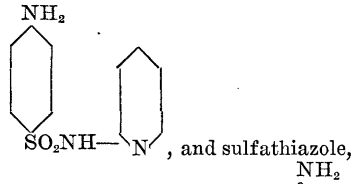
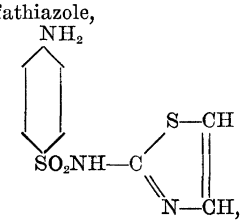
are inactive. This difference in behavior suggests that sulfanilamide must possess some significant property not shared by the other two members of the family. This must be responsible for its activity. Just how it acts and on what it acts are not definitely established. At present it is safe to say that the drug retards the growth of bacteria. Whether this is primarily due to changes brought about in the cycle of events involved in the reproduction of the cells or whether it concerns the food-assimilating functions of the bacteria can not be determined from the available evidence. It is evident that a thorough study of the metabolism and growth of bacteria with active and inactive sulfanilamides should throw some light on the important features of the mode of action of the drugs. The solution of this problem will serve to establish a fundamental basis for the further study of chemotherapy of infectious diseases.

The results obtained with sulfanilamide have been, in many cases, dramatic. In the short time it has been in use it has proved particularly effective in the treatment of infectious diseases, such as erysipelas, scarlet fever, tonsilitis, mastoiditis, meningitis (both streptococcal and meningococcal), peritonitis, puerperal fever, septicemia, osteomyelitis, streptococcal pneumonia and gonorrhea. Infections that proved fatal in practically all cases now clear up with its aid, and recovery follows. Many lives have been snatched from the jaws of death with it.

Of the sulfanilamide derivatives that have proved to be effective in experimental infections, sulfapyridine,



, and sulfathiazole,



appear at present to be particularly important. They are better than sulfanilamide against pneumococcal and staphylococcal infections. Sulfapyridine has been tested clinically and its value as a drug for the treatment of pneumonia established. In experimental pneumococcal infections sulfathiazole appears to be about as good as sulfapyridine, but not sufficient clinical data are yet available to show what place it will take in the chemotherapy of pneumonia. At present the evidence shows the product to be superior to both sulfanilamide and sulfapyridine in the treatment of staphylococcal infections. Further clinical evidence is needed to show its relative importance as a therapeutic agent.

The scope of chemotherapy is wide. Daily, new results appear showing that the sulfanilamides have helped in this and in that disease. There is some evidence that sulfanilamide and certain of its derivatives have a beneficial effect on the course of experimental tuberculosis in guinea pigs, but so far the clinical experiments have not demonstrated that they are valuable therapeutic agents for the treatment of tuberculosis in humans. There is also some evidence that certain of the sulfanilamides are effective for the treatment of gas gangrene, trachoma, undulant fever and lymphopathia venereum.

Enough has been said to indicate that real progress has been made in chemotherapy during the past few years. The results justify the hope that in the not too distant future a definite basis may be established for an understanding of the physical and chemical processes involved in health and disease. Then, the complexity of the human organism with its delicately adjusted mechanism will be better understood and appreciated. It will be seen that man is not necessarily "the animal of the wig, the ear-trumpet, the glass eye, the porcelain teeth, the wooden leg, the silver windpipe"—"a creature that is all mended from top to bottom"—"a basketful of pestilent corruption, provided for the support and entertainment of microbes"; but instead he is "a shop of rules, a well-trussed pack, whose every parcel underwrites a Law." He is a part of a great experiment. His life is like a string of many different colored beads whose beauty and usefulness depend upon the cord that binds them together in unity of pattern and purpose.

LO, THE POOR WHALE!

By Dr. ROBERT CUSHMAN MURPHY

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INFORMATION submitted to the International Whaling Conferences of the past three years discloses the long-expected decline of the fishery in its last and richest field, the Far South. The true measure of the decline lies not in the absolute number of whales killed, which may have been greater than ever before, but rather in the number taken per catching unit. On this basis the 1938–39 season is to be reckoned the

poorest in Antarctic history unless the season that ended in March, 1940, proves even worse. Detailed figures for neither period have yet been published.

Despite the publicity given to modern whaling, most Americans probably still think that the peak of slaughter on the high sea came at some time between the era of "Moby Dick" and the fading away of the Yankee fleet toward the close of the nineteenth century. In 1846, 736 American whaleships, and 230 craft of other nations, were cruising. New Bedford, the last stronghold, reached its top in 1857, when 329 vessels and 10,000 seamen called that city their home port.

It is possible that in the heyday of oldtime whaling as many as 12,000 great "fish," comprising sperm whales, right whales, bowheads and humpbacks, may have fallen within a single calendar year to all the hand harpoons and lances in action. The oil produced in 1846 by American crews from twenty-seven ports, according to Starbuck's tables of the year 1878,[1] totalled 302,918 barrels of thirty-one and one half gallons. Taking into account the average yield of the species forming the prey, this might indicate a kill of approximately 7,500 whales by ships under our flag alone.

All such older records pale into insignificance when compared with those for the recent world catch, as issued annually or more often by the Committee for International Whaling Statistics. Between 1920 and 1940 approximately half as many whales were killed as during the whole preceding history of whaling. The total for three centuries (1620–1920) is believed to have been not more than a million, or an average of about 3,000 whales a year. Subsequently the average has been well above 25,000 a year.[2] The columns for 1937–38 show a slaughter of 54,664 whales, the largest number ever killed; 46,039 of these were taken in Antarctic waters within a summer period extending from October or November at least into April, the remaining 8,625 during part or all of a twelve-month season in the Arctic, the North Pacific, the North Atlantic, along the African coast and off the shores of South America and Australia.[3] The number of whales killed in all waters between 1919 and 1938, inclusive, reaches the staggering total of 543,622. Details of oil production, in barrels of the modern fifty-gallon capacity, are available for a still longer period; between 1909 and 1938 it summed up to 40,257,700 barrels.

[1] U. S. Commission of Fish and Fisheries, part IV, Report of the Commissioner for 1875–1876, Appendix A, pp. 434–442, Washington, 1878.

[2] *Cf.* "Whales." Hearing before a special committee on wild life resources, United States Senate, 72d Congress, 1st Session, Washington, 1931; testimony of A. B. Howell, p. 2, and of Remington Kellogg, p. 21.

[3] "International Whaling Statistics," edited by the Committee for Whaling Statistics appointed by the Norwegian Government, XIII, Oslo, 1939; also parts I–XII, Oslo, 1930–1939.

Such figures verge on the astronomical—or the numerical ideas associated with the current price of public administration! The stupendous quantities of flesh and blood now being taken from the sea by whaling operations can be grasped, perhaps, only by reference to the size of an individual whale. Eighty-two feet is about the average length of all the blue whales caught during the decade ending in 1938. A carcass of the sort might weigh eighty tons, the equivalent of twenty male African elephants or of more than a thousand men. The human species, it must be remembered, represents in the world of to-day neither a small nor an average-sized animal, but a relatively huge one. There are, indeed, only a few hundred kinds of creatures of greater bulk than man himself, these comprising numerous other mammals, certain fishes and reptiles, a handful of flightless ostrich-like birds and a few invertebrates such as giant squids. But about a million and a half described species are so much smaller than man, in varying degree, that an average drawn from one full-grown example of each of the known kinds, whales included, would give us a product not very different in size from a housefly.

The vital statistics tabulated in several hundred pages of the Norwegian reports referred to above were not compiled with the object of satisfying idle curiosity. Their inception lay in a deep-seated concern for waning resources needed by all nations and indispensable for the well-being of several. The original recommendation came from the International Council for the Study of the Sea, at a meeting held at London on April 10, 1929, which led in turn to the organizing of a central bureau by the Norwegian Government and to the first publication, in 1930, of tables covering the preceding ten-year period. Subsequently the committee still further extended the record by compiling, from all sources, figures relating to modern steam-whaling from its beginning off the northern coast of Norway in 1868. The first thirty-five years of such whaling proved relatively picayune, the largest annual number of victims during the nineteenth century being 1,993 whales, taken in 1898. It was not until 1904, with the entry of steam-catchers into the Atlantic section of the Antarctic, that the kill began to mount into impressive figures.

As a business proposition modern whaling has had its vagaries, a local falling off in the returns becoming apparent as soon as the size and perfection of equipment proved too formidable for the stock of whales to bear. The Newfoundland whale fishery, for example, began from shore stations in 1898, reached its peak in 1904 (1,276 whales), and fell away to five catching-craft and a negligible return in 1913. Whaling from the Norwegian coast and from many other northern-hemisphere stations has had a similar history, but the opening of the Antarctic grounds lent

an enormous new impetus to the exploitation of wealth which, fallaciously, seemed "inexhaustible."

The first sign of unmistakable danger showed itself in a shift in the species of whales that made up the preponderant part of the catch at South Georgia, 1,200 miles east of Cape Horn. Originally more than 95 per cent. of the whales there captured were humpbacks, but as these became rapidly decimated the trend was progressively toward the finback and blue whales, which have lately been the mainstay of the fishery. The blue whale, with a length sometimes exceeding 100 feet, is the largest creature that lives in the world to-day or that ever has lived. In the average summations of whalemen, with reference to derivation of oil, fertilizer and other products, one blue whale is taken to equal two finbacks, two and a half humpbacks or six sei-whales.

The first restriction in pelagic whaling came in 1932, purely as a result of economic necessity. The whale oil market was glutted and Norway's great fleet remained in port. Only Japanese shore-whaling has shown a rather consistent balance, related to supply and demand at home rather than to the uncertainties of a world market. This is because the whales taken in Japan have always been used primarily as human food, for which reason each carcass can be made to yield a far higher monetary return than that based principally upon the sale of oil. Between 1910 and 1932 Japanese domestic whale-catchers have at no time been fewer than twenty nor more than thirty-five. Throughout this period the average number of whales taken annually by each boat has been fifty-five, or roughly one a week, as against a corresponding annual average of 188 for waters around South Georgia. These Japanese data, however, refer only to vessels working offshore from home ports. Between November 1, 1937, and March 26, 1938, as well as during the two subsequent southern-summer seasons, Japan has carried on whaling in the Antarctic Ocean, with at least four floating factories and thirty catchers, entirely unimpeded by the limitations that other whaling nations have finally imposed upon themselves.

The first voluntary attempts to reduce the number of whales killed were influenced by the world financial crisis and realized by agreement between commercial companies. In this move labor had an equal share with capital, even to the point of threatening a general strike. The whale quota, that is the absolute number of animals in "blue whale equivalents" which each company was entitled to shoot, was mutually determined, in addition to which special efforts were made to assure the utmost possible recovery from each carcass. Cow whales seen to be accompanied by calves were granted immunity at all seasons. With very few exceptions, such regulations seem to have been scrupulously honored. Under the stimulus of action by the Norwegian Parliament in 1934, all Norwegian companies and all but two of the foreign whaling companies then operating in the Antarctic further accepted seasonal restrictions in waters south of latitude 50° S., and showed evidence of enlightened self-interest, if not of humanitarianism, by endeavoring to cooperate heartily with purely scientific investigations into the life history of whales, such as those sponsored by the British Discovery Committee. Gradually all whaling concerns have entered the concordat, with the exception of the Japanese.

Notwithstanding these commendable attempts to repair a situation so palpably intolerable that it could end only in disaster, successive reports of the Committee on International Whaling Statistics during the 1930's developed a monotonous tone in reporting that the previous season's catch had again been "the largest ever recorded." In 1936 the governments of Great Britain and Norway pledged themselves to curtail the season everywhere south of 40° S. latitude to the short period between December 8 and March 7, and still further to cut down the number of whale-catchers entitled to accompany each floating factory. During the following season, however, two Japanese expeditions and one German conducted their carnage without restrictions of any sort.

Ultimately, in June, 1937, the situation attained full-fledged international status as regards the richest and ultimate field, namely, all the free waters and national territories lying beyond latitude 40° S. Stringent regulations for this great area, even to "game laws" covering a minimum legal size for whales of each species, were officially approved by the South African Union, Argentina, Australia, Germany, Great Britain, Ireland, Northern Ireland, New Zealand and the United States; only Japan, among the effective nations, still proved recalcitrant.

German pelagic whaling has, of course, been interrupted by the war. Whether it can ever be resumed is at least questionable because many of the leading Norwegian operators are now convinced that the whole exploitation is certain to fall below its practicable economic threshold within the next five years. German whaling aims are concerned largely with food-fats, specifically whale-oil margarine, which are also of prime importance in the Scandinavian countries and elsewhere. American consumption of the oil, on the other hand, has thus far related chiefly to the manufacture of soap. The ambitious nature of the German program is set forth in the best compendium yet published.[3] This deals with Antarctic colonization and the oceanic environment, the history of

[3] Nicolaus Peters, editor. "Der neue deutsche Walfang." 237 pp. Hamburg, 1938.

whaling, problems of international regulation, the newly built German fleet, catching and reducing methods and equipment, the biology of whales and the nature and chemistry of both raw materials and derivatives. The book is fully illustrated and closes with a well selected bibliography of 182 titles and an index. Particularly informing are the tables listing, as of 1938, the mother-ships, oil and guano reduction plants and 432 whale-catching vessels of 61 commercial companies representing ten nations, the British Empire being treated as a unit.

In 1938–39, twenty-eight floating factories, with individual registered tonnages up to 21,846, and 281 whale-catchers were at work in Antarctic waters. In 1939–40, the average number of catchers per mother-ship is stated to have been still higher, though precise figures are not yet available. The Japanese ships carried larger crews than similar vessels under other flags, but Japanese oil recovery per whale was the lowest in the field. Somewhat more than 11,000 men are now engaged in Antarctic whaling; the oil from Antarctic waters totaled during the latest season of record (1937–38) more than half a million tons, which fetched an average price of $65.00 a ton, or only 50 per cent. of the *lowest* mean annual value for an earlier thirty-year term (1900–1929). The number of whales being slain is at least fourfold what the oceans can endure on a long-term basis, yet the goal of reasonable, and hence perpetual, utilization seems farther off than ever.

OBITUARY

FRIEDRICH EMICH

1860–1940

FRIEDRICH EMICH, professor emeritus of chemistry at the Polytechnic Institute of Graz, Austria, the originator of modern microchemistry, died at his home in Graz on January 22, 1940. He was born there on September 5, 1860, and received his primary and preparatory schooling in Laibach (at present Yugoslavia). He then attended the Polytechnic Institute in Graz from 1879 to 1884, majoring in chemistry. Four years later he was admitted to the faculty of the same institute as "privatdozent," becoming associate professor of chemistry the following year. In 1894 he was appointed to full professorship, a position which he held until his retirement in 1931. He was repeatedly elected dean and chancellor of the institute.

In recognition of his scientific achievements he was awarded several honorary doctor's degrees and was decorated by both the Imperial and the Republican Governments of Austria. In 1918 he was appointed corresponding member of the Austrian Academy of Science and became full member of that organization in 1928.

From 1882 to 1890 his scientific papers were chiefly in the field of organic chemistry, while from about 1890 to 1905 a series of papers in organic and general chemistry were published. The first microchemical paper appeared in 1893, dealing with a qualitative test for sulfur. His systematic investigations in microchemistry began not until seven years later and culminated in 1911 in the publication of the still standard microchemical text, "Lehrbuch der Mikrochemie." His most important contributions in the field of microchemistry included a comprehensive treatise on microbalances (1915), the development of methods of capillary technique (1915–1920), quantitative inorganic analysis (1920–1926), application of Schlieren phenomena to chemical reaction studies (1926–1931) leading to his final contribution in 1936, "Observation of Changes at the Critical Temperature of Certain Gases by Means of the 'Schlieren-Microscope.'"

In the field of organic microchemistry, that branch of microchemistry which overshadows in importance all others and which was universally recognized with the reward of the Nobel prize in chemistry to the late Professor F. Pregl, also of Graz, Professor F. Emich made the first and pioneering contributions, such as the micro Carius and Kjehldahl determinations. These initial successes of F. Emich formed the foundation upon which later the entire field of quantitative organic microanalysis was built by his colleague, F. Pregl. Thus the work of these two eminent Austrian scientists, the cautious and eminently refined technique of F. Emich and the sure and successful practical application of F. Pregl, eventually blended into one of the outstanding scientific monuments of former Austria.

Their contributions revolutionized organic chemical research, inasmuch as modern investigations in the field of hormones and vitamins could not possibly have been brought to the present heights without the combined work of these two investigators, whose lives were in many respects so similar. Their work was also not without due influence in the United States. Pregl's methods were introduced here in 1925 and Emich's in 1929. The American Chemical Society soon recognized the importance of this new branch of chemistry by establishing the Division of Microchemistry.

Professor F. Emich, who is survived by his wife and two daughters, was the ideal of a pure scientist. Possessed of an extremely pleasing but nevertheless commanding personality, he combined thorough scientific knowledge with supreme refinement of experimental technique and infinite patience. Being a superb