described the plight of the laborers, chiefly Irish immigrants, who were sent to dig the big ditches and lay the rails that connected the Eastern seaboard with the Ohio River and the Great Lakes. He pointed out that many of them “were already broken in health from the long ocean voyage to this country, packed in steerage, and their hard labor in unhealthy terrain did little to improve their condition” (McReady, 1837).

The period was one of intense struggle. The typical workday was sunrise to sunset, six days a week. Child labor was virtually uncontrolled. Workers organized embryonic unions, and strikes were organized in protest of the low wages and long workday.

Studies by Thackrah, Chadwick, and others had already shown the marked class differentiation in health and mortality. As the degree of physical labor and dependency on capital increased, life expectancy decreased. These studies were the precursors of the British Registrar General’s decennial reports of mortality based on the occupational class.

The 19th century also saw the beginnings of ideas for the humanization of work. Robert Owen (1771–1858) was a textile manufacturer in England who saw the evils of the factory system. He became a socialist and tried to establish villages of “unity and cooperation” in New Lanark, England and New Harmony, Indiana. He supported

labor unionism and factory reform, both of which upheld the view that machinery should be subordinate to people. His work and thought were forerunners of modern socialism and the cooperative movement (*Encyclopedia Britannica*, 1974). Engels called him “a man of almost sublime and childlike simplicity of character and at the same time one of the few born leaders of men . . .”

A century earlier, John Bellers, a cloth merchant of London, had succinctly characterized the employer-employee relationship, when he stated:

Regularly laboring people are the Kingdom's greatest treasure and strength, for without laborers there can be no lords; and if the poor laborers did not raise much more food and manufacture than what did subsist themselves, every gentleman must be a laborer and every idle man must starve. (Bellers, 1714; quoted in Rosen, 1974)

A century and a half later, Abraham Lincoln, in his first annual message to Congress (December 3, 1861) said, “Labor is prior to, and independent of, Capital. Capital is only the fruit of labor, and could never have existed if labor had not first existed. Labor is the superior of Capital and deserves much the higher consideration . . .”

Thus, if we are to understand the history of occupational health, it must be viewed in the context of the labor-capital relationship: work-related disease is socially produced and is, therefore, preventable; and work can be the source of good health and happiness rather than disease and misery.

Throughout this chapter, it is important to follow the fundamental issues in occupational health that underlie all detailed events: the recognition and, therefore, the basis for prevention of work-related illnesses and disabilities; the control of working conditions, including hours and pace of work; the setting of health and safety standards; and the degree of participative democracy in the work environment.

The history of occupational health also demonstrates the prominent, often crucial, role played by community action. For example, one could recall the attention given to lead poisoning, once its hazard to the community and to children was demonstrated (Bayer, 1988). Industrial contamination of the community environment stimulates attention and mobilizes powerful forces. For example, chemicals in the water supply draw attention to the industries that generate them.

Efforts to combat Minimata disease in Japan helped clean up the polluting industry. Thus, the environmental protection movement is a potent ally to the industrial worker.

THE SOCIAL PRODUCTION OF DISEASE AND THE
BEGINNINGS OF SOCIAL MEDICINE

In 1848, Virchow crystallized the concept of social medicine in his classic statement that “Medicine is a social science and politics are nothing else than medicine on a large scale” (Sigerist, 1956). The idea of social medicine began centuries ago when early physicians first associated the illnesses of slaves and serfs with their working and living conditions. Ancient Egyptian records on wall paintings show workers laboring under the whip as they built the pyramids and the temples. Egyptian literature reveals descriptions such as the following:

I have never seen a blacksmith acting as ambassador or a foundry worker sent on a mission, but what I have seen is the metal worker at his work: he is grilled at the mouth of the furnace. The mason, exposed to all weathers . . . builds without clothing. His arms are worn out with work, his food is mixed up with dirt and rubbish: he bites his nails, for he has no other food. . . . The weaver engaged in homework is worse off in the house than the women: doubled up with his knees drawn up to his stomach, he cannot breathe. The laundryman on the quays is the neighbor of crocodiles. The dyeworker stinks of fish spawn: his eyes are tired, his hand works unceasingly and as he spends his time in cutting up rags, he has a horror of clothing. (Sigerist, 1960)

Hippocrates described a case of lead poisoning (Sigerist, 1960). Pliny (23–70 A.D.) spoke of the poisonous nature of lead, mercury, and sulfur, but nothing was done to protect the workers. He described how minium refiners used membranes as masks, which proved to be a very inadequate form of protection (Sigerist, 1960). However, medical care was provided to the upper classes and to those who entertained, such as the gladiators, but never to manual laborers.

At the end of the 15th century, literature began to be devoted to occupational diseases. By this time, the increase in trade had stimulated a demand for gold and silver. Firearms were being developed, creating a demand for iron, copper, and lead. This spurred deeper

mining. In 1473, a German physician, Ulrich Ellenbog, wrote a short treatise, *On the Poisonous Wicked Fumes and Smokes*, referring to fumes from coal, nitric acid, lead, mercury—encountered by goldsmiths and other metal workers (Sigerist, 1960). In 1587, Paracelsus (1493–1541), a Swiss, published the first monograph on the diseases of mine and smelter workers. He described the “lung sickness” of miners, which he attributed to the climate and vapor of the mines. Agricola (Georg Bauer, 1494–1553) was a German mineralogist and scholar who became a physician and practiced in a mining town. In 1526, he published *De Re Metallica*, a book on metallurgy, which described the diseases and accidents prevalent among miners, as well as recommendations for prevention. Agricola spoke of the dust that “. . . eats away the lungs, and implants consumption . . . ; hence in the . . . Carpathian mountains women are found who have married seven husbands . . .” (Sigerist, 1960).

Bernardo Ramazzini (1633–1714) practiced medicine in Modena, Italy. His famous book, *De Morbis Artificum Diatriba, The Diseases of Workers*, was first published in Latin in 1713. In 1715, an English translation appeared under the title, *A treatise of the Diseases of Tradesmen, Showing the Various Influence of Particular Trades upon the State of Health; with the Best Methods to Avoid or Correct It, and Useful Hints Proper to Be Minded in Regulating the Cure of All Diseases Incident to Tradesmen*. This was the first comprehensive presentation of occupational diseases, and it covered all the trades seen in his part of the world. Although Ramazzini, as most physicians of the time, was supported by the nobility, he devoted some of his time to the care of workers. “I will relate the incident that first gave me the idea of writing this treatise on the diseases of workers,” he wrote. And with his delicious sense of irony, he began Chapter XIV, “Diseases of cleaners of privies and cesspits”:

At this point, I hesitate and wonder whether I shall bring bile to the noses of the doctors . . . they are so particular about being elegant and immaculate—if I invite them to leave the apothecary’s shop . . . and to come to the latrines . . . it is the custom to take the houses one by one every three years and clean out the sewers . . . I watched one of these workmen . . . and saw that he looked very apprehensive and was straining every nerve. I pitied him at that filthy work . . . The poor wretch lifted his eyes from

the cavern . . . and said: “No one who has not tried it can imagine what it costs to stay more than four hours in this place; it is the same thing as being struck blind.”

Ramazzini then described the effect on the eyes and resultant blindness if care were not taken. Following this experience, he decided to study other occupations. Ramazzini’s humanity is revealed in many of his writings. Of his decision to study workers’ health, he said:

. . . we owe this to the wretched condition of the workers from whose manual toil, so necessary though sometimes very mean and sordid, so many benefits accrue to the commonwealth of mankind; yes this debt must be paid by the most glorious of all the arts . . . that of Medicine “which cures without a fee and succors the poor.” (Ramazzini, 1713)

Ramazzini supported “guilds and corporations of workers” and “laws . . . to secure good conditions for the workers” (1713). He is remembered in medical education by his advice to examining physicians:

. . . when a doctor arrives to attend some patient of working class . . . let him condescend to sit down for awhile . . . if not on a gilded chair as one would in a rich man’s house, let him sit, be it on a three legged stool or a side table. He should look cheerful, question the patient carefully, and find out what the rules of his own profession and his duty to humanity require him to know. There are many things . . . for so runs the oracle of our inspired teacher: “when you come to a patient’s house, you should ask him what sort of pains he has, what caused them, how many days he has been ill, whether his bowels are working and what sort of food he eats.” So says Hippocrates in his work *Affections*. I may venture to add one more question: What occupation does he follow?

Ramazzini pointed out that “in medical practice . . . attention is hardly ever paid to this matter . . .” (1713). The same can be said three centuries later.

One of the most remarkable of the pioneers of social medicine was Johann Peter Frank (1745–1821). Born in Baden near the border between France and Germany, Frank became a physician and educator. He lived at the time of absolute monarchies in France, Prussia,

Austria, and Russia. Under these conditions, it was remarkable that he perceived and taught about the relationship of the people's environment to their health. In 1790, as Dean of the University of Pavia Medical School, he delivered an address to the graduating class entitled, *The Peoples Misery: Mother of Diseases*. In it, he described the conditions of the peasants and made a plea for social and economic reform. The ruler of Austria, Joseph II, had abolished serfdom in 1781, but the nobility and clergy brought such pressure against his reforms that, on his deathbed, he revoked most of them.

The French revolution was in progress. Peasant uprisings were common throughout Europe. Frank advocated that the land should belong to those who till it and that every family should have enough land to produce their own food and be able to sell the surplus to the cities.

In his oration to the medical students, Frank stated:

Starvation and sickness are pictured in the face of the entire laboring class . . . whoever has seen will certainly not call any one of these people a free man . . . With emaciated body under the hot rays of the sun, he plows a soil that is not his and cultivates a vine that for him alone has no reward. His arms fall down, his dry tongue sticks to the palate, hunger is consuming him. The poor may look forward to only a few grains of rice and a few beans soaked in water . . .

Sigerist (1956) wrote that:

After I had translated his address, I read parts of it to my seminar students and asked them to guess who had written it. Some thought it was President Roosevelt, others guessed it was Harry Hopkins or John A. Kingsbury, and they were rather astonished to hear that this oration had been delivered in 1790.

At the time of Frank's death in 1821, the industrial revolution, which began in England and later spread throughout the continent, was well under way. The steam engine, railroads, textile weaving machines, and other technologic developments resulted in peasants leaving the land to secure jobs in the burgeoning factories in the cities. At the same time, mines were being exploited on a larger scale with the aid of new equipment. New working conditions, more crowded housing, and urban ghettos created new hazards to health. Death rates soared. Life expectancy was short.

Child Labor

Of Thackrah's work, Black (1979) said, "The thread that runs through his whole narrative is purposive compassion." This is illustrated by Thackrah's discussion of child labor.

The employment of young children in any labor is wrong. The term of physical growth ought not to be a term of physical exertion. Light and varied motions should be the only effort—motions excited by the will, not by the task-master—the run and the leap of a buoyant and unshackled spirit. How different the scene in a manufacturing district! . . . thousands of children, many from six to seven years of age, raised from their beds at an early hour, hurried to the mills, and kept there . . . till a late hour at night; kept moreover, in an atmosphere impure, not only as defective in ventilation, but as loaded with noxious dust. Health! Cleanliness! Mental improvement! How are they regarded? (Thackrah, 1831)

Thackrah pleaded for prevention: "From a reference to fact and observation, I reply, that in many of our occupations, the injurious agents might be immediately removed or diminished."

A report on *The State of Children Employed in Cotton Factories* was sent to Parliament in 1818, along with a petition signed by 6,000 factory workers (above age 16), "praying for a limitation of the hours of labor" for children. The prevailing work periods then were 14 hours a day, six days a week. The report included simple epidemiologic observations. Physicians, clergymen, and other concerned people visited the Sunday schools in Manchester and compared the health of the children who worked in the mills with those who did not. The working children were "sickly, pale, and inanimate." There was "a very peculiar hoarseness and hollowness of voice" among them "which seems to indicate that the lungs are affected." These children were debilitated with "pains in their legs, knees, and ankles," and "in many instances, consumption and deformity."

In 1775, Percival Pott, a general practitioner in London, had described cancer in chimney sweeps (the first occupational cancer recorded in history).

The child apprentices, who had to be small to negotiate flues only seven inches in diameter, were stolen for the purpose or

were sold by their parents for a few pounds. They were driven up the chimneys and sometimes forced to climb by means of a fire of straw lighted beneath them . . . many were suffocated. They usually slept in cellars with a bag of soot for a bed and another for a coverlet . . . not surprising that some of the boys never washed . . . but just dusted themselves, nor is it remarkable that they were covered with lice. It was part of the duty of the child apprentice to advertise his master by crying the streets. (Hunter, 1975)

In 1789, William Blake, the poet, wrote:

The Chimney Sweeper

When my mother died I was very young,
And my father sold me while yet my tongue
Could scarcely cry “ ’weep ’weep ’weep ’weep!”
So your chimneys I sweep, and in soot I sleep . . .

In the long struggle for the 10-hour-workday bill in England, during the period 1830–47, ragged children chanted, “we will have the 10 hours bill. Yes, we will. Yes, we will.”

At the same time, a movement for a 10-hour day was taking place in Massachusetts, then our most industrialized state. At the time, it was typical to work 12–15 hours per day, six days a week. In 1836, Massachusetts passed the first child labor law, stating that every child employed under age 15 receive at least three months of schooling per year. This law was amended in 1842 to prohibit children under 12 years old from working more than 10 hours a day.

Yet a century later, in 1915, the American poet, Sarah Norcliffe Cleghorn (1876–1949), wrote:

The golf links lie so near the mill,
That almost every day,
The laboring children can look out,
And watch the men at play . . .

The Children’s Bureau was established in 1912 by the U.S. Department of Commerce, and was later transferred to the Department of Labor, in response to the growing problem of child neglect and child labor.

In South Africa, in 1949, Schepers reported:

I made the first official governmental radiological and clinical survey of the asbestos industry in the North Eastern Transvaal . . . I found young children, completely included within large shipping bags, trampling down fluffy amosite asbestos, which all day long came cascading down over their heads. They were kept stepping lively by a burly supervisor with a hefty whip. I believe these children to have had the ultimate of asbestos dust exposure. X-ray revealed several to have radiologic asbestosis with cor pulmonale before the age of 12. (Schepers, 1965)

In India, in 1978, a physician reported the following:

On the morning of December 27, 1978, a terrible accident happened in a village near Sivakasi, in which 35 children were drowned when their bus was washed away by a flash flood. The poignancy of the tragedy was heightened when it became known that the victims were not school children but factory workers aged between 10 and 14 years, most of whom were girls . . . The children were being transported from villages . . . on a routine basis to the industrial units in the town which engaged “mostly child labor for its cheapness and availability.” (Vilanilam, 1981)

In 1992, P. J. Landrigan quoted Pollack et al. (1990) in his testimony before a U.S. Congressional Committee, concerning HR3160 Comprehensive Occupational Safety and Health Reform Act, stating that “. . . recent data . . . indicate that child labor with its attendant health hazards has increased substantially over the past decade. In New York state alone 1,200 working children received workers compensation awards. Forty-two percent of these awards to children were for permanent occupational disability” (Pollack et al., 1990).

Child protection legislation came incrementally, with each small improvement following some tragedy or some scandal. Each step forward was supported by labor and reformers, and opposed by industry and often by government. In England in 1802, the Health and Morals of Apprentices Act established the 12-hour working day, without age restriction. In 1819, the English Factory Act established the minimum working age of 9 years. In 1836, Massachusetts passed the nation’s first child labor law and, in 1874, was the first state to limit women’s work to 10 hours a day, 60 hours a week.

Inequalities of Health

Coming 130 years after Ramazzini's book, Thackrah's work ranks as one of the landmarks in the history of worker health. Among other things, he added the epidemiologic dimension. He studied the bills of mortality and observed that death rates were higher in manufacturing towns than in agricultural areas. He attributed the excess deaths in manufacturing towns to "The injurious effects of manufactures, the crowded state of population and the consequent bad habits of life" (Thackrah, 1832). Thackrah divided society into five classes according to occupation, and demonstrated that manual laborers lived shorter lives than the more affluent merchants, professionals, and employers.

"On July 9, 1842, at the height of a summer marked by perhaps a greater incidence of unemployment, destitution, and social protest than any other in the nineteenth century," Edwin Chadwick, Secretary to the Poor Law-Commission, presented to the House of Lords his *Report on the Sanitary Condition of the Laboring Population of Great Britain* (Chadwick, 1842). This report stimulated the passage of the Public Health Act of 1848 by which, for the first time, the British Government charged itself with a measure of responsibility for safeguarding the health of the population. Chadwick's work covered living conditions, housing, and environment of the laboring classes. He cited the wretched conditions and the preventable diseases, as did Thackrah. He described in statistics the striking inequalities of health between the social classes. Following is an example:

Deaths by Social Class in Manufacturing Towns—1837-40

<i>No. of Deaths</i>	<i>Town of Truro</i>	<i>Average Age of Deceased</i>
33	Professional persons or gentry, and their families	40 years
138	Persons engaged in trade, or similarly circumstanced, and their families	33
447	Laborers, artisans, and other similarly circumstanced, and their families	28

A similar, but occupationally more specific, pattern was published by Shattuck in Massachusetts in 1850.

The British Registrar General's decennial mortality reports were

inaugurated in 1851. In these reports, deaths are related to social classes, with Class I representing corporation executives and professionals, etc., down the social ladder to Class V, which represents unskilled workers. Although life expectancy in all classes had gradually lengthened, the data consistently show increasing mortality ratios (observed/expected) as the social gradient descends (Figure 1). In recent years, the gap between I and V has widened (Fox and Adelstein, 1978; Marmot and McDowell, 1986; Fox, 1990; Morris, 1990).

The more recent standard mortality ratios provided in Figure 1, show the same patterns as those of more than a century earlier:

FIGURE 1

Occupational class and mortality in adults, early 1980s.
 SMR = observed deaths/expected deaths.



[†] Great Britain.

(Source: OPCS, 1986a; 1986b).

Similar observations had been made in other countries in the wake of the industrial revolution. For example, in 1873 Germany, Pettenkoffer wrote:

. . . Political and social conditions are also influential upon the health and mortality of a population. All over the world the rich generally enjoy better health and live longer than the poor. Every epidemic, whether intermittent fever, typhoid or cholera, takes a larger toll from the poorer classes . . . cholera was a few years ago still called a disease of the proletariat. . . . (Rosen, 1947; Sigerist, 1941)

In at least two studies in the United States, the same phenomena are demonstrated today (Kitigawa and Hauser, 1973; Rogot et al., 1992).

Workers Compensation

In 1883, thirty-five years after Virchow agitated for reform of working and living conditions, Bismarck, the Prussian Junker Chancellor, inaugurated the first social insurance legislation in the Western world. In that year, Prussia enacted sickness insurance, and in 1884, workman's compensation was enacted, the prototype for today's workers compensation in Western Europe and the United States. Bismarck acted not out of the goodness of his heart, but to quell the growing socialist revolutionary sentiment in Germany.

In the United States, the first worker compensation acts were passed in New York in 1910 and in Wisconsin and Washington in 1911. The last was passed in 1948 in Mississippi. At first, these laws compensated only for accidental injuries. Later, occupational diseases were listed on a schedule, which stipulated that if a worker had an occupational disease that was not listed, there would be no compensation.

Today, most worker compensation laws in the United States theoretically cover all occupational injuries and diseases. However, it is interesting to note that although these laws were at first touted as a stimulus for job health and safety protection, this has not been demonstrated (Beckwith, 1992). Only an estimated 5 percent of workers disabled by work-related illness are compensated under this system. Many workers either are not compensated, or resort to lawsuits under product liability tort litigation, a difficult and expensive process.

Industrial Revolution in the United States

In 1776, at the time of the American Revolution, agriculture was the basic industry. During this time, some three million inhabitants lived

in the 13 colonies. Many early workers had come from England as indentured servants. Importation of slaves from Africa, which had already begun in the early 18th century, intensified in the South following the invention of the cotton gin. Other textile technology increased the need for labor on cotton plantations.

Textile mills, our first large industry, attracted young girls from the countryside who worked 14 hours a day, six days a week. The same issues developed here, as they had in England and Europe: hours of work, wages, child labor, housing, and the rise of “consumption,” as tuberculosis was called.

The U.S. government pioneered the nation’s first occupationally-oriented health program. In 1798, the Marine Hospital Service was established to provide care for merchant seamen. This represented the country’s first health insurance plan, and was the beginning of what eventually became the U.S. Public Health Service. Not until 1914, however, did the U.S. Public Health Service recognize the importance of occupational health, when it set up the Office of Industrial Hygiene and Sanitation, the distant ancestor of today’s National Institute for Occupational Safety and Health (NIOSH).

Between 1800 and 1811, Eli Whitney, the inventor of the cotton gin, contracted with the government for the manufacture of muskets. He set up the first fixed assembly line “with its dehumanization of the worker” (Felton, 1976).

A. M. Schlesinger (1946) wrote, “During the 1820s, the new industrial order had stirred deep currents of discontent through the laboring classes of the North and East . . . an inexorable destiny seemed to be pressing them into a separate estate as the dispossessed of the nation, and they were struggling frantically to escape.” Most affluent people of the day “sought to explain away industrial poverty by proclaiming its inevitability, when they did not proclaim its nonexistence.” According to McReady (1837), one exception was Matthew Carey, a rich Philadelphia businessman who viewed the working class as “no more depraved than any other class.” He proposed that the main cause of their discontent was wages too low for subsistence, and he wrote a pamphlet entitled, *Appeal to the wealthy of the land, ladies as well as gentlemen, on the character, conduct, situation, and prospects of those whose sole dependence for subsistence is on the labor of their hands*. Carey pointed out to the power elite that, in another part of Philadelphia, they could find “fifty-five families, con-

taining two hundred and fifty-three individuals huddled together in thirty tenements, without the convenience of a privy!!!” (Carey, 1837).

Between the Civil War and 1900, steam and electricity transformed industry. The railroads were built by immigrants from Europe and China. “The Union Pacific used 20,000 workers . . . who laid 5 miles of track a day and died by the hundreds in the heat, the cold, and the battles with Indians opposing the invasion of their territory” (Zinn, 1980). In 1889, the Interstate Commerce Commission recorded 22,000 railroad workers killed or injured (Zinn, 1980).

As the 20th century began, immigrants from everywhere, but predominantly from central and eastern Europe, were flooding into America looking for jobs. Eastern Europeans found work in the steel mills, the foundries, and the coal mines. Chinese laborers worked on the railroads in the West. Italians and Jews entered the needle trades. Slavs found work in the great Chicago meat packing plants, alongside the Irish who had preceded them.

Like *Uncle Tom’s Cabin*, with its focus on slavery, several landmark books reflected the time and influenced thinking. Among these were Edward Bellamy’s *Looking Backward* (1888), and Upton Sinclair’s *The Jungle* (1906). Later, Rachel Carson’s *Silent Spring* (1962) inaugurated the environmental movement.

Sinclair was a socialist writer. In 1904, he went to Chicago, lived for seven weeks with immigrant workers in the stockyards neighborhood, and toured the meat packing plants incognito. His resulting book became a best-seller and prompted a congressional investigation. It was also responsible for passage by the U.S. Congress of a new meat inspection law and our first comprehensive food and drug act.

Ironically, Sinclair was disappointed. He had been less interested in reforming the meat packing industry than he was in arousing concern about the lot of packing house workers. He later wrote, “. . . I had been made into a celebrity not because the public cared anything about the sufferings of workers, but simply because the public did not want to eat tubercular beef.” He added, “I aimed at the public’s heart, and by accident, I hit it in the stomach” (Young, 1985).

Tragedies for unprotected workers continued day by day. On March 25, 1911, a fire occurred in New York City at the Triangle Shirtwaist Company, in which 146 workers, mostly young immigrant women, were killed. Many of them perished while trying to open exits that had been locked. (In bitter irony, on the same day that the

Triangle Shirtwaist fire occurred, the New York Supreme Court declared the newly enacted worker's compensation law unconstitutional. The justices said, "The Statute judged by our common-law standards is plainly revolutionary . . . (it) violates private rights by taking the property of one and giving it to another without due process of law . . ."). A plaque in New York City at the site of the fire reads, "On this site, 146 workers lost their lives in the Triangle Shirtwaist Company fire on March 25, 1911. Out of their martyrdom, came new concepts of social responsibility and labor legislation that have helped make American working conditions the finest in the world."

Tragically, 80 years later on September 3, 1991, a fire at the Imperial Food plant in North Carolina killed 25 workers, mostly women. As at the Triangle Shirtwaist plant, the fire exit doors had been locked.

As Eula Bingham (1992) said,

Parallels of these two incidents are sobering but instructive . . . In both cases, mostly women perished. The dead bodies were mostly immigrants in 1911, while in 1991, they were people of color. In both cases, the victims were lowly paid and feared for the loss of their jobs if they complained of unsafe, sweatshop conditions. In each case, locked fire exit doors were explained as necessary to ensure profits . . . In each, there was a failure to provide adequate fire suppression systems. . . . In the Triangle fire, the State of New York failed to enforce the laws. Eighty years later, with a Federal and State OSHA [Occupational Safety and Health Administration] law in place for 20 years, there was failure to inspect and enforce. . . . (Bingham, 1992)

Bingham added, "After 20 years of OSHA, the number of workplace deaths remains too high. Each year, 14,000 die from work-related injuries and another 50,000 to 70,000 from work-related illness. This carnage is unacceptable because we know that each death is preventable."

Enactment of the 1969 Coal Mine Health and Safety Act preceded by one year the 1970 Occupational Safety and Health Act. The legislation was stimulated by continuing accidents and diseases, including growing awareness of the problems of occupational cancer and other chronic diseases. The Occupational Safety and Health Act gave the

federal government powers of inspection and enforcement in the states for the first time. It simultaneously established the National Institute for Occupational Safety and Health (NIOSH), whose purpose is to develop a scientific basis for the enforcement function of OSHA.

1970 also saw the enactment of the Environmental Protection Act, and in 1976 the Toxic Substances Control Act was empowered. Randall and Soloman (1977) explained how final stimulus for passage of the latter act was effected by the congressional hearings on lung cancer deaths from bis-chloromethyl ether at the Rohm and Haas Chemical Plant in Philadelphia.

But good legislation is only effective if the government in power seriously wishes it to succeed. Symptomatic of the difficulties experienced during the Reagan-Bush years (1980-92) is the following example: A proposal was made to remedy gaps in OSHA protection to workers in construction trades, maritime industry, and agriculture. The U.S. Office of Management and Budget (OMB) blocked the proposal by arguing that the costs of implementing these improvements would be passed on to consumers and workers, resulting in increased prices and decreased wages and benefits. It would, therefore, be better not to make these changes because "richer workers . . . buy more nutritious food and more preventive health care, and smoke and drink less than poorer workers" (U.S. Office of Management and Budget, 1992).

In this statement of twisted cynicism, a government agency acknowledged that better income results in better health, but used the argument to deny better health protection on the job! It was a consummate illustration of how "cost-benefit analysis" can be used to thwart the public health.

THE "PROGRESSIVE ERA"
(AND SOME REGRESSIVE EVENTS)

The years from approximately 1890 to 1920 were a remarkable period in the history of health and welfare in the United States. They were marked by the struggle for workers compensation, factory inspection laws, child labor protection, and the eight-hour workday. They were years of tragedy, as evidenced by the disfiguring cancers detected in the radium dial painters, "phossy jaw," lead and mercury poisonings, silicosis, and other pneumoconioses. Coincidentally, they

were also years of triumph. It was during this period that Jane Addams of Hull House in Chicago, along with many of her disciples, including Alice Hamilton, Florence Kelley, Julia Lathrop, Grace Abbott, and others, successfully pioneered for social and health reforms.

Florence Kelley, a social worker, worked at Hull House with Alice Hamilton. She was appointed by the governor of Illinois, John Peter Altgeld, to investigate the sweatshops in the garment industry where most of the employees were women. As a result of her report, the Illinois Legislature passed the first state law limiting the hours of work for women and establishing the minimum work age of 14 years. It also resulted in the creation of the Illinois State Factory Inspection Department, and in July 1893, Kelley was appointed Chief Inspector. In 1899, she became general secretary of the National Consumers League, which was trying to improve working conditions for women.

In 1924, the New Jersey chapter of the National Consumers League first called attention to the sickness and death occurring among girls who were painting watch dials with a paint containing radium and mesothorium. For years, these girls had been losing their teeth and had developed disfiguring bone cancers, mainly in the jaw. Their dentists and physicians made various diagnoses: "poor dental hygiene," syphilitic osteomyelitis of the jaw, Vincent's angina, rheumatism, anemia. In 1924, a dentist, Theodore Blum, diagnosed the condition as "radium jaw." In 1925, Frederick Hoffman presented a paper on "Radium Necrosis" at an American Medical Association meeting in Atlantic City. Harrison Martland, Chief Medical Examiner of Essex County, New Jersey, reported his autopsies of several girls who had died of the disease. Nevertheless, the United States Radium Corporation attempted to suppress the report of their own consultant Cecil Drinker of Harvard. The company president wrote, "It is quite probable that we are suffering from a hysterical condition brought about by coincidence" (Martland, 1925). In 1929, Martland wrote in the *Journal of the American Medical Association (JAMA)*, "I was surprised when a leading authority in industrial diseases told me that this disease was an obscure one about which little was known."

In the end, the problem was resolved, following publicity engendered by the Consumers League and the *New York World*. Because workers compensation at that time did not include radium poisoning, five young women sued the company. As the company dragged out

their case, the girls became sicker and one died. Finally, in 1928, the company settled (Cloutier, 1980; Abrams, 1983; Rosner and Markowitz, 1987). At the time, labor unions played no part in this episode. The dial painters had no union (Rosner and Markowitz, 1987). The episode resulted in a national conference on radium, called by the U.S. Public Health Service. Rosner and Markowitz (1987) pointed out that the “research scientists used the conference to wrest from manufacturers the power to determine the occupational hazards posed by radium dial painting.” Unlike the phosphorous match problem of a few years earlier, which resulted in eliminating the use of white phosphorous, the scientists succeeded in maintaining the use of radium under their standards of controls. “These experts appear as far from heroic figures; scientists were slow to recognize the need for independent investigation of radium poisoning and devoted much of their initial effort to disputes over professional ethics and battles for procedures” (Rosner and Markowitz, 1987).

Alice Hamilton (1869–1970) was a product of this period. She received her medical degree from the University of Michigan in 1893. Her initial interest was in pathology. She interned in Boston, and studied bacteriology and pathology in Germany, and later at Johns Hopkins. In 1897, Hamilton went to Chicago to teach pathology at Northwestern University Women’s Medical School. She resided at Hull House and became a close associate of Jane Addams. She established a baby clinic in the basement of Hull House, and also worked among immigrants who were poor and exploited. As she encountered factory workers, she noted cases of carbon monoxide poisoning among steel workers, lead palsy in painters, and pneumonia and rheumatism in many of the stockyard workers. In 1910, she was appointed to the Illinois Commission on Occupational Diseases. When investigation revealed the need for a statewide survey, Hamilton was appointed director of the survey and, thus, started her career in occupational medicine.

Hamilton pioneered studies on lead poisoning by means of “shoe-leather epidemiology.”

She tracked down dispensary and union death records and persuaded workers . . . to cooperate—often a difficult task, since admission of illness meant almost certain loss of an already precarious livelihood. Her careful work established beyond a doubt

which Illinois industries used lead and demonstrated shockingly high morbidity and mortality rates. She went on to become a special investigator for the Federal Bureau (later Department) of Labor, a position she held from 1911 to 1920. (Sicherman, 1984)

In 1919, Harvard University appointed Hamilton assistant professor of industrial medicine—the first woman to be appointed to Harvard’s faculty (Harvard did not admit women students until 1945).

To reassure anxious members of the Harvard Corporation, Alice Hamilton agreed to forego such perquisites of faculty standing as access to the Harvard Club and tickets to football games . . . each year her printed invitation to commencement carried a handwritten warning: *Under no circumstances may a woman sit on the platform.*

Hamilton proceeded to conduct, in many parts of the country, pioneer studies in mining and smelting, silicosis, vibration injuries, as well as many other studies of occupations and their associated risks and diseases. Her autobiography, *Exploring the Dangerous Trades* (1943), describes her work and philosophy. She was not only a superb physician, scientist, and teacher, but also a social reformer. She took forthright stands for birth control and for civil liberties. She opposed our entry into World War I, and later, the Vietnam War. Her work was so effective that “The FBI was still keeping tabs on her in the 1960s when she was in her 90’s” (Sicherman, 1984). She died at the age of 101.

In her autobiography, Alice Hamilton said:

I should have never taken up the cause of the working class had I not lived at Hull House and learned much from Jane Addams, Florence Kelley, Julia Lathrop and others . . . The years from 1914 to 1942 have been full of issues more tremendous than the struggle of labor for its rights, and living as I did with Jane Addams, I could not escape being drawn into the peace movement. (Hamilton, 1943)

The Struggle for Recognition of Occupational Disease

The struggle to achieve recognition of, compensation for, and prevention of, occupational diseases is well illustrated by the radium dial

painters story, as well as by the high incidences of byssinosis, lead poisoning, coal workers pneumoconiosis, asbestos-related diseases, silicosis, and many other diseases. These histories raise poignant questions of the roles of scientists, labor, and industry. In the story of byssinosis, or “brown lung,” there is an all-too-familiar pattern. The disease was made compensable in Great Britain in 1941, but not until 1969 was it recognized in the United States as “worthy of concern.” Why the lag? “Why was it not a major issue for the organized labor movement until the late 60’s? We believe the answers to these questions lie in two related areas: the weakness of the American trade union movement and the historic relationship between labor and science” (Rosner and Markowitz, 1987, p. 208). The authors refer to the “. . . inordinate awe in which health science is held by workers and their organizations What is so pernicious about labor’s dependence on the good will of the scientist is that close economic and class links tie the university to industry” (Rosner and Markowitz, 1987, p. 221). The authors were critical of the unions because they failed to involve the disabled workers who were no longer active in the union. They cited the success of the Brown Lung Association in “building links between progressive scientists and disabled workers,” and demonstrating that workers could grasp difficult issues and become a political force.

Similarly, Smith (1981) brilliantly drew the lessons of how the black-lung movement mobilized workers around an occupational health issue, aided by progressive physicians and scientists, and how this struggle helped to bring reform to a union.

Silicosis has been known since antiquity. Workers themselves used the terms “miner’s phthisis,” “potter’s consumption,” “grinder’s rot,” and “granite-cutter’s phthisis.” Yet, as a reflection of our inadequate control of dust hazards, and failures of medical and health education, this oldest of industrial diseases continues to survive and to appear periodically as a “discovery,” or even as a covered-up scandal. Recent years have seen such examples as acute silicosis in a silica flour plant in Illinois (Banks, 1981), and diatomaceous earth silicosis in California (Abrams, 1954). The pulmonologist, Fishman (1988), wrote, “Succeeding generations of physicians and industrial hygienists have had to ‘rediscover’ silicosis; and each new circumstance of occupational exposure seems to go unscrutinized until the health costs become obvious.”

The silicosis story was also complicated by its confusion with tuberculosis and the influence of the germ theory. Silicosis predisposes to tuberculosis, which has historically been a disease of poverty. For centuries, “consumption” has been a disease of the working classes, and in many settings “phthisis” has been regarded as an occupational disease. After Koch discovered the tubercle bacillus in 1882, physicians and scientists diverted their focus for many years from dust to bacterial infection. Separating out silicosis as a disease of industrial origin took years. The process delayed the acceptance of industrial and governmental responsibility for control and prevention (Rosner and Markowitz, 1991).

Some early investigators, however, kept their eye on the ball and insisted that “. . . phthisis can be caused by dust” (Oliver, 1902). British, South African, and German literature reported phthisis as industrial in origin. Workers in the dusty trades were not fooled and understood that their respiratory diseases resulted from their work. Reformers in the late 1890s and the early years of the 20th century observed tuberculosis as a disease of poverty. This experience exemplified the linkage of social conditions, including work, to disease. Labor called for factory inspection, good wages, “fresh air” in the shops, and legislation.

For many years, the British had been using statistics and epidemiology to study occupational diseases. Hoffman, a statistician with Prudential Life Insurance Company, was one of the first Americans to employ this approach (Hoffman, 1918; Rosner and Markowitz, 1991). Lanza noted the silicosis-tuberculosis relationship and in 1917 wrote, “While the cause of miners’ consumption is found entirely in the underground work of the miner,” it was “the poor and often wretched conditions under which so many live and the presence of tuberculosis foci” that led to the chance of TB infection. Workers had no trouble recognizing their problem. The Granite Workers Union (1905) wrote in their journal, “The constant breathing of stone dust is unquestionably highly detrimental to health and it should be incumbent upon employers to install the means of reducing such risks to a minimum” (Rosner, 1991).

The introduction of pneumatic tools in granite cutting increased the dust, and when workers objected to their use in winter, when the sheds were closed, the employers fired them and locked them out, leading to a strike throughout the Barre, Vermont, area. But, as Ros-

ner and Markowitz (1991) wrote, effective reform of working conditions was not begun until the late 1930s “after evidence of excess death among granite workers had become overwhelming and after a series of crises in not only granite but among foundry workers, metal miners, potters, glassblowers, etc.” In 1958, a Public Health Service report stated that “at that time practically every pneumatic tool operator could be expected to develop the disease after 15 years of exposure to granite dust” (Hosey et al., 1958; Rosner and Markowitz, 1991).

In the early 1930s, what is described as the worst industrial disaster in U.S. history occurred. More than 2,000 workers, mostly black, were employed in West Virginia to drill a 3.75 mile tunnel through a mountain for a hydro-electric plant at Gawley Junction. Within a few years, 700 workers had died, and most of the others were disabled by *acute* silicosis. In the subsequent congressional hearings, it was brought to public attention that 169 of the workers had been buried in a mass grave by a local undertaker who was paid by the company, a subsidiary of Union Carbide (Comstock and McClung, 1973; Cherniak, 1986; Rosner and Markowitz, 1987). In 1984, Union Carbide again came to public notice in connection with the Bhopal disaster in India.

During this same period, the danger of white phosphorous in matches was recognized. “Phossy Jaw” was a common occupational disease, sometimes confusing the diagnosis of osteogenic sarcoma among radium dial workers. Phossy jaw became the center of nationwide campaigns by labor and reformers. John B. Andrews, head of the American Association of Labor Legislation, played a leading role in the years 1910–1920, when use of white phosphorous was finally abolished by imposition of a tax.

The petro-chemical industries are another great constellation of industries in which workers have had to struggle for recognition and prevention of hazards. Mehlman (1991) described the cancer hazards of petroleum products. Scott (1974) told the story vividly from the worker’s point of view: fatal but preventable accidents, company denial of a myriad of health hazards, from asbestos to hydrogen sulfide to noise-induced deafness. To preserve the outward impression of a good safety program, an injured worker may be brought into the plant to avoid poor safety statistics. A worker tells of one of his colleagues who was badly burned: “They brought him in there in an ambulance, so they wouldn’t get lost time” (Scott, 1974).

The “progressive era” was also influenced by two significant pub-

lications already mentioned: *Looking Backward* by Edward Bellamy (1888), and *The Jungle* (1906) by Upton Sinclair. Both were best sellers. In Bellamy's novel, the main character falls asleep and wakes up in the year 2000 in a socialistic society in which people live and work cooperatively. The book influenced many, including the great labor leader, Eugene Debs. Two excellent textbooks on occupational health also appeared during the period (Kober and Hanson, 1916; Kober and Hayhurst, 1924).

In *Industrial Health*, Kober and Hayhurst (1924) quoted the physiologist, Collis: ". . . The statement may be made that the intelligence of a race is measured by its industry, and that the primary *raison d'être* of industry is safety and health. . . ."

The 1911 fire at the Triangle Shirtwaist Company, described previously, reminded society of how far it still had to go to vindicate Collis' brave words. In 1912, the Committee on Standards of Living and Labor of the National Conference of Charities and Correction, a voluntary organization, called for minimum standards for every American for a life of decency: a living wage, an eight-hour workday, and the right to a home. Although these standards are almost a century old, they accord amazingly with political campaign issues in the United States in recent years!

THE ROLE OF LABOR

It is important to recognize that throughout the often tragic history of worker health and disease, the worker played a primary role as the basis of every significant improvement in legislation, factory inspection, compensation, correction, and prevention. Labor unrest, protests, strikes, lawsuits, and catastrophes were vital catalysts in obtaining action. A few examples point up the forces at work:

In 1827, "an 'unlettered mechanic' gave an address before the mechanics and working classes . . . of Philadelphia," in which he said, "We find ourselves oppressed on every hand—we labor hard in producing all the comforts of life for the enjoyment of others, while we ourselves obtain but a scanty portion, and even that . . . depends on the will of employers" (Zinn, 1980).

In 1835, fifty different trades organized unions in Philadelphia, where laborers, factory workers, bookbinders, jewelers, coal heavers, butchers, and cabinet workers were successful in their strike for the 10-hour day. Soon, 10-hour laws were enacted in Pennsylvania and

other states, but the laws allowed that employers could have employees sign contracts for longer hours (Zinn, 1980).

One of the early unions in America was the Mechanics Union of Trade Associations in Philadelphia, which sponsored the first Working Men's Party during the 1820s and 1830s. Such parties spread to Massachusetts and other areas. They pointed out "that the laboring classes in our country, in consequence of the inroads and usurpations of the wealthy and powerful, have for years been gradually sinking in the scale of public estimation." The working men attributed the main source of their growing inequality to the "continued prevalence of irrational, anti-republican and unchristian opinions in relation to the worth and respectability of manual labor." The union called for unity of the working class and for a series of specific demands (Schlesinger, 1946):

- Equal Universal Education
- Abolition of Imprisonment for Debt
- Abolition of all Licensed Monopolies
- An entire Revision, or Abolition of the Present Militia System
- A Less Expensive Law System
- Equal Taxation on Property
- An Effective Lien Law for Laborers
- All Officers to be Elected by the People
- No Legislation on Religion.

Now, more than 160 years later, some of the same forces to whom these demands were made are attacking the hard-won public school system. See "The battle for public schools," *The Nation*, Sept. 21, 1992, and *Savage Inequalities* by Jonathon Kozol (1991), Crown, N.Y.

In 1832, the New England Association of Farmers, Mechanics, and Other Workingmen was formed. Their weekly paper, *The New England Artisan*, was headed by Seth Luther. His write-ups were vivid, of

. . . anxieties which were eating away at the security of the New England working man: bitter sketches of children whipped from bed at four in the morning, wakened by a plunge in cold water and sent off to work; of managers turning clocks backward or forward to cheat the workers of vital minutes of rest; of a dead, gray life, crushed by want and oppression. (Schlesinger, 1946)

In 1833, the New England Association established the General Trades Union in Boston. This union and other unions were attacked

as “criminal conspiracies” for “combinations, amongst journeymen, mechanics and laborers to raise their wages and regulate the hours of work.” Nevertheless, the unions launched a campaign for the 10-hour day, and the stone cutters authorized a strike. “I am for arraying the poor against the *principles* that keep them poor,” declared a union leader, “and if this be arraying the poor against the rich then I say go on with ten-fold fury” (Schlesinger, 1946).

In 1845, the working day in the mills in Lowell, Massachusetts, varied from 11 hours and 24 minutes during the months of December and January to 13 hours and 31 minutes in April; that is, from sunrise to sunset. Ten-hour days became a political issue. In 1850, the superintendent of the Boott Mills threatened to fire every man who voted for the 10-hour ticket.

Women Workers

In 1845, the Female Labor Reform Association was formed in Lowell, Massachusetts. Members sent thousands of petitions to the legislature asking for the 10-hour day. The legislature held public hearings, “the first investigation of labor conditions by any government body in the country,” but the legislature rejected their demand. In Patterson, New Jersey, strikes for the 10-hour day were organized by children (Zinn, 1980).

Of the country’s six million member work force in 1850, half a million were women: 330,000 worked as domestics; 55,000 were teachers. Of the 181,000 women in factories, half worked in textile mills. In 1825, women represented by the United Tailoresses of New York organized their first strike, demanding higher wages. In 1828, the mill women, independent of any other participants, organized their first strike in Dover, New Hampshire. They shot off gunpowder in protest against new factory rules, which included charging fines for coming late to work, forbidding talking on the job, and requiring church attendance. However, they were forced to return to the mill, their demands unmet, and their leaders were fired and blacklisted (Zinn, 1980, p. 223).

In Exeter, New Hampshire, women mill workers went on strike because the overseer was setting the clocks back, in order to get more time from them. Their strike succeeded in exacting a promise from the company that the overseers would set their watches correctly.

Lowell, Massachusetts, was the first town created for the textile

mill industry. The “Lowell system” hired young girls to work in the mills and live in dormitories supervised by matrons. But the dormitories became prison-like, controlled by rules and regulations. The supper (served at the conclusion of a day in which the girls had risen at 4:00 A.M. and worked until 7:30 P.M.) often consisted merely of bread and gravy. Consequently, the Lowell girls organized. They started their own newspapers. They protested against the weaving rooms, which were poorly lit, badly ventilated, impossibly hot in the summer, damp and cold in the winter (Zinn, 1980, p. 223).

After the Civil War,

the cities to which the soldiers returned were death traps of typhus, tuberculosis, hunger, and fire. In New York, 100,000 people lived in the cellars of the slums; 12,000 women worked in houses of prostitution to keep from starving; the garbage, lying 2 feet deep in the streets, was alive with rats. In Philadelphia, while the rich got fresh water from the Schuylkill River, everyone else drank from the Delaware, into which 13 million gallons of sewage was dumped every day. In the Great Chicago Fire of 1871, the tenements fell so fast, one after another, that people said it sounded like an earthquake. (Zinn, 1980)

A movement for the eight-hour day began among working people after the war . . . A three-month strike of 100,000 workers in New York won the eight-hour day, and at a victory celebration in June 1872, 150,000 workers paraded through the city. The *New York Times* wondered what proportion of the strikers were “thoroughly American.” (Zinn, 1980)

In 1869, the collar laundresses of Troy, New York, whose work involved standing “over the wash tub and over the ironing table with furnaces on either side, the thermometer averaging 100 degrees, for wages averaging \$2.00 and \$3.00 a week,” went on strike. In Fall River, Massachusetts, women weavers formed a union independent of men weavers. They refused to take a 10 percent wage cut that the men had accepted, struck against three mills, won the men’s support, and with 3,200 workers on strike, brought to a halt 3,500 looms and 156,000 spindles. But because their children needed food, they were forced to return to work and, ultimately, to sign an “iron-clad oath” (later called a “yellow-dog contract”) not to join a union (Zinn, 1980, p. 236).

Black workers at this time found the National Labor Union reluc-

tant to unionize them. As a result, they formed their own unions and carried on their own strikes—such as the levee workers in Mobile, Alabama in 1867, the Negro longshoremen in Charleston, and the dockworkers in Savannah. This probably stimulated the National Labor Union, at its 1869 convention, to resolve to unionize women and Negroes, declaring that it recognized “neither color nor sex on the question of the rights of labor” (Zinn, 1980, pp. 236–237).

In 1880, 1,118,000 children under the age of 16 (one out of six) were at work in the United States. With everyone working long hours, family members often became strangers to one another. A pants presser named Morris Rosenfeld wrote a poem, “My Boy,” which became widely reprinted and recited:

I have a little boy at home,
A pretty little son;
I think sometimes the world is mine
In him, my only one. . . .
'Ere dawn my labor drives me forth;
Tis night when I am free;
A stranger am I to my child;
And stranger my child to me. . . . (Zinn, 1980, p. 261)

In 1900, there were 500,000 women who were employed as office workers. In 1870, there had been 19,000. Women also worked as switchboard operators, store workers, and nurses. Half a million were teachers. The teachers formed a Teachers League that fought against the automatic firing of women who became pregnant. The following *Rules for Female Teachers* were posted by the school board of one town in Massachusetts (Zinn, 1980, p. 330):

1. Do not get married.
2. Do not leave town at any time without permission of the school board.
3. Do not keep company with men.
4. Be home between the hours of 8 P.M. and 6 A.M.
5. Do not loiter downtown in ice cream stores.
6. Do not smoke.
7. Do not get into a carriage with any man except your father or brother.

8. Do not dress in bright colors.
9. Do not dye your hair
10. Do not wear any dress more than two inches above the ankle.

The conditions of women working in a Milwaukee brewery were described by “Mother Jones,” who worked there in 1910 (she was close to 80 at this time):

Condemned to slave daily in the wash-room in wet shoes and wet clothes, surrounded with foul-mouthed, brutal foremen . . . Rheumatism is one of the chronic ailments and is closely followed by consumption . . . The foreman even regulates the time the girls may stay in the toilet room. (Zinn, 1980, pp. 330–331)

Black women faced double oppression. A Negro nurse wrote to a newspaper in 1912:

We poor colored women wage-earners in the South are fighting a terrible battle . . . On the one hand, we are assailed by black men, who should be our natural protectors; and, whether in the cook kitchen, at the washtub, over the sewing machine, behind the baby carriage, or at the ironing board, we are but little more than pack horses, beasts of burden, slaves! . . . (Zinn, 1980, p. 339)

The 8-Hour Day

In 1868, the federal government decreed an 8-hour day for federal employees. In the 1880s, labor, which was then organized as the Knights of Labor, commenced a national campaign for the 8-hour day. The campaign was taken up soon after by the newly organized American Federation of Labor. The struggle culminated on May 1, 1886, when demonstrations were held in many cities. On May 3, at a union demonstration at the McCormick Harvester plant in Chicago, police fired into the crowd, killing and wounding many. The union called a protest meeting for May 4 at Haymarket Square, where 3,000 people assembled. There were 180 policemen present, who ordered the crowd to disperse. However, a bomb was thrown, killing 11 persons, including several police. Eight well-known anarchists were arrested, although only one had attended the meeting. He was speaking when the bomb exploded. These eight had been known

for their ideas and their literature calling for social change, and a jury convicted them all. Four were hanged, and the others were sentenced to life imprisonment. The executions aroused people all over the world, including such prominent persons as George Bernard Shaw. 60,000 people signed petitions, which were sent to the newly elected Governor, John Peter Altgeld, who pardoned the four remaining prisoners.

While the struggle for the eight-hour workday was taking place, and some workers had won the shorter day, others, such as steelworkers, continued working 12-hour days, seven days a week. These predominantly Slavic immigrants worked in “a system that stifles initiative and destroys healthy citizenship.” John A. Fitch, an almost forgotten product of the Progressive Era, was a leading advocate for the steelworkers. He listed their hazards as mineral dusts, tuberculosis, heat, deafness, and deaths from explosions, asphyxiation, falls, and electric shock. In 1904, the Amalgamated Association of Iron, Steel, and Tin Workers established a death benefit fund. Employers fought the union with court injunctions, police, and “Pinkerton” spies and thugs. Homestead, Pennsylvania and other mine and mill towns were scenes of violence. The employers inveighed against “labor agitators,” and the “cheap college professors and still cheaper writers in muck-raking magazines.” Fitch said, “as long as the 12-hour day prevails, attempts to improve health conditions in the mills will be largely nullified” (Fitch, 1910).

Even as the United States became industrialized and the agricultural base diminished, a new and greatly neglected population emerged—the migrant and seasonal farm laborers. Largely of foreign or ethnic minority origin, they were going through the same evolution of struggle as the immigrant workers of the 19th and early 20th centuries. Facing the hazards of pesticides, machinery, and poor living conditions, they helped keep agriculture, construction, and mining as the first three causes of occupational mortality (McWilliams, 1939, 1948; Abrams, 1986).

The 8-hour day was not recognized as standard throughout the country until passage of the Fair Labor Standards Act in 1938, which set maximum hours and minimum wages for interstate commerce. In the end, hours and conditions of work depended fundamentally on the strength of the labor movement and the help they could get from reformers to persuade the decision makers.

Health Services for Workers

Almost all occupational health services in capitalist countries have been employer-controlled and oriented, or professionally-controlled, as in the numerous private practices in the United States. Frequently, workers have not been well served by these arrangements. They often fall short in prevention, education, informing workers of their medical findings, or advocacy for the worker in compensation proceedings. Too often, professionals in these settings have tried to blame the victims. As a result, workers traditionally lack trust in the “company doctor.”

Many attempts have been made to set up services in which workers may obtain honest, objective, and sympathetic treatment. Shortly after the Revolutionary War, laborers in the United States already began organizing mutual benefit associations, sometimes called “benevolent” or “friendly” societies. In 1787, freed slaves organized the Free African Society (Falk, 1961). As already mentioned, some unions in the United States set up their own clinics in the early 1900s. Community movements, such as the National Consumers League, sparked campaigns for protecting radium dial painters, phosphorous match makers, and others.

One of the most interesting attempts to protect industrial workers was organized by three women: Grace Burnham, Harriet Silverman, and Charlotte Todes. All were social reformers, products of the “Progressive Era.” From 1921 to 1928, they ran The Workers Health Bureau, which was organized at a time of severe repression of labor by government. Eugene Debs, the great labor leader, was in jail for having opposed our entry into World War I. The U.S. Attorney General, A. Mitchell Palmer, was carrying out raids, arrests, and deportations of immigrant workers and political activists. In this context, these three women, working with the support of many unions, including the International Ladies Garment Workers Union (ILGWU) and the Amalgamated Clothing Workers Union (ACWU), and assisted by some eminent public health experts, such as Alice Hamilton and Professor C.E.A Winslow of Yale, established a remarkable worker health service that has not been emulated since that time. Their concept was that safety and health were “class issues to be controlled by unions and workers themselves,” in contrast to control by professional engineers and scientists. They argued that “health is an

industrial and class problem deserving the same place in (the) union program as hours, wages, and working conditions.”

During the short life of this program, the Workers Health Bureau organized its own office and laboratory with x-ray facilities. They employed a physician, dentist, nurse, and technicians, and organized health services and studies of painters, textile workers, and others. They studied lead poisoning and death rates from heart disease, and were instrumental in correcting the mercury poisoning of workers in the felt hat industry. In this, they worked with the United Hatters of America, in Danbury, Connecticut, where mercury poisoning, which affected the nervous system, had already generated the expression, “mad as a hatter.” Grace Burnham traveled to the Soviet Union to meet with scientists who had found a safe substitute for the nitrate of mercury which was causing this serious disease of the nervous system. Harriet Silverman said, “Labor needs a parallel for the Rockefeller Foundation, an Institute of Health Research.” They nearly succeeded in achieving that goal, but ultimately were defeated as a result of the hostility of the American Federation of Labor, headed by the conservative, William Green.

“It was not until . . . OSHA that recognition was given by government and labor to the rights of workers to a safe and healthy workplace. It is to the credit of these three women that they pointed the way” (Rosner and Markowitz, 1987).

In 1913, in recognition of the high rate of tuberculosis and other diseases in the sweatshops, the ILGWU established its first health center in New York City. Ultimately, more than 15 union health centers of the ILGWU were established around the country. (Today, as this is being written, only three remain, reflecting changes in the industry, the union, and medical care patterns). Following the ILGWU’s lead, other unions, including the ACWU, the Amalgamated Meat Cutters Union, the Hotel Workers Union, and the Building Service Employees Union, established similar health centers. The Labor Health Institute of St. Louis, established by a Teamster local, is one outstanding example of these health centers.

In the mid-1940s, when unions were able to bargain collectively for health care benefits, the United Mine Workers of America (UMWA), the United Auto Workers (UAW), and many others, established health centers, hospitals, and health insurance plans. These emphasized comprehensive medical care and were designed to rem-

edy the absence of national health insurance. For the most part, these programs provided general health care and were little concerned with occupational diseases. Some notable exceptions include the UMWA, which played a strong role in obtaining recognition for black lung disease, described decades earlier in England, and in winning passage of the 1969 Coal Mine Health and Safety Act. Its enactment was spurred by the growing recognition of black lung disease and the occurrence of several mine disasters, the final push resulting from the November 1968 explosion in West Virginia, which killed 78 miners. Four thousand miners per year (11 per day) were dying of black lung disease (Kerr, 1971; Smith, 1981). It was during this period that the UMWA pioneered the building of ten labor-sponsored hospitals and the establishment of many excellent medical groups in the coal mining areas. The UAW also played a leadership role in the drive for national health insurance. However, many of these achievements were later defeated, as much of U.S. basic industry moved to third world countries, or succumbed to foreign competition. Additionally, labor organizations became greatly weakened, partly as a result of the anti-labor policies of the Reagan-Bush administration of 1980-92.

Worker Control

In more recent years, the Scandinavian nations have pioneered worker participation, on both the national and industry level, in the determination of issues such as protection against hazards and humanizing work. Early in this century, Italian workers, with the help of professionals, pioneered clinical services that were university-based, industry-based, and/or government-based. Through their unions, Italian workers have sparked some interesting developments:

The *Workers Homogeneous Group* includes workers who perform similar tasks and are, therefore, exposed to the same hazards, who develop their own programs. Their emphasis has been on changing work conditions and preventing disease, rather than on compensation. *Factory Councils* have been organized to give workers power over their circumstances. *Workers Subjectivity* is a concept that recognizes the need to listen to workers and give credence to their insight into what is going on within their own bodies and within the plants. *Legislative efforts*

give workers more control over their health hazards. (Assenato and Navarro, 1980; Reich, 1984)

In the United States, under OSHA, MSHA (Mine Safety and Health Administration), and other national legislation, movements have been developed for such concepts as the “right to know,” and labor-management health and safety committees. On the community level, “COSH” (Community Occupational Safety and Health) groups have developed in many cities. These are coalitions of workers and professionals striving for better worker health protection. During the Carter years (1976–1980), a renaissance of worker health activities occurred on the national level. Several “Educational Resource Centers” were funded by NIOSH at universities, and OSHA mounted “New Directions” to support labor initiatives in health and safety.

The success of all of these attempts by workers to improve their situation has fluctuated with the strength of unionization and the political character of the government in power. For example, a serious erosion occurred during the Reagan-Bush years (1980–92) of the advances that had been made since 1970. This paralleled the loss of basic industries and the weakening of organized labor.

Simultaneously, however, hopeful developments have been seen elsewhere. In Canada, several worker-controlled occupational clinics have developed. In New York state, under the state health department, worker/public university-based occupational health services have developed. Currently in New York, there are eight clinics available where workers may bring their problems and expect help (personal communication: Landrigan, Melius, London, 1992). In Cincinnati, as of this writing, there is a clinic for occupational diseases, sponsored by the Central Labor Union.

The Worker as Teacher

In addition to the role of organized labor in the progress of occupational health, the role of individual workers must be recognized. Workers frequently understand the hazards of their occupations long before their employers or their doctors are willing to recognize them (Abrams, 1983). Edward Jenner, a physician in England in the 18th century, learned a lesson from dairymaids who, despite having been exposed to the occupational disease, cowpox, did not come down with the disease. From this knowledge, Jenner developed the small-

pox vaccine. Around the same time, Percival Pott inaugurated the study of environmental cancer when he observed cancers of the scrotum among the boy chimney sweeps of England.

Long before the excess incidence of lung cancer among uranium miners was scientifically documented, workers in the silver and uranium mines of central Europe were able to predict the outbreak of fatal lung diseases whenever a new vein of ore was discovered (Abrams, 1983).

Coal miners who complained of respiratory troubles were frequently dubbed malingerers. Those who persisted in their complaints of breathlessness were referred to psychiatrists. Had any of these physicians gone down into a mine? Had any of them seen a miner coughing up tenacious black sputum at the end of the day? Had any of them listened to their patients? (Abrams, 1983)

Failure to inquire and listen also resulted in missing the diagnoses of diseases such as angiosarcoma of the liver from vinyl chloride, lung cancer from bischloromethyl ether, and many others. All the more credit should be given to doctors who did listen: for example, Creech and Johnson (1974), whose patients were exposed to vinyl chloride, and Figueroa and Weiss (1973), whose patients dealt with bischloromethyl ether. Figueroa, a chest specialist at the University of Pennsylvania, was stimulated by the discovery of oat cell carcinoma in a nonsmoker from the Rohm and Haas Chemical plant. Denied access to company medical records, Figueroa pieced together an epidemiologic study by obtaining from his first patient the names of fellow workers who had lung cancer (Figueroa and Weiss, 1973).

DOCTORS AND SCIENTISTS

Sigerist once said, "We must see to it that the student entering medical school be an educated person . . . The physician must be at least as well educated as his patient if he is to assume leadership over him" (Sigerist, 1960). In 1700, Ramazzini observed that the patient is the source of our knowledge of occupational medicine. He urged physicians to inquire, "What is your occupation?" But two centuries later, Alice Hamilton made this trenchant comment: "The most interesting points about this history of phosphorous poisoning are that it proves that very serious poisoning may exist in an occupation . . . without

the medical profession knowing anything about it,” and, she added, “it is possible, through the arousing of public opinion to bring about such abolition in civilized lands, even when the industry involved is large, important, and influential” (Hamilton, 1925). Many years later, in 1965, Harriet Hardy wrote, “a critical fact in the failure to recognize beryllium poisoning is the ignorance of many physicians of the existence of industrial illness.”

In an incisive analysis of three major occupational and environmental episodes—lead poisoning, coal workers diseases, and asbestos-related diseases—Bayer et al. (1988) dissect out the forces at play: industry, labor, science, and government. In this array, science professionals appear as secondary, usually subservient, to the establishment.

One of the most vivid illustrations of this subservience is the now infamous quote from the letter written by a top industry executive to a prominent medical researcher: “It is our understanding that the results obtained will be considered the property of those who are advancing the required funds, who will determine whether, to what extent, and in what manner they shall be made public” (Abrams, 1992).

The physician-researcher agreed to this stipulation and, thus, contributed to the long delay in recognizing asbestos as a major occupational and public health hazard.

This is but a tiny fragment of the “hidden history” of occupational health—one in which some physicians and scientists have collaborated with industry in concealing and obscuring the occupational origin of many diseases. The unmasking of these “cover-ups” has been accomplished by courageous physicians, writers, lawyers, reformers, and others (Brodeur, 1985; Lilienfeld, 1991; Abrams, 1992).

In the lead poisoning story, the author demonstrates that

with few exceptions neither scientists nor engineers made any substantial effort . . . on behalf of workers . . . Those . . . from whom we might have expected greater concern—university affiliated researchers and those within the public health services—behaved in much the same way. The U.S. Public Health Service acted as if it were a service agency for corporate America, and university scientists were closely linked with the auto, oil, and lead industries. (Bayer, 1988)

Similar arguments were advanced by pundits in the coal tragedy:

“Miner’s asthma is . . . an ordinary condition that need cause no worry . . .” Scientific uncertainty, which characterizes virtually all our environmental health problems, is fully exploited by vested interests that, in the name of science, attempt to delay action—delay which often results in incurable illness and death, which could have been prevented.

One of the worst examples of preventable injury resulted from the actions of the federal governmental agency that was responsible for the production of nuclear weapons, the Department of Energy (DOE), as well as its predecessor agencies. For almost half a century, the health hazards to both workers and the general public were hidden behind a wall of secrecy, or were distorted by inadequate or biased reports. “Perhaps, most damaging of all was the violation of basic principles of unfettered scientific investigation. Secrecy is totally inappropriate in investigations of health and safety” (Geiger, 1992).

In one particular broadcast of the television program, “Nova,” which focused on trichloroethylene as a possible cause of childhood leukemia, a lawyer stated, “The law is more humane than medicine.” It is a charge that should provoke some thought (Nova, 1978).

In Bayer (1988), the authors conclude:

Historical reflection underscores that the scientific debate existed within, and contributed to, a framework of political economics which shaped the sciences and ultimately determined how science would be applied through public policy . . . the history of the 1969 Coal Mine Health and Safety Act underscores the importance of compelling scientists, doctors and engineers to confront the moral context and ethical implications of their work.

Sigerist (1960) pointed out that in most western countries

medical students are recruited from among the upper middle class and have no idea of what living and working conditions are in other social strata. Most of them have never seen what work is like in a coal mine, in a steel mill, in an office where 50 people work in the same room. In other words, they do not know the social environment from which their patients come.

Yet, today, medical students in the United States average only four hours of instruction in occupational medicine in the four year course.

Again, Sigerist (1960):

Whatever plans are being made for the future of medical services, they should provide for the physician to be economically independent of the patient. The doctor's prosperity should not depend on the ill health of his patients, and the doctor of the future will not wait for his fellow men to become sick but will teach them how to remain in good health and will be with them in the factories, on the farms, in offices, wherever people live and work and are exposed to illness and injuries. Medical schools must teach the student that the practice of medicine is not a trade but a social service . . . he must not be exposed to the indignity of having to sell his services on the open market.

“Social medicine is not so much a technique as rather an attitude and approach to the problems of medicine” which no doubt “will someday permeate the entire curriculum. . . .” “. . . occupational diseases are different from other diseases not biologically, but socially” (Sigerist, 1946).

Although physicians and other scientists have at times played subservient roles in this history, it is important to remember that many others have honestly fulfilled their oath of Hippocrates. The pantheon of heroes in the history of occupational medicine is large. Among them, we must especially note Ramazzini, Thackrah, Potts, McReady, Hamilton, Hardy, Hueper, Kerr, and Selikoff; those who, although not occupational specialists, contributed greatly: Johann Peter Frank and William Martland; and the compassionate and incisive medical historians, Sigerist and Rosen, who help us remember.

In recent times, Selikoff, a skilled clinician, teacher, and epidemiologist, by means of his studies and publications of asbestos-related diseases, not only contributed greatly to our knowledge, but also indirectly helped open the hitherto secret files of industry. Selikoff also pioneered, in the best sense of a doctor striving for the people, by working with the union representing the asbestos workers, utilizing their welfare and retirement records for his epidemiologic studies. He led the way for a whole new wave of science researchers by breaking away from the industrial control of research and bringing investigators closer to the workers, who are the victims of occupational disease and injury.

As a result of advances in science and technology, we now have the means to prevent illness on a large scale, “and now is the time to

reverse the relationship which has existed for the last 5,000 years between physician and patient. Instead of waiting for health to break down and patients to seek his advice, the doctor must become more and more an educator who looks out for potential patients wherever people congregate for work, in the factory, on the farm, and in the office” (Sigerist, 1956).

FUTURE HISTORY

Occupational health problems vary with the dynamics of industry. For example, while the United States in recent years has lost much of its heavy industry and has increased its service industries, we have seen the growth of new (or perhaps, only newly recognized) conditions, such as repetitive motion disabilities, multiple chemical sensitivities, and work-stress-related mental and physical ailments. However, the basic principles of worker protection remain the same.

In 1945, when the nuclear bombs were exploded, a whole new, yet familiar, set of environmental health concerns emerged: those of uranium miners, nuclear weapons workers, atomic energy workers, and people who are generally exposed to ionizing radiation in fallout. Yet, as we know, the basic principles of protection were already known, except that the dimensions of our effort have been greatly expanded. In addition to providing leaded barriers and exhaust ventilation, industrial hygiene had moved to the world societal level. As Einstein said, “. . . everything had changed except our way of thinking.”

As we approach the 21st century, the evolution of occupational and environmental health provisions will be shaped by how we manage such major issues as:

1. Control over the work process: hours and pace of work, workers' right to know, workers' right to participate in their safety and health protection, and quality of medical care.
2. Definition and recognition of work-related diseases and their prevention. The view must be broad to embrace not only diseases that are narrowly work-related, such as chemical poisonings, but also the wider group of conditions in which work and living conditions are interdependent, such as atherosclerotic heart disease, hypertension, many cancers, many respiratory conditions, musculoskeletal conditions, and mental illnesses.
3. Setting standards for health and safety.

4. The will of society to view work as a means to fulfillment—health as a result of work, rather than its casualty.
5. Relationships of the industrial plant and the surrounding community and between workers and other people in the community, in terms of the quality of life.

Satisfaction with work appears to be the best predictor of longevity—better than known medical or genetic factors—Dull and demeaning work, work over which the worker has little or no control . . . also contribute to an assortment of mental health problems . . . From the point of view of public policy, workers and society are bearing medical costs that have their genesis in the workplace and which could be avoided through preventive measures . . . well-documented experiments show that productivity increases and social problems decrease when workers participate in work decisions affecting their lives and when their responsibility for their work is buttressed by participation in profits. (Work in America, 1973)

According to the Swedish viewpoint, it is not enough that everyone have work, that people can freely choose between jobs, and that work be productive, but work must be performed in an environment that meets the requirements of physical and mental well being (Royal Ministry of Agriculture, 1971).

“I think most of us are looking for a calling, not a job. Most of us, like the assembly line worker, have jobs that are too small for our spirit. Jobs are not big enough for people” (Nora Watson, cited in Terkel, 1974).

The sociologist, C. Wright Mills (1951) provides an appropriate thought for this brief history of occupational medicine:

No moral endeavor, no political orientation, no human study that does not pay close attention to men at work, can possibly be adequate for our time. For work is affected by and in turn affects all that man is and all that he might become. The question we must ask of any society or of any social program is what kinds of men and women does it select, encourage, create? And in terms of this human evaluation, the most important question we can ask is whether work is a void in which men sacrifice themselves or whether work is a central feature of a style of life in which man may realize himself.

As the 20th century comes to a close, it is sobering to consider the wider catastrophes that have occurred in this century: Two world wars; the Holocaust; Hiroshima; Bhopal; Chernobyl; nuclear testing and contamination from our nuclear weapons plants; and, what may be in the final analysis the most invidious of our environmental problems, the assaults on our children by social dysfunction and by growing ethnic and racial intolerance (Davis, 1992; Geiger, 1992).

Our tremendous base of knowledge and the availability of effective scientific methods for the investigation and conquest of occupational and environmental health hazards should give us cause for optimism in achieving the objectives of the Occupational Safety & Health Act and the Environmental Protection Act. Political will is the issue.

Thus, "the history of occupational diseases is infinitely more than medical history . . . hazards and diseases changed with developing industries and whether any use was made of medical knowledge did not depend so much on the physicians as on the social organization under which the laborer performed his work . . . The history of occupational disease, therefore, reflects as in a mirror the history of industry and the history of labor, in other words some of the most important chapters in the history of human civilization" (Sigerist, 1943).

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REFERENCES

- ABRAMS, H.K. (1954). "Diatomaceous earth pneumoconiosis. Some sociomedical observations." *Am. J. Pub. Hlth.* 44 (May): 592-599.
- ABRAMS, H.K. (1983). "The worker as teacher." *Am. J. Ind. Med.* 4: 759-768.
- ABRAMS, H.K. (1986). "Working the fields." *OHS News* 2: 1-4.
- ABRAMS, H.K. (1992). "Some hidden history of occupational medicine." *Env. Res.* 59: 23-25.
- ASSENATO, G. and NAVARRO, V. (1980). "Workers' participation and control in Italy: The case of occupational medicine." *Int. J. Hlth. Svcs.* 10: 217-231.
- BANKS, D.E., MORRING, K.L., BOEHLECKE, B.A., ALTHOUSE, R.B.,

- and MERCHANT, J.A. (1981). "Silicosis in silica flour workers." *Am. Rev. Respir. Dis.* 124: 445-450.
- BAYER, R., ed. (1988). *The Health and Safety of Workers*. Oxford Univ. Press, N.Y.
- BECKWITH, G.C. (1992). "The myth of injury prevention incentives in workers compensation insurance." *New Solutions* 2: 52-68.
- BELLAMY, E. (1888). *Looking Backward*. Harvard Univ. Press (1967), Cambridge, MA.
- BINGHAM, E. (1992). "On the need for reform of the OSHA Act." *Am. J. Ind. Med.* 21: 891-893.
- BLACK, D. (1979). "The spirit of occupational medicine." *BMJ* 279: 1622-1676.
- BRODEUR, P. (1985). *Outrageous Misconduct*. Pantheon Press, N.Y.
- CAREY, M. (1837). "Appeal to the wealthy of the land, ladies as well as gentlemen, on the character, conduct, situation, and prospects of those whose sole dependency for subsistence is on the labor of their hands." Quoted in Schlesinger, A.M. (1946). pp. 132-134.
- CARSON, R. (1962). *Silent Spring*. Fawcett World Lib., N.Y.
- CHADWICK, E. (1842). *The Sanitary Condition of the Laboring Population of Great Britain*. Edinburgh Univ. Press, Edinburgh (1965).
- CHERNIAK, M. (1986). *The Hawk's Nest Incident, America's Worst Industrial Disaster*. Yale Univ. Press, New Haven.
- Children. (1818). *Information concerning The State of Children Employed in Cotton Factories for the use of both Houses of Parliament*. Manchester: J. Gleave, 196 Deansgate.
- CLEGHORN, S.N. (1915). "The Golf Links . . ." *Bartlett's Familiar Quotations* (1968). 14th ed., p. 940. Little Brown, Boston, MA.
- CLOUTIER, R.J. (1980). "Florence Kelley and the radium dial painters." *Health Physics* 39: 711-716.
- COMSTOCK, G.W., and McCLUNG, B., eds. (1973). *West Virginia Heritage*, Vols. 4 and 7. Heritage Foundation, Richwood, W.Va.
- CREECH, J.L. and JOHNSON, M.N. (1974). "Angiosarcoma of the liver in the manufacture of polyvinyl chloride." *J. Occup. Med.* 16: 150-151.
- DAVIS, A.M. (1992). "Health care after Chernobyl: Radiation, scarcity and fear." *PSR Quarterly* 2: 3-24.
- DERICKSON, A. (1992). "Making human junk: Child labor as a health issue in the progressive era." *Am. J. Pub. Hlth.* 82: 1280-1290.
- DEUTSCH, S. (1981). "Work environment, reform, and industrial democracy." *Sociology of Work and Occupations* 8: 180-194.
- ENCYCLOPEDIA BRITANNICA. (1974). 15th ed., p. 80. Chicago, IL.
- FALK, L. (1961). "Outline of history of industrial medical care." (unpublished).

- FELTON, J.S. (1976). "200 years of occupational medicine in the U.S." *J. Occ. Med.* 18: 809-817.
- FIGUEROA, W.G. and WEISS, W. (1973). "Lung cancer in chloromethyl ether workers." *New Engl. J. Med.* 288: 1096-1097.
- FISHMAN, A.P. (1988). *Pulmonary Diseases and Disorders*. 2nd ed., p. 829. McGraw-Hill, N.Y.
- FITCH, J.A. (1910). *The Steel Workers*. pp. VII-XIV, 57-71. Univ. of Pittsburgh Press, Pittsburgh, PA.
- FOX, A.J. (1990). "Socioeconomic differences in mortality and morbidity." *Scand. J. Soc. Med.* 18: 1-8.
- FOX, A.J. and ADELSTEIN, A.M. (1978). "Occupational mortality: Work or way of life." *J. Epid. & Comm. Hlth.* 32: 73-78.
- GEIGER, H.J. (1992). "Devastating the future." *PSR Quarterly* 2:1-2.
- GRANITE WORKERS UNION. (1905). "About the dust question." *Granite Cutters Journal* 29: July.
- HAMILTON, A., (1925). *Industrial Poisons in the U.S.* pp. 308-316. MacMillan, N.Y.
- HAMILTON, A., (1943). *Exploring the Dangerous Trades*. Little Brown, Boston.
- HARDY, H. (1965). "Beryllium poisoning: Lessons in control of man-made diseases." *New Engl. J. Med.* 273: 1188-1199.
- HOFFMAN, F.L. (1918). *Mortality from Respiratory Diseases in Dusty Trades*. USDL, Bureau Labor Statistics Bull. No. 231, Washington, D.C.
- HOSEY, A.D., ASHE, H.B., and TRASKO, V.M. (1958). "Control of silicosis in Vermont granite industry." U.S. DHEW PHS., Washington, D.C.
- HUNTER, D. (1975). *The Diseases of Occupations*. English Univ. Press, London.
- KERR, L. (1971). "Coal workers pneumoconiosis." *JAMA* 216: 1361-1362.
- KITIGAWA, E.M. and HAUSER, P.M. (1973). *Differential Mortality in the U.S.* p. 39. Harvard Univ. Press, Cambridge, MA.
- KOBER, G.M. and HANSON, W.C. (1916). *Diseases of Occupational and Vocational Hygiene*. Blakiston, Philadelphia, PA.
- KOBER, G.M. and HAYHURST, E.R. (1924). *Industrial Health*. Blakiston, Philadelphia, PA.
- LANZA, A.J. (1917). *Miner's Consumption*. U.S. Treasury Dept. PHS Pub. Health Bull. 85 GPO. pp. 25, 28. Washington, D.C.
- LILIENFELD, D.E. (1991). "The silence: The asbestos industry and early occupational cancer research—a case study." *Am. J. Pub. Hlth.* 81: 791-800.
- LINCOLN, A. (1861). *First annual message to Congress*. December 3.

- MARMOT, M.G. and McDOWELL, M.E. (1986). "Mortality decline and widening social inequalities." *Lancet*, August 2: 274-277.
- MARTLAND, H.S. (1929). "Occupational poisoning in manufacture of luminous watch dials." *JAMA* 92: 466-552.
- MARTLAND, H.S., CONLON, P. and KNEF, J.P. (1925). "Some unrecognized dangers in the use and handling of radioactive substances." *JAMA* 85: 23.
- McREADY, B.W. (1837). *On the Influence of Trades, Professions and Occupations in the U.S. in the Production of Disease*. Reprinted (1943) by The Johns Hopkins Univ. Press, Baltimore, MD.
- McWILLIAMS, C. (1939). *Factories in the field*. Little Brown, Boston, MA.
- McWILLIAMS, C. (1948). *Harvest of Shame*. Little Brown, Boston, MA.
- MEHLMAN, M.A. (1991). "Dangerous and cancer-causing properties of products and chemicals in the oil refining and petrochemical industry: Part I—Carcinogenicity of motor fuels: gasoline." *Toxicol. Ind. Hlth.* 7: 143-152.
- MEHLMAN, M.A. (1991). "Dangerous and cancer-causing properties of products and chemicals in the oil refining and petrochemical industry: Part VI—Human health and environmental hazards resulting from oil and oil products." *J. Clean Tech. & Environ. Sci.* 1: 103-121.
- MORRIS, J.N. (1990). "Inequalities in health: Ten years and little further on." *Lancet* 336: 491-493.
- NATIONAL SAFE WORKPLACE INSTITUTE. (1990). "Beyond Neglect: The Problem of Occupational Disease in the U.S." Labor Day '90 Report, Chicago, IL.
- NOVA. (1978). "Toxic Trials." WGBH Television, Deerfield, IL.
- OLIVER, Sir Thomas. (1902). Cited in Rosner, D. and Markowitz, G. (1991). p. 21.
- OFFICE OF POPULATION CENSUSES AND SURVEYS (OPCS). (1986a,b). "Office of Population Censuses and Surveys. UK, London." In: Report of Working Group on Inequalities in Health, the Black Report. (1988). Penguin, London.
- POLLACK, S.H., LANDRIGAN, P.J., and MALLINO, D.L. (1990). "Child labor in the 1990s: Prevalence and health hazards." *Ann. Rev. Publ. Hlth.* 1990: 359-375.
- RAMAZZINI, B. (1713). *Diseases of Workers*. Reprinted (1940) by Univ. of Chicago Press, Chicago.
- RANDALL, W.S. and SOLOMAN, S.D. (1977). *Building 6: The Tragedy at Bridesburg*. Little Brown, N.Y.
- REICH, M.R. and GOLDMAN, R.H. (1984). "Italian occupational health: Concepts, conflicts, implications." *Am. J. Pub. Hlth.* 74: 1031-1041.
- ROGOT, E., SORLIE, P.D., JOHNSON, H.J. (1992). "Life expectancy by

- employment status, income, and education in the National Longitudinal Mortality Study." *Publ. Hlth. Reports* 107: 457-460.
- ROSEN, G. (1947). Cited von Pettenkoffer in *Bull. Hist. Med.*, Vol. 21.
- ROSEN, G. (1974). *From Medical Police to Social Medicine*. Science History Pubs. New York.
- ROSENAU, M.J. (1935). *Preventive Medicine and Hygiene*. 6th ed., p. 1261. Appleton-Century, New York.
- ROSNER, D. and MARKOWITZ, G. (1987). *Dying for Work*. pp. 53-63, 208, 221. Indiana Univ. Press, Bloomington, IN.
- ROSNER, D. and MARKOWITZ, G. (1991). *Deadly Dust*. Princeton Univ. Press, Princeton, N.J.
- ROYAL MINISTRY OF AGRICULTURE. (1971). "The Human Work Environment. Swedish Experiences, Trends, and Future Problems." U.N. Conference on the Human Environment. Royal Ministry for Foreign Affairs, Royal Ministry of Agriculture, Sweden.
- SCHEPERS, G.W.H. (1965). "Remarks on asbestos disease." *Ann. N.Y. Acad. Sci.* 132: 246.
- SCHLESINGER, A.M. (1946). *The Age of Jackson*. Little Brown, Boston.
- SCOTT, R. (1974). *Muscle and Blood*. pp. 106-118. E.P. Dutton, N.Y.
- SHATTUCK, L. (1850). "Report of the Sanitary Commission of Massachusetts." Reprinted (1948) by Harvard Univ. Press, Cambridge, MA.
- SICHERMAN, B. (1984). *Alice Hamilton: A Life in Letters*. Harvard Univ. Press, Cambridge, MA.
- SIGERIST, H.E. (1933). *The Great Doctors*. pp. 338-340. Norton, New York.
- SIGERIST, H.E. (1941). Translation from German of "The value of health to a city," by M. von Pettenkoffer (1873). *Bull. Hist. Med.* 10: 605.
- SIGERIST, H.E. (1943). Quoted in Rosen, G. (1943). *The History of Miners' Diseases*. p. ix. Schuman, N.Y.
- SIGERIST, H.E. (1946). *The University at the Crossroads*. Schuman, N.Y.
- SIGERIST, H.E. (1956). *Landmarks in the History of Hygiene*. p. 65. Oxford, London.
- SIGERIST, H.E. (1960). *On the History of Medicine* (F. Marti-Ibanez, ed.). pp. 47-50. MD Publishers, New York.
- SIGERIST, H.E. (1960). *Remarks on social medicine in medical education*. In: *On the Sociology of Medicine* (M.I. Roemer, ed.). pp. 360-368. MD Publications, N.Y.
- SINCLAIR, U. (1906). *The Jungle*. A Signet Classic. New American Library.
- SMITH, B.E. (1981). "Black lung: The social production of disease." *Int. J. Hlth. Services* 11: 343-359.
- TERKEL, S. (1974). *Working*. p. xxiv. Pantheon Press, N.Y.
- THACKRAH, C.T. (1831). *The Effects of the Principal Arts, Trades and*

- Professions, and of Civic States and Habits of Living, on Health and Longevity, with Suggestions for the Removal of Many of the Agents which Produce Disease and Threaten the Duration of Life." 2nd ed. (1832). Longman, London. Cited in Sigerist (1960). pp. 54-55.
- U.S. OFFICE OF MANAGEMENT AND BUDGET. (1992). Occupational Health and Safety Letter. April 1.
- VILANILAM, J.V. (1981). "A historical and socioeconomic analysis of occupational safety and health in India." In: Health & Work Under Capitalism (V. Navarro and D. Berman, eds.). p. 254. Baywood, Farmingdale, N.Y.
- VON PETTENKOFFER, M. (1873). "The value of health to a city." Cited in Rosen (1974). p. 92.
- "Work in America." (1973). Report of a special task force to the Secretary of Health, Education, and Welfare. MIT Press, Cambridge, MA.
- WRIGHT-MILLS, C. (1951). "Man and Work." Symposium presented at North California Mental Health Association, Asilomar, CA.
- YOUNG, J.H. (1985). "The pig that fell into the privy: Upton Sinclair's *The Jungle* and the meat inspection amendments of 1906." Bull. Hist. Med. 59: 467-480.
- ZINN, H.A. (1980). A People's History of the United States. Harper & Row, New York, N.Y.