the glacier at the cirque front, even dashing a little upward on the opposite mountain side; and then, rushing down the steep glacial cascade where it cut off séracs and clogged crévasses, it divided on the convex surface of the lower glacier and overran both lateral moraines but failed to reach the mid-extremity of the tongue on the floor of the Allée blanche. The total distance traversed by the slide was about 8 kilometers according to the map, but only 5 according to the text; the total descent was from altitude 4,300 to 1,500 meters. The time of descent of the first slide on Nov. 14, as estimated by eye witnesses, was between 2 and 3 minutes; the velocity of movement was the greater because winter snows had not yet fallen on the ice in the great cirque. The volume of the slide was roughly estimated at between 4,000,000 and 5,000,000 cubic meters. Dust of rock and ice was spread by the wind blast of the slide, right and left of its course on the glacier and the mountain flanks, for a width of a kilometer or more; trees were overturned by the blast outside of the lower lateral moraines; a temporary lakelet was formed where the right lower branch of the slide, crossing the trough floor and ascending a little on the farther side, obstructed the Dora Baltea. The slide was evidently one of those spasmodic efforts by which the Alpine mountain faces, over-steepened by glacial sapping, try from time to time to regain more moderate slopes, such as they had in Preglacial time; but the volume of the fallen rock was but a trifling fraction of the spur from which it was detached.

W. M. D.

EXTRA-MUNDANE LIFE: A COMMENT

To the Editor of Science: In discussing the highly speculative subject of intelligent life in other worlds it is well to keep in mind two serviceable precepts of scientific reasoning: First, failure to prove that A is B is not a proof that A is not B. Thus, failure to furnish evidence that other worlds are inhabited by intelligent creatures is not to be construed as proof that such extramundane life does not exist. Second, of two discordant propositions: A is B; A is C; one of which must be true and for neither of which any evidence is forthcoming, we are intellectually bound to accord hospitality—not adoption but hospitality—to the one which is marked by the greater likelihood. Viewed without anthropometric bias this earth is, as we know, one of the less important members of the system to which it primarily belongs—a system dominated by a single undersized yellow star. If we had a time word corresponding to the space word *parsec,* and also had more definite geological knowledge of the past and future duration of this planet, we might express quantitatively the fact that the human race is relatively a mere episode in the history of the planet itself; while our increasing knowledge of the Milky Way with its encircled disk of stars must convince us that our solar system is, in turn, only an incident in the history of the stellar system to which it belongs. Which is more probable, that this one insignificant planet is the only world in which creatures capable of feeling and knowing have originated and developed, or that multitudes of other worlds have afforded both conditions and cause for life, including intelligent life, and are the homes of beings of both physical and mental parts. The latter supposition seems to be invested with incomparably greater likelihood.

Ellen Hayes

Wellesley, Mass.,
May 22

SCIENTIFIC BOOKS

The Health of the Industrial Worker. By Edgar L. Collis and Major Greenwood, containing a chapter on Reclamation of the Disabled by Arthur J. Collis and an introduction by Sir George Newman. London, J. & A. Churchill, 1921.

The appearance of the first English book on industrial hygiene could not have been more happily timed. With a combination of an industrial depression and a glutted labor market there is a widespread tendency among American managers to scrap the elaborate personnel machinery established during the war—"to safeguard the health and capacity of the

workmen . . . by sensible observance of the facts and teachings of physiological science."

The authors form a peculiarly authoritative combination. As late H. M. Medical Inspector of Factories, member of the Health of Munition Workers Committee and Director of Welfare and Health under the Ministry of Munitions, Dr. E. L. Collis brings to his task an unusual background of practical experience in preventive medicine and industry. Dr. Major Greenwood is probably the foremost British medical statistician. Both authors are members of the Industrial Fatigue Research Board.

The book is divided into four parts. In the first section an historical review of British industrial conditions preceding the eighteenth century is followed by an account of industrial legislation from the famous Ordinance of Laborers in 1349, following the Black Death, to the recent (1911) Coal Miners Act and Workmen's Compensation (Silicosis) Act of 1918. The first section closes with two valuable chapters on the utilization of statistical methods in industrial preventive medicine and the effects of industrial employment upon health as indicated by vital statistics. A study of the mortality and accident rates in the English coalfields has brought out a most suggestive correlation between the percentage of miners who voted in favor of a general strike in August, 1920, and the regional mortality distribution. In Nottinghamshire where deaths and accidents are at a minimum, only 55 per cent. of the miners favored a general strike while in Lancashire where conditions are the worst of any English coalfield, unrest was likewise at a maximum since 89.7 per cent. of the miners voted to strike. These figures indicate a deep-lying relation betwen social unrest and health conditions.

In the second part of the book a chapter is devoted to each of the following subjects: Fatigue, tuberculosis, cancer, accidents and the industrial employment of women.

> No matter in the whole field of industrial hygiene is of more fundamental importance than the occurrence of fatigue. Researches . . . into the way in which the human machine works, are showing that optimum output is obtained by not allowing fatigue to exceed physiological limits: that the goal of the economist—output—can be best attained through the same agencies as allow the medical man to obtain his objective—health.

The authors place little faith in the so-called direct tests for fatigue and caution against conclusions regarding fatigue that have been drawn from output, sickness and turnover figures, except in cases where working conditions are remarkably uniform.

The problem of industrial tuberculosis is summed up as follows:

> Not through any special intensive measures of campaigning against the tubercle bacillus, not even by the segregation of the actively tuberculous, does there seem any real hope of salvation. We have to improve the homes of the working classes in the first place—it is a sound popular instinct that inspires the popular outcry against urban and even rural housing conditions: in the second place, we have to ensure better factory conditions. We require regulations of the hours and intensity of work, of the physical characters of the atmosphere, and of the quantity and quality of the meals taken, so that the workman returning home shall not reach it in a condition of definitely lowered resistance to an infection which must still be regarded as ubiquitous.

Pathological fatigue, inadequate ventilation and insufficient food are believed to be the three outstanding disposing factors to tuberculosis among industrial workers.

Although tuberculosis has been steadily decreasing, "the sudden change which has taken place in the conditions of life consequent upon the development of modern industry, has been associated with a rapid rise in cancer mortality, and this rise is greatest where modern industry is most developed." In a selected group of occupations (1900–02) the mortality from cancer in England and Wales was greatest among chimney sweeps and seamen and least among farmers and grocers. Chimney sweeps' cancer seems to be directly associated with their occupation; in Belgium, where coal like English coal is used, there is almost complete immunity, but great care is taken to prevent contact with soot. No explanation is offered for the increasing cancer

mortality which parallels advancing industrialism.

A study of British industrial accident statistics for 1913 has shown that more fatalities resulted from persons falling than from machinery moved by mechanical power. This fact suggests a high proportion of preventable accidents and further studies have indeed shown that 60 to 80 per cent. of all industrial accidents are apparently due to mistakes on the part of the workers. Safeguarding of machinery alone has not been found to reduce accidents more than 10 per cent.—a result which conforms with American experience. The interesting studies of Greenwood and Woods regarding predisposition to accidents are presented in considerable detail and additional evidence is advanced corroborating their conclusion that a trivial accident indicates a susceptible worker.

> A worker who has had three trivial accidents is a more dangerous person than one who has had a single bad wound.

In the chapter on the industrial employment of women the authors have presented a thoughtful analysis of the physical, physiological and psychological aptitudes and shortcomings of women. The commonly accepted physical inferiority of women they believe may be due to lack of physical training rather than actual structural capacity. The problem of the expectant mother was successfully met by the Ministry of Munitions by establishing a light employment dêpot.

> Overalls and gloves were made and mended and other sewing work was done by expectant mothers drawn from several factories in a district. The hours of work were shorter than normal, and the workers were paid on a time basis. Milk was given in the morning, a good meal mid-day, tea in the afternoon, and a rest room provided.—The women readily availed themselves of these facilities; lost time was negligible, and work was so well done that the dêpot was a financial success.

Although the authors admit "that the effect of plumbism in causing miscarriage and still births is a sufficient reason for excluding females from exposure to lead fumes . . ." they "are unaware of any scientific evidence in support of the alleged sexual proclivity." This conclusion is contrary to the findings of Oliver, Legge and Goodby.

The third part of the book consists of a practical discussion of industrial food requirements, ventilation, lighting and general sanitary accommodations. Attention is again directed to the disproportionately high percentage of wages required for the purchase of adequate food in the case of workers on "heavy jobs," jobs that require 3,800 calories as compared with 2,800 calories for light work. According to the calculations of Greenwood, Hodson and Tebb workers in the former class must spend nearly 13 s. weekly for food alone while in the latter case 10 s. will suffice. The practical problem is complicated by the fact that remuneration is less in the case of heavy jobs than for operations needing many fewer calories. In calculating working men's budgets the physiological demands of specific occupations must therefore be taken into consideration.

The value of the chapter on ventilation might have been considerably enhanced by a discussion of some of the methods for dust determination and the presentation of E. V. Hill's "zone of comfort" chart. The report of the New York Ventilation Commission should certainly be included in the bibliography. On page 327, Fig. 26-B presents a somewhat unfortunate example of "good lighting." The intense local illumination and the consequent deep shadows and contrasts are certainly not in keeping with the best modern practise. American experience has shown that a high general illumination with local illumination reduced to a minimum gives the most satisfactory results.

The fourth section of the book will be of particular interest to industrial physicians and nurses, personnel managers and social service workers. In the opinion of the reviewer a discussion of the physical standardization of jobs, for example by Martin's method, would have been a welcome addition to the chapter on "Supervision of Industrial Health." There is far too great a tendency to depend upon such qualifications as "short

and wiry" or "tall and flabby" (p. 381) in placing prospective workers. What we have to know is the limits of physical strength required for specific jobs. Similarly the question of heart efficiency as studied by Lowsley, Crampton and Schneider in this country would be of interest to the industrial physician. The omission of the nine figures illustrating the application of iodine and finger bandages (pp. 397–400) would provide ample space for such a discussion.

The maintenance of high production in any field of activity depends upon the health of the workers. Industrial hygiene need therefore make no appeal to the charity or humanity of industrial managers. It is primarily good business. Efficient, healthy, productive men and women have a social value whether their production is for service or for profits. Under any system of social organization industrial hygiene must therefore play a leading rôle in the future development of the world's industry.

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SPECIAL ARTICLES

SOIL ACIDITY THE RESULTANT OF CHEMICAL PHENOMENA

SALTS of strong acids with strong bases, of strong acids with weak bases, of weak acids with strong bases, of weak acids with weak bases, calcium hydroxide, the lowering of the freezing point, the catalysis of esters and the hydrogen electrode are all in use in one or another of the various methods advocated for the determination of "soil acidity." The results obtained by the different methods show that the condition of a soil at any time can be considered as its progress towards a constantly changing equilibrium according to the principles of Le Chatelier. It is to be remembered that those metallic elements occurring in ordinary soil stand at the top of the electromotive series of elements and that sodium and potassium compounds are all somewhat soluble; whereas, many calcium and magnesium compounds and most iron and aluminum compounds are very sparingly soluble in water.

The entirely different results obtained with different salts, and the large variations in soil acidity recently found by Conner when soils were kept at different moisture contents, make it certain that acid soils usually contain many soluble hydrolytic products which are controlled in amount by the quantity of alkaline earths and alkali metals present in the soil.

Carbon dioxide gas has long been known to cause many chemical changes in silicates and phosphates resulting in the increased solubilities of constituents making up these substances. The following results were obtained in recent investigations where soils in culture pots were treated with carbon dioxide. (The details of the different experiments will be published elsewhere.)

1. An "alkaline" sandy soil became acid in reaction in three months treatment with carbon dioxide gas.

2. The acidity of an acid brown silt loam was increased by treating the soil with carbon dioxide gas.

3. Liming this loam decreased its acidity but not as much as the original "lime requirement" determination (Veitch) indicated. One and one half times the total lime requirement did not neutralize the soil.

4. Where the soil was limed, limed and phosphated, and limed and treated with dried blood or sodium nitrate, carbon dioxide gas additions to the soil increased the soil acidity.

5. The specific conductivity of extracts obtained on treating the soils with conductivity water showed that the carbon dioxide gas had changed the constitution of the soil. The specific conductivity of the carbon dioxide treated soils was greater.

6. The acidity of the soils was lowered by extraction with conductivity water and the lowering was greater for those samples which had been subjected to the carbon dioxide treatments. A further evidence that the acidity was due to chemical changes in the soil was that the aluminum and iron in the normal potassium nitrate extracts was effected by the carbon dioxide treatments.