THE NAVY AND ITS HEALTH PROBLEMS.

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THE history of hygiene is one that is replete in military and in civil lines with names of eminent achievement. I wonder if we all fully appreciate, or does familiarity blind us to the fact that we have in our midst and have just been listening to, one whose name will go down in the pages of history as equal, in his benefit to the human race, to the greatest of those who have preceded him. The man who made the Panama Canal possible will never be forgotten by future history.

Gentlemen: Hygiene is of all ages and hygiene is in itself civilization. That which constitutes the gradual and imperceptible advance from a barbaric state to that of our present luxury and safety in our civil life is but hygiene. It has always been a matter of romantic interest to me to watch the gradual development of naval hygiene, impelled by the spurs that have made all progress in hygiene possible, the crowded conditions that have presented themselves in ship life as in civil life. Whether recognized as such or not, naval hygiene has necessarily been a concomitant of the life of all mariners since the first frail barque ventured upon the Mediterranean or skirted the shores of the mysterious and unknown Atlantic. Inconveniences and hardships have been and always will be experienced where men endeavor to live, to work or to fight in the unnatural surroundings of ship life. In the earliest days unconscious efforts in hygiene were directed toward the retention of life, in order to make maritime traffic and warfare possible in these surroundings. Efforts at amelioration of overcrowding aimed no higher.

As far back as the history of the world has been chronicled, the seas have been navigated and nations have bartered and have fought. The Hebrews, Phœnicians, Greeks, Carthaginians, Romans, and Britons have all shared in the development and the mastery of the sea, and by the increasing boldness of their cruising created the major hygienic problems that have confronted us ever since.

The stanchness of construction found necessary to combat the wildness and buffets of the larger seas, the greater storage space for distant cruises, made necessary an increasing number of decks to house personnel and stores. The comparative slowness of naval architecture may be typified by the fact that the *Great Harry*, built in 1545, the pride of the English Navy of that day, was 138 feet long, 36 feet wide, and carried 80 guns; and in vessels materially smaller than this Columbus discovered new continents, DaGama rounded the Cape of Good Hope, and Magellan's ships circum-

navigated the globe. Developments in number, size and armament were rapid thereafter, spurred largely by the spirit of exploration and conquest created by the discovery of new worlds and by the inereasing rivalry for the mastery of the seas by the English, Dutch, French and Spanish. The study and application of hygienic principles became a steady problem with the development of larger fleets. In the last 500 years the study of naval hygiene may be considered as the study of hygiene of the British Fleet.

It has not been until the last 100 years that distant fleet cruising has been feasible without terrible loss of life. Epidemic fevers, hunger, and scurvy have demanded toll by thousands. The problems that were met in that day are problems that are met today; improper ventilation, unsatisfactory humidity, poor light, and deficient or defective food and water, all in connection with constant and unavoidable overcrowding. I might almost say that only one problem that has arisen in the hygiene of cruising ships in past history has been satisfactorily solved, that is, the once terrible menace of scurvy. We owe it to James Lind's discoveries and to Sir Gilbert Blane's vigorous enactment thereof that this scourge has been eradicated as a fleet menace. In his Treatise on the Scurvy, Lind said: "In the late war scurvy cut off more valuable lives in our fleet than the united efforts of the French and Spanish arms." Commodore Anson in his famous voyage round the world in the first nine months lost 666 men out of 961.

It was not, however, until the year 1797 that the systematic use of lime-juice was introduced into the British Navy through the importunate solicitation of Sir Gilbert Blane. This fortunate circumstance was brought about in consequence of the alarm created by the prevalence of scurvy in the fleet under the command of Lord Howe in the spring of 1795, the outbreak being traceable to causes highly analagous to those which induced the epidemic on former occasions, namely, the deprivation of fresh vegetables. So prevalent was scurvy in this fleet and so much enfeebled were the crews by its visitation, that the ships were rendered quite inefficient and the safety of the empire became in consequence absolutely imperilled.

The remarkable success, from a hygienic point of view, achieved by Captain Cook in his three year voyage around the world in which with a crew of 118 men he lost only four men, two from drowning, one from a fall, and only one from disease, are attributable to his observance of hygienic common sense and the observation and deductions of James Lind. His measures consisted in providing a dry and well ventilated ship, storing it with good provisions, a supply of lemon juice, and an abundant supply of fresh water, fresh vegetables and fruit at every port when procurable. Great pains were taken to see that the men kept themselves clean, and that the hammocks, bedding and clothes were kept clean and dry.

With scurvy eliminated the chief problem that the mariner of old had to contend with, which is not encoun-

tered at the present time, at least in naval cruising, is that of the moisture and over-humidity encountered in wooden ships, particularly those of many decks. The chief concern of naval hygienists of the last century, and only materially obviated by the use of steel and iron, was that of the constant moisture and over-humidity below decks due to the necessity of cleanliness and the difficulty in reducing the heavy moisture incident thereto. Many conditions which we know from our present knowledge to have been due to extraneous causes, such as the epidemic influences producing yellow fever and typhus, were attributed to the baneful influences of the humidity below decks. Ventilation, other than natural, was procured in those days only by means of windsails; light came from a tallow candle or oil lantern; food for longer voyages was necessarily dried or salted; and water was carried in hogsheads or tanks that were refilled at the various ports of call, even though its source might be doubtful.

In contrast to these conditions, gentlemen, let me outline what may be unfamiliar to many of you, our modern methods of ventilation aboard ship. Artificial ventilation may consist either in supplying a large abundance of fresh air, diluting or driving out the impurities in the living spaces, what we call the supply system, or secondly the method whereby we exhaust from the living spaces the vitiated air. This latter method is rarely used alone but it is used as supplemental to the supply or plenum system.

In the supply system large intakes are situated at such points as will insure the greatest purity of supply with least possibility of contamination. The air is driven by large fans throughout the ship, in branching and diminishing channels similar to the arteries and capillaries of the human circulatory system. The needed supply for the various living spaces varies with the complement living or working therein, and mathematical accuracy is possible in estimating and delivering to the various living spaces the amount of air necessary for the hygienic well-being of their personnel. Living spaces that never see sun or daylight and that are never reached by the natural channels of ventilation are rendered perfectly and hygienically habitable by such methods. There are many such individual systems throughout the ship and compartments vary widely in their demands as regards the character and quantity of air supply. An effort is made as far as possible to include in the ramifications of one trunk line spaces of similar demand. Heat is supplied through the same channels by installing large heating systems called thermo-tanks in these various trunks. A much more beneficial and economical distribution of heat is possible by this method than by that of a number of scattered radiators with their necessarily greater ramification of steam lines.

With a carefully controlled supervision of these various heating units, and by an effort in their installation to secure a uniformity as regards their demand for heat, a remarkably successful combination of ventilation and

heating has been achieved. In contrast to the old problem of excessive humidity and its deleterious effects we have now in consequence of this arrangement very frequently an overdrying of the air, particularly objectionable in its effects upon the mucous membranes of the nose and throat. Various efforts are now being made to overcome these objections, none as yet entirely successful. The method of washing and consequently purifying as well as humidifying the incoming air as practised in our larger hospitals and institutions, is impracticable in ship life for various reasons.

The lighting of the modern battleship presents many more problems than does the similar achievement in the schoolroom or in the factory. That character of lighting most suited to the individual space, either the direct, the indirect or the semi-indirect is utilized, and the character, size and position of the various lighting units are carefully studied. Luckily the powerful heating plant necessary to the maintenance of such a tremendous structure as our modern battleships, provides an abundance of energy for the maintenance of the very extensive lighting system necessary for a structure 1,000 feet long, 7 to 9 decks deep, and housing a personnel of 1,000 to 1,500 men.

The seagoing battleship formerly so subject to scurvy and to hunger owing to deficiency in character or in quantity of the food supply carried, is today no more dependent on outside conditions, or upon the distance of its cruising or the ports visited, for a wide and varied food supply than is the most modern hotel. Large cold-storage plants are maintained where meats, vegetables, and fruits are safely stored and which manufacture daily large quantities of ice. Modern methods of preserving and canning have also been of tremendous benefit.

No longer is the cruising ship dependent upon an uncertain water supply, as all fresh water consumed is distilled from the salt ocean upon which the vessel floats.

Infectious diseases that formerly carried off their thousands, such as yellow fever, typhus, cholera, and typhoid have all yielded to our modern knowledge of their causes and our consequent logical measures taken for their prevention.

How successful the naval hygienists have been in saving life may be indicated by the fact that prior to the introduction of antiscorbutic measures in the British Navy, the death-rate was approximately 120 out of every 1,000, per year. Fifty years later the death-rate in the British Navy was 30 per 1,000 of personnel. Last year in our own service this loss was but 4.48 per 1,000 of personnel. Not only are these figures gratifying by comparison with previous years; but they are doubly gratifying to me in that an analysis of them reveals the fact that a marked factor of safety is apparent in naval life over the figures of the same character of personnel in civil communities. The total death-rate for the registration area of the United States for the census year 1910 was 17.8 per 1,000 of our population. This of course includes all from infancy to old age; but even for

the ages from 20 to 29 years which would approximate fairly closely the average naval age limit the mortality tables give 8 per 1,000 as the incidence of death. This includes both sexes and would be appreciably higher if quoted for males alone.

Thus we have roughly a death-rate of 8 plus per 1,000 and 4.48 per 1,000 as the respective rates for the young men of our country, the larger representing the risk incurred in the ordinary hazards of farm or city life, the latter representing the peace time losses while serving their country, and while under the constant watchful care of the Medical Department of the Service.

But please do not let me seem to convey to you what would be a contradiction of what I have already told you. We have not perfectly ventilated ships, we have not perfectly lighted ships, and we have not perfectly provisioned ships! There is marked room for improvement in all these lines and it is our constant effort and thought to reach higher ideals and efficiency. And complicate all these structural and supply problems with those of the individualities of the 1,000 inhabitants of our berthing and messing spaces, and you will have some idea of the complexity of questions possible.

You know what diseases, what habits, what crotchets of the brain, may be existent in such a gathering, and what measures are necessary to eliminate, correct and counteract these, and to establish a normal living community standard.

The requirements of training make for an ever shifting personnel at sea and again as men complete their period of service — 4, 8, 12 years or more— others come to replace them, recruits fresh from civil life and its varied pursuits. Thus we have a constant flow of influences, that may be good or bad, direct from the communities of many types scattered throughout our broad land. Here is a youth from a town where the inhabitants do not believe in vaccination or where the authorities have not yet risen to the height of enlightenment which dictates chlorination of the lake water they drink though their supply pipes are not 100 feet from the sewer outlet. He is a potential menace to his shipmates unless the government's compulsory protection has been furnished him by the surgeon. Yonder robust youth hails from a rural section where air and sunshine abound but he left at home a younger brother just recovered from cerebro-spinal meningitis. He himself is a "carrier." Beside him with bright eye and ruddy cheek, but drawing swift breaths under the weight of his bag and hammock is a lad that must soon occasion serious thought to the guardian of the ship's health. Leave is requested to go home to see his mother reported dying of "something wrong in her chest." What is to be our attitude to tuberculosis, for instance, and is a hard and fast standard possible by which we may protect our crews from the presence of latent cases? By what criterion are we to recognize the incipient case and secure for him and in the interest of his shipmates the prompt transfer to sanitarium so essential for the good of all concerned?

How shall we clothe these young

men, how many calories must their daily food consumption yield for work and play? How may we adapt the big muscled coal passer, the intelligent looking firemen to the trying conditions in the bunkers and fire rooms down in the bowels of the ship and how shall we protect, increase and prolong their useful activities under conditions so unfavorable to growth and life? The anchor has fouled its chain and behold two divers are preparing to submerge and disentangle it. Skimming along the surface a cable's length from us goes a submarine preliminary to a dive. What of the air and food of the denizens of that bold craft, crowded into a minute space under the menace of chlorine gas arseniuretted hydrogen and carbon dioxide ever threatening.

High above us we hear the soft purring of the seaplane motor. Into a realm new to man are venturing bold and fearless aerial navigators. What of their physical requirements, what of the development of senses heretofore of limited use, what of the effects of atmospheric tenuity on the human organization!

We are living in a great age, throbbing with new and mighty endeavor. A century ago could we have convinced a visitor to this city that cars would run over a route propelled by unseen force of electricity, guided by a wire? Would we have believed it possible that you and I could talk to a friend in Chicago or to the captain on the deck of a war ship at sea? Would he be astounded with the thought that Jules Verne's dream of submarine navigation had come true? Would he be amazed in realizing that today air ships are gliding aloft, going hither and thither in the aerial ocean, offering all in one, the possibilities of travel over land and over water.

Gentlemen, past history and even more so present history have revealed the meaning of the navy in Great Britain's national life. The watery isolation of that wonderful island empire from its past, present or future antagonists of the old world is entirely analagous, only on what is and will be a stupendously more magnificent scale, to the situation of our own country and continent. What the future must inevitably hold, if armaments continue, for this great colossus of a nation, is that of the dominating naval power of the world. No spirit of aggression will prompt it but a spirit of defense will demand it.

And in the conservation of the health and wellbeing of its personnel, without which its crowded battleship would be but as Goliath before David, I pledge myself, my present colleagues of the Medical Corps of the Navy, and those who will shoulder our burdens when we are gone, in life and in death, to the preservation and the perpetuation of the glory of our country and our flag.