day: For breakfast, 12 per cent.; for midday meal, 47 per cent.; for supper, 31 per cent.

In warm climates, however, it will be found a good rule, especially on board a ship-of-war where drilling is done morning and afternoon, not to overfill the stomach of the men at midday but to make the heavy meal the 5 P.M. meal of the day. The above percentage distribution would have to be slightly modified in accordance with these requirements.

The Dietary Value of One Week's Ration.—In order to obtain an approximately correct estimate of the dietary value of the meals as they are actually served out on board a ship in commission, the commissary yeoman of one of them was requested to furnish us with a list of the articles included in one week's allowance and divide that up into the customary three daily meals. With the aid of table XV., the food value of each meal in proteids, fats, and carbohydrates was then calculated and expressed in terms of nutrient units, obtained after the manner found described in the preceding pages. In this estimate no deductions were made for indigestible matters nor for the work expended on digestion, because these values, as will be remembered, had already been deducted in the various multiples used in the calculation of the numbers of nutrient units which each article represents. But a loss of twenty-five per cent., in round numbers, had to be allowed for the usual and unavoidable waste made in the preparation of the raw material for cooking, as well as for a less necessary but always notable waste incurred in serving.

The results of this work are exhibited in table XVIII. A careful study of this table is of some interest. It shows, for instance, that while the sum of nutrient units for almost every single day comes up to and often exceeds the required number, there is quite a considerable lack of uniformity in the several corresponding meals of the different days of the week. The number of nutrient units for one day is almost doubled on another day. It also shows that our sea ration as well as our port ration was deficient in carbohydrates, while the proteids were two per cent. below the standard in the sea ration and three per cent. above the standard in the port ration.

In table XIX., which has been borrowed from Plumert, the proteid content of the United States navy ration is given as 69.2 per cent. This estimate, obtained from our printed allowance-list, puts its dietary value on top of all the other naval rations. According to our present calculation, the dietary value of our port ration is but twenty-three per cent. in proteids, or just one-third of that given by Plumert. Although we must admit that the two estimates are not strictly comparable, this exceedingly large difference between the two nevertheless shows that there are instances in which discrepancies occur between what is found on paper and what the men, in actual practice, get on their table and inside their stomachs.

Proposed New Navy Ration.—The Secretary of the Navy, recognizing the needs of the service and the importance of a well-appointed ration, on July 15th, 1901, ordered a board of officers to examine the ration and the system of messing in the navy. This board, to which the writer was originally ordered a member, but was prevented from attendance by illness, held its sessions in Newport, R. I., and completed its labors September 4th, with a report, which has not yet been made public. A very complete abstract, however, appeared in the *Army and Navy Journal* of January 25th, 1902, from which we take the following. This board recommends legislation as follows:

"Hereafter the navy ration shall consist of the following daily allowance of provisions to each person: One pound and a quarter salt or smoked meat, with three ounces of dried or six ounces of canned fruit, and three gills of beans or peas, or twelve ounces of flour; or one pound of preserved meat, with three ounces of dried or six ounces of canned fruit and twelve ounces of rice or eight ounces of canned vegetables, or four ounces of desiccated vegetables; together with one pound of biscuit, two ounces of butter, four ounces of sugar, two ounces of coffee or cocoa, or one-half ounce of tea and one ounce of condensed milk or evaporated cream; and a weekly allowance of one-half pound of macaroni, four ounces of cheese, four ounces of tomatoes, one-half pint of vinegar, one-half pint of pickles, one-half pint of molasses, four ounces of salt, one-quarter ounce of pepper, and one-half ounce of dry mustard. Five pounds of lard or a suitable substitute, will be allowed for every hundred pounds of flour issued as bread, and such quantities of yeast as may be necessary.

"The following substitution for the components of the ration may be made when deemed necessary by the senior officer present in command:

"For one and one-quarter pounds of salt or smoked meat or one pound of preserved meat, one and three-quarter pounds of fresh meat; in lieu of the article usually issued with salt, smoked, or preserved meat, fresh vegetables of equal value; for one pound of biscuit, one and one-quarter pounds of soft bread or eighteen ounces of flour; for three gills of beans or peas, twelve ounces of flour or rice, or eight ounces of canned vegetables; and for twelve ounces of flour or rice, or eight ounces of canned vegetables, three gills of beans or peas.

"An extra allowance of coffee or cocoa, two ounces of sugar, four ounces of hard bread or its equivalent, and four ounces of preserved meat or its equivalent, will be allowed to enlisted men of the engineer and dynamo force when standing night watches under steam."

The Board has also recommended some other changes to be made in the system of messing and has suggested some much needed reforms in the organization of the personnel of the commissary department on board ships, but, the above changes in the food-supply being the only ones of interest in connection with the study of the actual food value of the ration, we cannot here consider them.

The same commissary yeoman who had previously furnished us with a written weekly allowance list, divided into the customary three daily meals, made up from the old ration, was now requested to do the same with this proposed new ration. This he very kindly did, after having been thoroughly advised of the promised additions to the present ration, and the following table XX. shows the food value for this new ration in nutrient units, expressed in terms of proteids, fats, and carbohydrates, which the new ration would yield *in his hands*.

While, in our opinion, the ration is very ample, the table shows that both in the port ration and in the sea ration we have an excess in fats and a deficiency in carbohydrates, while the proteids may be regarded as just about up to the standard. We also notice the same lack of uniformity as regards the distribution of the quantities between the different days of the week as well as between the three meals of the day that has been previously noted. The importance of the personal equation of the yeoman and its influence upon the whole subject of rationing on board ship is well brought out. A very natural suggestion, therefore, would seem to be that either the commissary yeomen of the navy be given a great deal more instruction as regards the value in nutrient units of the different classes of food which it is their duty to distribute, than they now possess, or that this distribution be supervised on board ship by the class of men whose training and education ought to be a guarantee of the fact that they possess the required knowledge to do so in accordance with the best principles.

The Influence of Climate upon Nutrition.—Any discussion of the navy ration would be incomplete without some consideration of the influence of the various climatic factors upon nutrition. The problem of what constitutes a proper ration for a definite climate can be solved only on the basis of an exact knowledge of the physiology of general nutrition, as modified and influenced by the different climatic conditions. When we shall be in possession of a full and complete knowledge of this, then the proper ration for almost any climate will become a matter of exact calculation and a mere application of principles to practical life. We must, in the first place, find out what climate is, and in the second place ascertain its influence upon nutrition.

Since some very important and fundamental work has, within recent years, been done in this line of research by German hygienists, which must hereafter be taken into account whenever the questions of climate and nutrition become subjects for further research or discussion, it is absolutely necessary in this connection briefly to call attention to a few of the leading points in this great work. In doing this, only so much of it will be reviewed as seems necessary for a better understanding of the subject under discussion; for a fuller and more detailed account the reader is respectfully referred to a most excellent monograph by K. E. Ranke.*

TABLE XVIII.

Days.	Meals.	At Sea. Nutrient Units in— Proteids.	Fats.	Carbohydrates.	Sum.	In Port. Nutrient Units in— Proteids.	Fats.	Carbohydrates.	Sum.
Sunday	Breakfast	109.9	353.9	720.6	1,184.4	109.9	353.9	720.6	1,184.4
	Dinner	385.9	1,207.4	371.4	1,964.7	398.0	248.6	449.0	1,095.6
	Supper	192.0	119.4	593.0	904.4	93.0	184.9	822.0	1,099.9
	Total	687.8	1,680.7	1,684.0	4,053.5	600.9	787.4	1,991.6	3,379.9
Monday	Breakfast	77.0	64.9	477.0	618.9	189.0	577.0	409.0	1,175.0
	Dinner	213.5	445.0	390.0	1,048.5	664.0	280.0	390.0	1,334.0
	Supper	222.0	403.0	590.0	1,215.0	222.0	403.0	590.0	1,215.0
	Total	512.5	912.9	1,457.0	2,882.4	1,075.0	1,260.0	1,389.0	3,724.0
Tuesday	Breakfast	139.0	343.0	409.0	891.0	196.4	186.7	409.0	792.1
	Dinner	361.6	1,455.2	746.6	2,563.4	664.0	280.0	390.0	1,334.0
	Supper	222.0	247.0	492.0	961.0	90.0	247.0	492.0	829.0
	Total	722.6	2,045.2	1,647.6	4,415.4	950.4	713.7	1,291.0	2,955.1
Wednesday	Breakfast	190.9	354.9	720.6	1,266.4	190.9	354.9	720.6	1,266.4
	Dinner	230.5	455.0	390.0	1,075.5	387.0	249.0	490.0	1,126.0
	Supper	241.0	234.0	466.0	941.0	151.0	53.6	686.0	890.6
	Total	662.4	1,043.9	1,576.6	3,282.9	728.9	657.5	1,896.6	3,283.0
Thursday	Breakfast	161.0	91.0	459.0	711.0	148.2	624.0	347.0	1,119.2
	Dinner	481.0	305.0	823.0	1,609.4	390.0	249.0	490.0	1,129.0
	Supper	117.7	347.7	417.0	882.4	94.0	27.6	954.0	1,075.6
	Total	759.7	743.7	1,699.0	3,202.8	632.2	900.6	1,791.0	3,323.8
Friday	Breakfast	130.0	279.0	409.0	818.0	181.0	246.0	309.0	736.0
	Dinner	418.5	476.0	390.0	1,284.5	390.0	249.0	490.0	1,129.0
	Supper	194.6	909.4	466.0	1,570.0	149.0	182.0	675.0	1,006.0
	Total	743.1	1,664.4	1,265.0	3,672.5	720.0	677.0	1,474.0	2,871.0
Saturday	Breakfast	214.0	27.0	579.0	820.0	189.0	138.9	409.0	736.9
	Dinner	399.0	2,452.0	721.6	3,572.6	399.0	2,452.0	721.6	3,572.6
	Supper	147.0	99.0	630.0	876.0	337.0	143.0	490.0	970.0
	Total	760.0	2,578.0	1,930.6	5,268.6	925.0	2,733.9	1,620.6	5,279.5
Average values	In per cent. (round numbers) daily average	18.0	40.0	42.0	100.0	23.0	31.0	46.0	100.0
	Should be	20.0	13.3	66.7	100.0	20.0	13.3	66.7	100.0
	Difference	−2.0	+26.7	−24.7	....	+3.0	+17.7	−20.7	

TABLE XIX.—(From Plumert.)

Navy.	Sum Nutrient Units of Animal Origin. Proteids.	Fats.	Sum Nutrient Units of Vegetable Origin. Proteids.	Fats.	Carbohydrates.	Sum Total of Nutrient Units in the Daily Ration. Proteids.	Fats.	Carbohydrates.	Proteids in per cent.
Austrian, in port	286	156	381	29	502	667	185	502	42.9
Austrian, at sea	280	259	421	26	542	701	285	542	40.0
German, in port	273	235	414	35	601	687	270	601	39.7
German, at sea	320	412	394	29	595	714	441	595	44.8
Italian, in port	276	107	315	25	475	591	132	475	46.7
Italian, at sea	294	146	437	35	560	731	181	560	40.2
French, in port	286	176	333	24	470	619	200	470	46.2
French, at sea	261	219	341	16	523	602	235	523	43.3
English, in port	377	138	523	52	572	900	190	572	41.9
English, at sea	318	536	362	49	593	680	585	593	46.8
Russian, in port	257	229	446	47	717	703	276	717	36.6
Russian, at sea	247	390	471	37	733	718	247	733	34.4
Swedish, at sea	379	517	386	27	558	765	544	558	49.5
Norwegian, at sea	456	473	419	49	667	875	522	667	52.1
Turkish, at sea	160	127	495	60	723	655	187	723	24.4
United States, in port	480	177	213	46	401	693	223	401	69.2
United States, at sea	343	461	402	31	590	745	492	590	46.0
Argentine Republic, at sea	518	294	344	32	536	862	326	536	60.0
Japanese, at sea	260	122	331	27	628	591	149	628	43.9

* "Ueber die Einwirkung des Tropenklimas auf die Ernährung des Menschen auf Grund von Versuchen im tropischen und subtropischen Südamerika," von Dr. Karl Ernst Ranke, München.

TABLE XX.—NUMBERS REPRESENT NUTRIENT UNITS.

Days.	Meals.	Sea Ration. Proteids.	Sea Ration. Fats.	Sea Ration. Carbo-hydrates.	Sea Ration. Sum.	Port Rations. Proteids.	Port Rations. Fats.	Port Rations. Carbo-hydrates.	Port Rations. Sum.
Sunday	Breakfast	210.3	262.2	724.8	1,197.3	210.3	262.2	724.8	1,197.3
	Dinner	283.7	881.4	501.4	1,666.5	323.4	141.5	500.4	965.3
	Supper	242.0	267.6	655.4	1,165.0	242.0	267.6	655.4	1,165.0
	Total	736.0	1,411.2	1,881.6	4,028.8	775.7	671.3	1,880.6	3,327.6
Monday	Breakfast	121.5	178.0	541.4	840.9	109.5	194.0	553.4	856.9
	Dinner	338.0	728.0	390.4	1,456.4	327.3	246.8	530.4	1,104.5
	Supper	102.6	152.0	795.8	1,051.2	231.1	191.2	700.4	1,122.7
	Total	562.1	1,058.8	1,727.6	3,348.5	667.9	632.0	1,784.2	3,084.1
Tuesday	Breakfast	147.6	569.7	476.4	1,193.7	198.0	977.0	486.3	1,661.3
	Dinner	306.9	2,480.5	724.8	3,512.2	306.9	2,480.5	724.8	3,512.2
	Supper	257.5	512.4	477.2	1,247.1	238.7	229.4	476.4	944.5
	Total	712.0	3,562.6	1,678.4	5,953.0	743.6	3,686.9	1,687.5	6,118.0
Wednesday	Breakfast	210.3	262.2	724.8	1,197.3	210.3	262.2	724.8	1,197.3
	Dinner	243.0	607.0	373.4	1,223.4	329.9	248.4	530.4	1,108.7
	Supper	151.4	434.6	634.6	1,220.6	122.5	381.0	434.4	937.9
	Total	604.7	1,303.8	1,732.8	3,641.3	662.7	891.6	1,689.6	3,243.9
Thursday	Breakfast	247.1	257.2	502.7	1,007.0	281.7	227.4	476.4	985.5
	Dinner	339.0	461.9	380.4	1,181.3	288.9	882.8	536.8	1,708.5
	Supper	215.5	248.4	350.4	814.3	211.5	723.4	476.4	1,411.3
	Total	801.6	967.5	1,233.5	3,002.6	782.1	1,833.6	1,489.6	4,105.3
Friday	Breakfast	139.9	772.5	476.4	1,388.8	260.2	312.1	490.4	1,062.7
	Dinner	158.6	221.3	695.9	1,075.8	380.3	78.4	776.4	935.1
	Supper	323.2	420.5	350.4	1,094.1	149.3	377.6	644.0	1,170.9
	Total	621.7	1.414.3	1,522.7	3,558.7	789.8	768.1	1,610.8	3,168.7
Saturday	Breakfast	268.3	189.6	382.5	840.4	201.7	203.4	476.4	881.5
	Dinner	309.9	2,431.9	754.8	3,496.6	365.9	1,235.2	754.8	2,355.9
	Supper	166.5	409.0	890.4	1,465.9	221.7	339.4	476.4	1,037.5
	Total	744.7	3,030.5	2,027.7	5,802.9	789.3	1,778.0	1,707.6	4,274.9
Averages	Daily in per cent	17.0	43.0	40.0	100.0	20.0	37.0	43.0	100.0
	Should be	20.0	13.3	66.7	100.0	20.0	13.3	66.7	100.0
	Difference	– 3.0	+ 30.0	– 26.7	....	0.0	+ 23.7	– 23.7	....

The physiological process, known as heat regulation or heat economy, consists, on the one hand, in the production of heat within the living organism through oxidative changes; and heat-dissipation, through conduction, radiation, and water evaporation, on the other. The remaining balance between these two phases of the process finds expression in the normal temperature of the animal under observation. That this heat-regulating process is influenced by a great variety of both environmental and subjective conditions has long been known, but a more exact knowledge of it has only recently been gained through the researches of Voit and Rubner and their numerous co-workers.

ENVIRONMENTAL CONDITIONS.—*Climate.*—Ranke has recently defined climate as being "the total mean thermic effect exerted upon a living organism, at a certain point on the earth's surface." This comprehensive definition of climate covers every point on the earth's surface, both at sea and on the continent. The total mean thermic effect is made up of several factors, namely: atmospheric temperature (direct solar rays, reflected and radiated heat), humidity, air currents, barometric pressure, and rainfall.

Against the untoward influence of these combined agencies the organism possesses certain physiological defences that are summed up in the term heat regulation, and, within a certain number of degrees of atmospheric temperature, the organism is able to accommodate itself to its environment, without losing control of its own normal temperature. This number of degrees of temperature has, accordingly, been called by Ranke the "temperature range." This range has an upper and a lower limiting point, beyond either of which the regulating influence of our physiological mechanism does not extend, and where our physiological defences begin to break down. When, therefore, the limits are surpassed, the normal temperature of the organism will either be raised or lowered, according as either the upper or the lower limiting point in the range is exceeded. We leave our normal ground and enter the pathological arena.

(*a*) *Atmospheric Temperature.* One of the most important factors in a climate is its temperature. Complete and accurate sets of experiments on the influence of atmospheric temperature on the temperature range have, so far, been made on animals only. A sufficient number of observations, however, has been made on man to enable us to summarize the different reactions thus observed into a connected whole. Thus Voit, in 1878, made the important discovery that the several factors concerned in the mechanism of heat regulation did not all act alike when followed through the whole of the temperature range. Proceeding from the lower in the direction of the upper limit, there soon comes a point on our scale where, for instance, heat production refuses to take any further part in heat economy. This point was likewise observed by Rubner and noted to occur in all his experiments on the heat regulation of animals. Ranke now proposes to designate the point "the critical point" in heat regulation. By it the whole temperature range is naturally divided into two great groups. According to the present state of our knowledge, the reactions of the different factors concerned in heat regulation, within the several groups and subdivisions of the temperature range, are about as follows: At the lowest limit of the range, we meet with the highest amount of heat production; from here on up to the critical point,

heat production is found to be gradually diminishing. Heat regulation, then, between the lower limit of the range and the critical point, occurs principally through changes in chemical heat production. Water evaporation behaves so indifferently here that no regulating function can be attributed to it. From the critical point on upward, no further decrease in heat production depending upon temperature occurs. In place of changes in heat production we now notice changes occurring in heat elimination. This second great group of the temperature range is again divided into two subdivisions, distinctly marked out by important changes in the reactions of the regulating mechanism. In the lower of these two divisions we find conduction and radiation actively increased. Although a slight increase in heat production is noticeable within this section, due to quickened circulation and respiration, this is exactly counterbalanced by a simultaneous slight increase in water evaporation. This kind of regulation extends, in the dog, to about 5° C. above the critical point.

In the upper of the two subdivisions of physical heat regulation we find that radiation and conduction cease to be actively or reflexly increased and are considerably diminished instead. In place of these factors, water evaporation suddenly sets in.

Rubner has shown that, when active perspiration begins in man, the influence of conduction and radiation ceases to be exerted upon heat economy, but that the work of the sweat glands here causes a further slight increase in the amount of heat production.

These somewhat complicated relations will be made clear by a glance at the accompanying chart, constructed from one of Rubner's experiments on the dog and intended graphically to illustrate the essential points in the mechanism of heat regulation under the influence of varying degrees of atmospheric temperature.

The next table (table XXI.) shows the experiment of Rubner on the dog which the chart is intended to represent graphically.

TABLE XXI.—RUBNER'S EXPERIMENT.

Atmospheric temperature.	Latent heat in calories in water vapor.	Conduction and radiation in calories.	Total heat production.	Atmospheric temperature.	Latent heat in calories in water vapor.	Conduction and radiation in calories.	Total heat production.
7.6	11.8	71.7	83.5	25.0	16.9	37.3	54.2
15.0	14.0	49.0	63.0	30.0	26.2	30.0	56.2
20.0	16.2	37.3	53.5				

In the chart, the ordinates indicate the number of calories, the abscissa, the degrees of temperature. *W.E.* stands for water evaporation; *C. and R.* for conduction and radiation, and *H.P.* for heat production; all else is self-evident.

(*b*) *Air Currents.* Air in motion has a very important influence upon heat economy. Rubner sums up its influence by stating that air currents cause physical heat regulation to begin at a few degrees higher temperature than during a calm. Ranke expresses the same thing by stating that air currents cause the critical point in the temperature range to move a few degrees upward.

(*c*) *Humidity.* The thermic influence of atmospheric humidity is twofold. It diminishes water evaporation and improves conduction. By increasing conduction it causes the lower limit of the temperature range to move upward, and by retarding water evaporation it moves

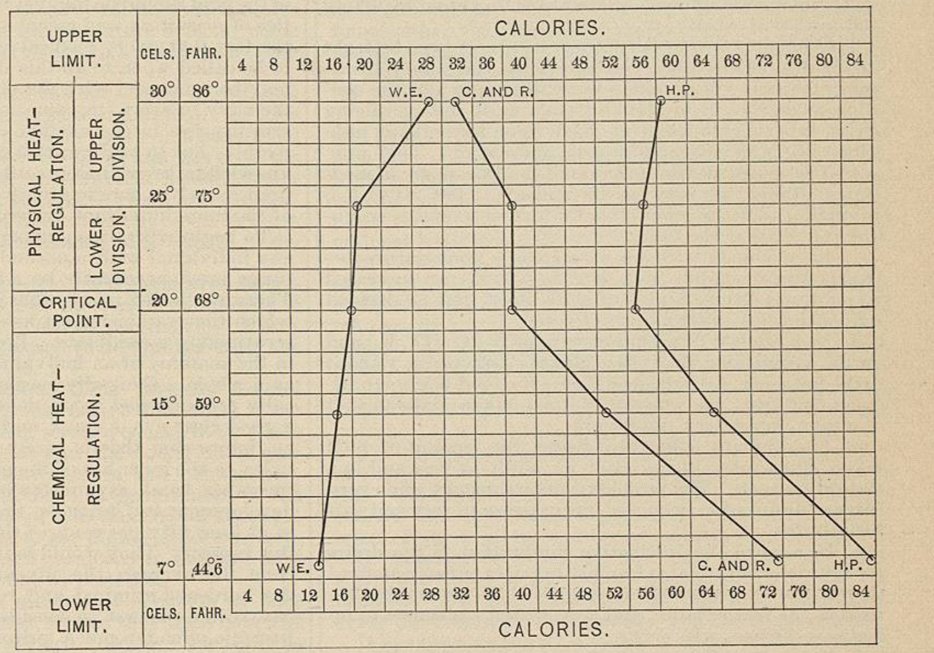

FIG. 3509.—Chart Showing Temperature Range and Heat Regulation.

the upper limit downward, thus narrowing the entire range. Moist cold is colder than dry cold and moist heat hotter than dry heat. It will be seen, then, that the organism possesses no defences against the combined influence of excessive humidities and temperatures.

II. SUBJECTIVE CONDITIONS.—(*a*) *Food and Feeding.*—That amount and variety of food which an organism is required to take in order to maintain its present weight is called its *need.* If more food is taken than is required for this purpose, the smaller part of the surplus only becomes converted into tissue; the greater part is decomposed and eliminated. Consequently, an increased heat production always follows the introduction of an amount of food beyond the needs of an organism to maintain its weight, and the consequence of that is that the entire range is moved downward. This is well shown in one of Rubner's experiments (also quoted by Ranke). In the experimental animal of Rubner, when it was in a state of hunger, this sudden water evaporation began at a temperature of 32.5° C.; when 200 gm. of meat were given, the sudden water evaporation began at 19.1° C., and when 320 gm. of meat were given, it began at 13.4° C. This shows the enormous influence of feeding upon the temperature range; it moves the entire range a considerable number of degrees downward. Under the influence of high temperatures, therefore, every increase in the food allowance beyond the mere need must materially increase the difficulty of heat elimination and cause the critical point to move a corresponding number of degrees downward. The proteid food substances are the most powerful in this respect, the fats the least effective, and the carbohydrates stand between the two.

(*b*) *Muscular Work.*—Numerous experiments have shown that the influence of muscular work upon the temperature range is a most powerful one. Since heat production is greatly increased by all kinds of muscular work, its influence upon the temperature range is, briefly stated, that it moves it downward. Near the upper limit of the range we may reach a point where a man may be able to exist while at perfect rest, but where every attempt at work will lead to heat accumulation and heat stroke and other pathological conditions.

(*c*) *Clothing* influences the temperature range by pushing it a certain number of degrees downward; it has, then, upon it an influence similar to that exerted by eating and muscular work.

The salient points of our subject have now been brought forward as thoroughly, we believe, as the scanty allowance of space will permit. We will simply add the conclusions arrived at by Ranke from a most self-sacrificing set of experiments which he made upon himself and published in the monograph already referred to. They are:

1. The temperature optimum of the European, in moderate clothing, lies between 15° and 18° C. (59°–64.4° F.), providing that the other climatic factors exercise no undue influence at the time.

2. In a climate with an atmospheric temperature between the optimum and 22° C. (72° F.) an increased water evaporation begins to show itself, but no decided influence upon nutrition is yet noted.

3. In a climate of a temperature of 25° C. (77° F.) and on the assumption that other climatic factors are without great influence, a diminished desire for food begins to become manifest; the amount of food taken sinks to that of a man doing very light work.

4. The climatic effect still rising, the amount of food taken sinks below the need of an adult at rest and in a state of hunger. The proteids remain constant, and every further diminution occurs at the expense of fats and carbohydrates.

5. If, against the instinctive diminution in the desire for nourishment, food is forcibly taken in greater amount than is desired, pathological changes in the general health, rises in the temperature, and a decreased resistance to infectious diseases will occur.

6. If, on the other hand, the quantities of food taken are permanently diminished in accordance with the demands of a tropical climate, as is usually the case, a deficient nutrition of the organism is the inevitable result, with all the dangerous consequences that follow in its train.

From these conclusions and from the preceding discussion, the leading principles that must govern the composition of a ration or the diet of a man who has transferred his residence from a temperate to a tropical climate may be easily inferred. The details of it are subjects of special research.

A sea climate is perhaps more nearly a purely solar climate than any land climate can ever be. A solar climate is defined as a climate which would be characteristic of every degree of latitude, if the earth was a mathematically perfect spheroid without unevenness, and had throughout the same composition. This is true at least for the great oceans. Although the value of the total mean thermic effect of the climate, which the seaman is exposed to as long as he confines himself to the limits of his ship, has not yet been determined with scientific accuracy, it may be safely said that that value is less than one found over a corresponding latitude on land. It would most undoubtedly be modified by the ship, especially one of the modern battleships, in which every part has a climate of its own and which must be regarded as a heat-producing body; nevertheless, the total mean effect on deck will be found to be considerably less detrimental than the corresponding shore climate. With the aid of a few thermometers, psychrometers, anemometers and some interest and experience in scientific investigations, this work should present no difficulty. Until it shall have been done, any expression of opinion on the influence of the climate in which the seaman lives, upon his heat economy, and upon the composition of his ration, would be premature.

IV. Recruiting.

Recruiting for the navy signifies the separation by a medical officer of the physically fit from the physically unfit, of the mentally sound from the mentally unsound, of good timber from bad timber, for a most serious and important service, the common defence of the land and its people against a danger threatening their commerce and their liberty from the direction of the sea. Every physician in the land should be familiar with the principles and practice of recruiting, and recent experience has demonstrated the fact that every medical man in the country is liable to be called upon to do this duty. Whatever else there may be connected with the process of enlisting a man in the navy or army, the point of gravity in the duty of recruiting lies in the medico-physical examination of the recruit; but to perform this duty properly requires some knowledge as well as practice. We shall be obliged to limit ourselves here to giving a very brief outline of some of the more important principles involved.

To begin with, it is a mistaken notion to presume that any individual with a normal heart and a good pair of lungs must necessarily be a fit candidate for the navy. There are indeed many other points of equal importance which the examiner must keep constantly in mind while scrutinizing a candidate. Besides seeing to special parts in the anatomy of an individual, he must look at the man as a whole. Generally speaking, a fine form symmetrically proportioned, good development, regular features, a good clear eye, a frank and open countenance, convey an impression that is rarely misleading; they form an index to the inner life of the man, usually favorable. On the other hand, asymmetry of face and body, irregular development and features, the stigmata of degeneration, in at least fifty per cent. of the cases are unfavorable in this respect. They would indicate an abnormal deviation from the average, the juvenile offender in the young, the hardened criminal and repeater in the adult. The navy can no longer be considered a reform school for the juvenile offender nor a prison for the cure of the hardened adult criminal. Neither the time nor the training can be given in the service to such objects, however noble, and there are other institutions, maintained by the state, the special function of which is to attend to these duties.

Besides good physique, the man, to be of any real and permanent value to the service, must bring with him right from the start a good will, a high sense of duty and responsibility capable of further training, all of which he must be prepared and willing to maintain during the entire term of service to his country and his flag. This may be aiming high, but many years' experience, both in recruiting and in surveying the unfit, have proved to my satisfaction that the service is not benefited but injured by anything below such a standard.

The British Navy.—The only other navy with which our own can be compared as regards the system of recruiting is the British navy. Although the system of conscription for the army has—until recently at any rate—always been considered in England to be a detestable and insufferable encroachment on individual liberty, sailors have at all times been regarded as bound to serve in the royal navy. If they did not enter the service voluntarily, they were simply pressed into it by the press-gang, often very ruthlessly and cruelly. These press-gangs, commanded by officers, were sent into the ports to seize all available seamen. The man, thus forcibly enlisted, had a small coin (the Queen's shilling) pressed into his hand, and it is from this circumstance that the name press-gang is said to have been derived.

This peculiar method of recruiting the navy, scorning, as it did, all law and humanity, had nevertheless taken such firm root in the habits and modes of thought of the

people of England that, even during the long period of peace after Waterloo, when humanitarian principles were taking a strong hold on all civilized communities, no attempt was made to abolish the press-gang. Down to the middle of the nineteenth century English admirals declared that the press-gang was one of the props of the greatness of England and absolutely indispensable.

By that time public opinion resolutely and persistently objected to this forcible enlistment, so that in 1852 the Admiralty was forced to adopt new methods for the recruiting of seamen for the navy—methods which turned out to be highly beneficial, leading as they did to a thoroughly beneficial reform in the manning of the navy and to a very superior personnel at the same time. The royal navy of Great Britain and the navy of the United States are now both recruited on the voluntary system, while in the continental naval services the system is by conscription.

The average of volunteers has invariably been found superior to that derived from those who were driven into the service either by force or by necessity or who entered for reasons of convenience. So far as the navy of the United States is concerned, its personnel has markedly improved during the last twenty-five years, and the general public is beginning to look upon the naval uniform with both pride and affection instead of as a mark of degradation.

For the details and the nature of the physical examination required in both services, the reader is referred to Appendices I. and II., at the end of this article. Every physician may well be supposed to be familiar with the technique of the examination.

The Recruitment of Officers.—This presents several rather interesting as well as instructive differences in the two services. In the English service, considerable stress is laid upon the circumstance that the young naval candidate possesses a good family origin and connections. Under the more democratic form of government f the United States, this principle of selection does not prevail. Then, again, the promotion to the higher grades of command rank does not proceed by seniority in England as it does in the United States, but by selection.

There is, then, a certain amount of selection at both ends of the line in the British service that does not exist in the United States naval service. Besides, the cadet as well as midshipman in the British service is obliged to defray not only all his private personal expenses but also to pay from fifty to seventy-five pounds a year for his schooling. Thus there is, in addition to the above, a money qualification. In both services alike there is a physical and a competitive mental examination, in both of which the candidate must be successful before he can become a cadet.

Granting that a certain amount of this selection which characterizes the British service as distinct from the United States service is done from motives of interest other than the best of the service, we must perhaps admit that the resulting average, thus carefully selected, may in the end be for a steady and constant improvement of their service after all. Even the least important of the qualifications, the money qualification, may not be altogether without a certain value as a principle of selection. If we regard, for instance, the possession of a certain amount of this world's treasure by the lad's father or other relatives as representing a certain amount of brain power which must have been expended at some time in order to accumulate it, the natural conclusion would be that the boy had inherited a part of this same brain power, in a facultative state, in the same natural way as he will some day inherit the accumulated ancestral possessions. We may, moreover, further assume that early training might do much to divert this power into other channels; in other words, turn the lad into a successful naval officer as his ancestor had proved himself successful in other ways.

In the free and unhampered competition in the civil life of a republic like that of the United States and in the general scramble or struggle of the masses for social preferment, high official position, professional distinction, or financial betterment, almost any individual will in the end find his level, in accordance with his natural and inherited endowments, his abilities, acquired through education, and the use which he makes of them. The gifted, industrious, physically and mentally fittest will easily rise to the top, while the physically weak and the mentally deficient will, as naturally and according to the same law, gravitate to the bottom of this sea of human life and of the multitude. The process of natural selection in the social sphere of human existence has full sway here.

In naval and military life, in countries where all are supposed to be born equal but are not, and in which selection on the principle of true merit and ability has been found either inconvenient, impracticable, or impossible, where artificial barriers are created and placed in the way of the advancement of organized merit and ability, the results must very naturally be somewhat different. While, perhaps, a high and uniform level of efficiency on the part of the individual members of such a body of men may not be inconsistent with such methods, an extremely dangerous dearth of leaders must, nevertheless, remain the inevitable result of such a system, a dearth most keenly felt at the most inopportune moments of national trials and tribulations.

In view of the above facts and considerations the process known as recruiting, being practically th only generally recognized and accepted method of selecting those who are fit for the service from those who are not, becomes of an importance all the greater. From this viewpoint the physical examination of the recruit, more especially, however, that of the cadet, must appear in an entirely new light and one which, in its far-reaching importance, it would indeed be difficult to exaggerate.

The Significance of Selection by Means of a Physical Examination.—With the aid of a physical examination, as this is understood at the present day, the scientifically trained and practically experienced examiner is able to select, from a given number of candidates, a group not only superior in physique, but also, and at the same time, one superior in mental qualifications to the remainder. He can, moreover, by the same means exclude the criminals, criminaloids, and the degenerates.

It has been shown by a series of observations in different parts of the United States and other countries, made by Porter, Christopher, Hastings, Beyer, and others, that children and youths who have inherited an exceptionally good physique almost invariably also manifest mental qualifications that are likewise superior. All these observations, made by different observers and by means of different methods, have led to such uniform results that the correlation must seem unavoidable to any unprejudiced observer and the application of the principles involved to the process of recruiting follows as a most natural corollary.

A necessary preliminary step to the application of these principles to recruiting is the preparation of tables according to the percentile grade system of Francis Galton from as large a number of subjects as possible and from subjects (men and boys) of as nearly the same type as those with whom the candidates under consideration are to be compared. Such tables may include any number of measurements and tests. While height, weight, and chest circumference must be regarded as absolutely essential, other dimensions are very desirable.

The tables published in "The Growth of United States Naval Cadets," United States Naval Institute No. 74, include a number of tests and measurements in various dimensions; they will, therefore, do good service in the examination of cadets. The adjoining three tables (XXII., XXIII., and XXIV) were made from 6,901 sailormen and boys, and may, consequently, be said to be fairly representative of the physique of that class of people who have at all times applied for enlistment in the naval service. Since, however, the averages must be preponderatingly made up from the descendants of Anglo-Saxon and Teutonic stock, the examiner will still have