MISCELLANEOUS

BY

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HEREDITY.

Fundamental Theories. J. Wright[1] refers to the observations of Bastian recently partly confirmed by Dunbar which show that bacteria or structures resembling them can be produced from liquids which contain no recognizable bacterial forms. He also refers to the observations of Prowazek that algæ after being thoroughly crushed will regenerate the algal structure. This would seem to show that life is not necessarily dependent on the cell unit but may exist in still smaller particles, and that it is the property of living matter which forms the structure of the cell and not the cell structure which makes matter living. The theory that smaller units than the cell, such as determinants, chromosomes, etc., are the active agents in heredity is not satisfactory. It accords more with the trend of opinion to look on these elements as the arrangements produced by force.

"The mosaic conception of heredity, formulated in the laws of Mendel, has still further added to the strength of Weismannism. But how can material units stand for immaterial forces? The bird's wing stands as the emblem of flight, but it is very far from explaining the physical processes whereby it keeps itself in the air. The chromatin granule in the nucleus contains no material subdivision, we may be sure, which does any more. The comprehension of the principles of aviation like that of the principles of heredity receives but slight assistance from the contemplation of such symbols.

"The physiochemical process whereby in natural heritable immunity the phagocyte engulfs the bacterium is a matter

(1) N. Y. Medical Jour., Jan. 9, 1909.

of the index of the electrodynamic surface tension of each. Its variation is a character of living things which is heritable. How are we to figure to ourselves the heredity here involved by means of material units? It is the dynamics of the cell, not the phosphorus nor the calcium nor the oxygen of the two living things, which is here concerned. It is the force that arranges the molecules and atoms.

"Weismann is forced to admit that his determinants which guide the course of evolution must be endowed with some vital property aside from the physiochemical forces with which we are familiar. So plain is this metaphysical element that Poulton, one of Weismann's followers, gives it an ancient theological twist by his interpretation that "no characters except those predetermined in the germ are available for evolution.

"Dividing things into vague infinitesimals and then calling them biophors or determinants is a more complex but not a more satisfactory solution than frankly vitalistic theories, when we are compelled in the end to affix the mystery to the infinitesimals."

Wright recognizes a metaphysical basis back of all things. Without the invention of a teleologic vitalism he does not see why the eye of the crab should resemble that of the ox. He thinks that the teleologic explanation is fatal to the curiosity which prompts investigation. The advance of science is continually showing a dependence of vital on physical phenomena or a close analogy between them.

The theory of Darwinism or neodarwinism does not give a satisfactory answer to the questions of heredity as shown by histology. Wright is inclined to emphasize the analogies between animate and inanimate nature as shown in the state of crystallization. This involves the assumption that no hard and fast line between inanimate matter and life exists.

"It has been insisted that a bar of iron once struck by the sledge of the blacksmith never returns to its pristine molecular condition. That blow forms part of the heredity of that bit of iron as long as it lasts. The reactions of a metallic colloid are also said to depend on its past experience. Wright cannot but believe that finally it will be shown that the colloid of the germ cell obeys the same law. Jennings declares that, for the somatic cells at least, the

physiologic states into which they are thrown by vital processes determine the character of their reaction to stimuli. The colloid state of the living cell thus shows its affinity with the colloid state of the metals."

Yet even after identifying vital processes with inorganic processes, even admitting they are all identical, which is far from having been proved, the heredity of living matter has been in no way explained.

E. L. Murdy[1] summarizes the laws of heredity in the following ten propositions:

1. The child tends to inherit every attribute of both parents.
2. Contradictory attributes cannot be inherited from both parents.
3. The child may inherit the attributes of either parent solely.
4. It may inherit the qualities of one parent in some respects and of the other in other respects.
5. It may inherit the father's attributes for one period of existence and the mother's for another.
6. Some attributes have the quality of prepotency, or the tendency to push aside or overrule other attributes.
7. Attributes which are similar in both parents tend to become prepotent, giving rise to convergent or cumulative heredity.
8. Attributes may be transmitted in latent form from one generation to another, to reappear in the third or fourth, or still more remote generation—a phenomenon termed "reversion."
9. Attributes tend to appear in the progeny about the same time of life at which they become manifest in the parents.
10. Attributes of the father tend to be inherited by the sons and of the mother by the daughters.

Acquired variation may occur according to the natural tendency which may be exaggerated and act in a cumulative manner from either natural or artificial selection and may tend to improvement or deterioration. The acquirement of hereditary immunity against disease is seen in the fact that races which have had long experience with

(1) Jour. Minn. State Med. Assoc., May 1, 1909.

particular diseases acquire such immunity that what is fatal to inexperienced races produces but slight effect on them. This is shown by the great susceptibility of the American Indians to tuberculosis, by the severity of measles in savage communities, by the comparative immunity of the negro to malaria.

The author gives the following facts relative to hereditary diseases:

"*In insanity,* 20 to 40% of the cases are hereditary or from parents who possess some neuropsychic equivalent. By the working of the laws of heredity reversion to type may explain a certain number of cases, and, again, that other law by which both parents possessing common neuropsychic attributes will transmit their common attributes in an exaggerated form, or in a prepotent form, resulting therefore in more perversion or more insanity for their progeny. Children tend to inherit the attributes of both parents; therefore, if there is insanity on both sides, or on either side, or an unstable nervous system, or if the parents possess the neuropsychic equivalents, insanity or its equivalent in their children will be the logical issue of the union.

"*In epilepsy* many of the same conditions prevail, and the same laws are operative. Outside of traumatic epilepsy 10 to 40% of all epileptics are the direct heritage of epilepsy or some neuropsychic equivalent.

"*In idiocy* 50% of the cases are the direct heritage of mentally defective parents, and the same laws are operative which apply to all neuropathic diseases."

Among the hereditary neuropsychoses may be included alcoholism and drug habits. About 10 to 30% of tuberculosis is evolved from the class with hereditary tendencies. The author contends that by prolonging the lives of defectives we are tending to deteriorate the human stock. He advises limitation of marriage and production.

W. E. Castle[1] gives the following exposition of the laws of heredity:

"By heredity we mean the fact that an individual resembles its ancestors. Such resemblance has its basis in the material out of which the individual is formed. But

(1) Ill. Med. Jour., April, 1909.

every new individual has its beginning in the union of two reproductive cells—an egg cell furnished by the mother and a sperm cell furnished by the father. Of the two, the egg is enormously larger, but its influence on the nature of the offspring is no greater. In heredity-transmission the two parents share equally. This fact indicates that a large part of the egg consists of substance nonessential to heredity. Indeed, we have reason to believe that there is no relation whatever between the mass of the reproductive cell and its influence in heredity. Heredity perhaps consists chiefly, if not exclusively, in the transmission of enzyme-like materials which initiate certain metabolic processes in a suitable medium represented by the food materials of the egg. On this view the mass of the hereditary substance is of no consequence whatever, since it contributes nothing to the end-product, but only sets going certain chemical processes. The nature of the end-product will depend upon what processes are set going and in what order.

"Regarding the reproductive cell as an assemblage of initiators or 'determiners' of metabolic processes, we are led by several distinct lines of evidence to consider each such reproductive cell, whether egg or sperm, as containing in general a complete set of all the determiners necessary to form an individual of the species. If so, the ordinary individual contains two such sets, since he has been produced by the union of two different reproductive cells. From the standpoint of heredity, therefore, if we regard the reproductive cell as single, the individual is double. This conception of the individual as a duality receives the fullest confirmation from breeding experiments with animals and plants alike.

"If two animals of different colors, black and white, are mated the offspring are black because the black character obscures the white, but in the second generation the black characters disappear in one-fourth of the offspring, which are the result of the junction of white reproductive cells only. This is an illustration of Mendel's law.

"This law of 'exclusive' or 'alternative' inheritance, in which the excluded character skips a generation, reappearing in the second generation, when suitable matings are made, applies to color inheritance quite generally. Thus in crosses, black and yellow as a rule exclude the less dense

pigments, brown and yellow. In man the brunette type excludes the blonde, and brown eyes exclude blue ones.

"But the workings of this law are not restricted to color characters. Hair-length and texture are likewise Mendelian characters in heredity. Long or 'Angora' hair in guinea-pigs and rabbits is a character excluded by short or normal hair. In man curly hair is dominant over straight hair. In guinea-pigs an abnormal arrangement of the hair in rosettes is dominant over normal coat, just as in birds abnormal arrangement of the feathers in crests, ruffs and frizzles is dominant over normal arrangement.

"Further, the Mendelian characters are not restricted to superficial or skin characters. In man a two-jointed condition of the fingers has been found to be dominant over the normal or three-jointed condition, the abnormality in this case being associated with shortening of certain other parts of the skeleton. This case is the more remarkable because skeletal characters in general seem to be non-Mendelian in heredity. Color blindness, left-handedness and other peculiarities due to abnormal structure of the nervous system follow the law of Mendelian inheritance, as do also numerous pathologic conditions, such as hemophilia, known to 'skip a generation' or appear sporadically in families."

Sex appears to be a Mendelian character and other Mendelian characters are sometimes associated with it in inheritance, appearing in one sex but not in the other. The equality of the sexes in the higher animals is therefore fixed by a mathematical necessity.

"But not all heritable characters conform with the law of Mendelian or alternative inheritance; another important class of cases is governed by what we may call the law of blending inheritance. This is well illustrated in a cross between races of rabbits which differ in ear length. The offspring in such cases, when full grown, have ears which approximate closely the mean of the ear lengths of the respective parents.

"The linear dimensions of the skeletal parts of rabbits follow the same law of blending inheritance. In consequence the offspring have both skeletal dimensions and skeletal proportions which approximate closely the mean of the corresponding parts in their respective parents.

"Between fully alternative and fully blending inheritance we can recognize intermediate types, in which there is neither complete blending nor complete segregation of the contrasted characters brought together in a cross. Such, for example, is the case with polydactylism in the guinea-pig. A cross between an established polydactylous race (four-toed) and a normal one (three-toed) produces young sometimes with fairly well-developed extra toe, sometimes with very imperfect extra toe, and sometimes with no extra toe at all. The next generation shows a similar diversity of conditions. Extra toes are produced of all grades of development except the highest, both by individuals having extra toes and by those which lack the extra toe. In such cases it is evident that modification of the contrasted characters has taken place as a result of crossing, but this modification is less extensive than in blending inheritance.

"It is plain that in such cases heredity units are concerned, but their behavior is not strictly Mendelian, i. e., accompanied by dominance and segregation. It seems probable that in blending inheritance also heredity units are involved, but their behavior is different, and the breeder will do well to treat them in a different way.

"To sum up our conclusions, in all forms of inheritance alike, each parent makes, as regards every separately heritable character, a unit contribution to the offspring. Consequently the offspring are as regards every character two-fold, or dual, organisms. When the offspring, in turn reproduce, they transmit the conditions which they received from their parents; they transmit those conditions separately in alternative inheritance, blended in blending inheritance, and partially separate, partially blended in other forms of inheritance."

If the characters which it is desired to combine in one race conform with Mendel's law in heredity, the entire process of producing and fixing the new combination may be completed within two generations, but not all the individuals of the second generation will breed true to the combination of characters they manifest. Here is where selection must come in to single out the individuals which will breed true.

E. Davenport[1] draws the following conclusions from the table of Galton, giving the relation of the height of parents to those of children in 205 cases:

1. Parents of all sorts, whether tall or short, good or bad, produce some offspring better than themselves (as taller), some that are worse (as shorter), but a larger number not far from the standing of the parent.

2. If the parent is above the average of his race, his offspring will average high, but many individuals will be near the lower limits of the race.

3. The exceptional individual may arise either from the exceptional parent or from the mediocre parent.

4. More exceptional individuals arise from mediocre parents than from exceptional parents, but it is because the number of mediocre families is high (41) as compared with the exceptional (6).

5. The proportion of exceptional individuals is vastly higher from exceptional parents than from mediocre parents.

6. Whatever the parentage, there will always be a portion of the race that is decidedly inferior in respect to any given character.

The offspring of superior people will be likely, but not necessarily, superior people, and the offspring of degenerates will mostly be inferior, and the offspring of mediocre people will, on the whole, be mediocre, with some exceptionals and a few degenerates. The selection of the few exceptionals is common in animal breeding, but is not necessary in human eugenics, because the principle of preferential mating accomplishes the same purpose. Men and women do not, as is popularly supposed, choose opposites. To go beyond this natural result of preferential mating, we should be obliged to interfere with the deepest human instincts. This is not necessary for two reasons: first, the effect of preferential mating and secondly because exceptional individuals arise in large numbers from mediocre parents. It is therefore only necessary to exclude the degenerates and the race will naturally improve. The judicial process in dealing with criminals should aim to determine whether the criminal is such by nature, in

(1) Ill. Med. Jour., April, 1909.

which case he should be permanently segregated from society and rendered incapable of producing offspring, but if he is merely an accidental criminal opportunity should be given him to reform.

Davenport would not tamper with the marriage relations of normal people, but would eliminate the degenerates as soon as possible.

Heredity of Disease. A. L. Smith[1] believes that the theory that consumption, cancer, insanity and drunkenness are hereditary has done great harm. So long as it was believed that consumption was hereditary effective treatment was not likely to be undertaken and prevention was hardly thought of; when it began to be believed that it was contagious, advance on the prevention was made and the death rate decreased. Cancer is on the increase according to Smith, because its contagious character is not recognized. Its hereditary character can not be sustained by investigation. Smith has endeavored to obtain information on this point by a collective inquiry and finds that most of those who responded to his questions had not observed the direct inheritance of the disease.

To sum up: The bubble of the heredity of consumption has been burst and requires no further argument. Cancer, which has been considered a hereditary disease, is largely on the increase, just as consumption is on the decrease. One of my correspondents, the medical health officer of the model town of Bernardstown, Mass., in which every death has been recorded, with its cause, since 1864, writes me as follows: "From 1864 to 1874, one death from cancer, and forty from tuberculosis. From 1874 to 1884, three deaths from cancer, and twenty-six from tuberculosis. From 1884 to 1894, eight deaths from cancer, and seventeen from tuberculosis. From 1894 to 1904, twenty deaths from cancer, and seven from tuberculosis." These data result because cancer is still believed to be hereditary and no precautions are taken toward stamping it out, while consumption is recognized as contagious and is being rapidly stamped out. So that it is of the utmost importance that the popular idea of its heredity should be

(1) N. Y. Med. Jour., Sept. 19, 1908.

changed; for until it is, no steps will be taken to isolate it and people will put off having it removed while it is still possible to remove it entirely.

The contagiousness of insanity is suggested. A man may die insane from some acquired cause and his son or daughter from another unrelated cause and yet the insanity of the son will be classed as hereditary. The author is convinced that a child born of the most clever and most intellectual parents may become insane, if improperly fed or badly brought up, while a child of weak-minded or even insane parents may grow up to be an intellectual giant if transplanted soon after birth to a highly intellectual environment and if properly fed. Idiots and those having organic disease of the brain are not referred to.

Dr. Vallee, superintendent of the Beauport Asylum, Quebec, believes that many cases of insanity are contagious, in the sense that one member of the family may by imitation of the insane actions of another member gradually become as insane as the first one.

Drunkenness is generally supposed to be hereditary. But the writer is convinced that what has been taken for heredity is simply a matter of imitation. He knows of several families where the father was a confirmed drunkard long before the children were born, and yet not one of those children care for alcohol; in fact, they loathe it. These children were for the most part educated away from home. In another family, where the father took to drink after all the children were born, the five boys were brought up with the constant example of a drinking father before them, and four out of the five have become drunkards. If drunkenness is recognized as contagious instead of hereditary many a family might be saved from this disease, either by isolating the drunken father or by sending the children away when practicable.

If more attention were paid to training and environment and less to heredity, there would be fewer consumptives, fewer people with cancer, fewer insane, fewer drunkards and fewer murderers.

AUTOPROTECTIVE MECHANISM OF THE ANIMAL BODY.

C. E. de M. Sajous[1] elaborates a theory of the protective influence of the glands having internal secretions which starts with the secretion of the adrenals, which secretion has a marked affinity for oxygen, and inevitably reaches the pulmonary air cells. On reaching the air cells, the adrenal secretion absorbs oxygen and becomes a constituent of hemoglobin and of the red corpuscles. It is the adrenal secretion which, after absorbing oxygen from the pulmonary air and being taken up by the red corpuscles, supplies the whole organism, including the blood, with oxygen. The red corpuscles, after absorbing the oxygenized adrenal secretion (the albuminous constituent of their hemoglobin) yield it to the blood plasma in the form of droplets, the so-called "blood platelets." The oxygen laden adrenal secretion is a constituent of the albuminous hemoglobin in the blood plasma. From this evidence he concludes that the adrenal secretion governs the metabolism of the body.

Sajous calls the oxygen-laden adrenal secretion adrenoxidase. This he concludes has intimate relations with the process of immunity. This is shown by its relation to the genesis of fever, in which it appears to be the agent that raises the temperature. The next step in the argument is to show the method by which the adrenals and their secretion are regulated through the nervous system.

The governing center of the adrenals is neither located in the cerebrum nor in the medulla oblongata, but in some organ at the base of the brain. Study of the pituitary body showed that it has close relations with this nervous control. The pituitary body sends nerve fibers upward to the *tuber cinereum* and the walls of the third ventricle and thence to the pontobulbar region and the spinal cord. It has been shown that lesions along this path provoke a rise of temperature. The pituitary, like the adrenals, influences general oxidation and temperature as well as metabolism and nutrition and like the adrenals it influ-

(1) N. Y. Med. Jour., Feb. 20 and 27, 1909.

ences blood-pressure. The pituitary also, like the adrenals, may cause glycosuria.

"Having ascertained 1, that the pituitary could alone be the source of impulses to the adrenals; 2, that this organ projected fibers toward the bulb; and 3, that the pituitary and the adrenals give rise to similar experimental and clinical phenomena, it became a question whether a nerve path actually united these organs. Study of this question showed that the phenomena provoked by both the pituitary and the adrenals can be traced by irritation or sections along a continuous path leading from the pituitary to the adrenals.

"Briefly, these facts jointly suggest that the pituitary adrenal path leaves the spinal cord through the upper four or five rami to enter the sympathetic chain and then the great splanchnic which, through the intermediary of the semilunar ganglia, supplies nerves to the adrenals."

From these considerations the author concludes 1, that the pituitary is connected with the adrenals by direct nerve paths; 2, that it thus governs, through the adrenals, general oxidation, metabolism, and nutrition.

He next proceeds to trace the analogies between the thyroid gland and the adrenals. The thyroid secretion is an iodized globulin, the globulin being the albuminous constituent of hemoglobin, i. e., adrenoxidase. The thyroparathyroid secretion eventually reaches the superior vena cava and is carried to the pulmonary alveoli where it is taken up by the red corpuscles along with the adrenal secretion. The thyroparathyroid secretion endows the albuminous portion of the hemoglobin with sensitizing properties. As such it is the blood constituent which A. E. Wright has termed opsonin. The thyroid secretion acting as opsonin also softens bacteria and other pathogenic agents to facilitate their proteolysis by the complement. As such it is known as agglutinin. Numerous chemical and clinical facts show clearly that the thyroid constituent of the hemoglobin enhances oxidation of the tissues.

Further analysis of this phenomenon then elucidated the nature of the process itself—that embodied in the following deductions:

1, The thyroparathyroid constituent of the hemoglobin

enhances oxidation by increasing, as a ferment, the inflammability of the phosphorus which all cells, particularly their nuclei, contain.

2, As such it combines with adrenoxidase to sustain metabolism and nutrition.

3, All pathogenic elements in which phosphorus is present: bacteria, their toxins or endotoxins, toxic wastes, etc., are similarly influenced by the thyroid product acting as opsonin or agglutinin; they are thus rendered more vulnerable to the digestive action of the plasmatic and phagocytic complement.

From the similarity in their functions Sajous concludes that a relation exists between the pituitary body and the thyroids and from evidence drawn from zoology he concludes that the pituitary body is a governing body to the thyroid mechanism. He finds that the pituitary body of all animals from mollusks to man contains a sensory organ which structurally resembles the nasal olfactory membrane. In ancestral animals the "test organ" serves to test the purity of the sea water ingested by them. In consideration of the anatomic relations the conclusion seems warranted that in the higher animals, including man, the "test organ" tests the purity of the qualitative homologue of sea water, the blood, for toxic substances and, where possible, causes destruction of these substances. Sajous expresses the view that fever is the physiologic expression of the defensive mechanism when a toxin capable of exciting the test organ is present in the blood. The experiments of Sawadowski showed that when a section was made through the optic thalami the injection of putrid substances into the blood failed to produce fever. This is explained by supposing that this section divided the nervous path by which the impulses were conveyed from the "test organ" to the adrenals and thyroids.

These experiments speak for themselves—especially in view of the fact that Sawadowski mentions among the concomitant effects of his sections "disorders of respiration and circulation," and also blueness of the blood—obvious evidences of defective oxygenation. Added to the foregoing evidence, they seem to Sajous to warrant the following general deductions:

1, Man, in keeping with many animals lower in the phylogenetic scale, is supplied with an autoprotective mechanism.

2. This mechanism includes: 1, the immunizing center, an organ of special sense annexed to the heat center, both centers being located in the pituitary body; 2, the thyroparathyroid glands; 3, the adrenals; and 4, special nerves which connect the immunizing center (through the heat center) with these two sets of organs.

3. The immunizing center which governs the autoprotective mechanism, is the developed "osphradium" or "test organ" described by zoologists in mollusks and certain ancestral vertebrates.

4. While the osphradium of primitive animals tests their respiratory fluid, sea water, its prototype, the immunizing center of higher animals, including man, tests the blood, also a respiratory fluid and a qualitative homologue of sea water.

5. When the functional activity of the immunizing center is increased through the presence in the blood of some toxin (i.e., wastes, toxins or endotoxins, mineral and vegetable poisons, certain venoms, drugs, etc.), capable of exciting this center, it stimulates correspondingly the heat center and thus awakens the immunizing process.

6. Fever indicates that the autoprotective mechanism is active. The rise of temperature is due to the increased production of thyroparathyroid and adrenal secretions and the resultant increment of metabolic activity. The immunizing process is a consequence of this hypermetabolism, all the immunizing agents, plasmatic and cellular, being produced in greater quantities.

7. Absence of fever in a toxemia of any kind is due to inability of the immunizing center to react under the influence of the toxin, owing to deficient sensitiveness (inherited or acquired) of this center, or to the fact that the toxin is itself a paralyzant or anesthetic of its sensory elements.

8. Excess of fever (above 105.5° F.) is due to excessive excitation of the immunizing center and a corresponding overproduction of defensive bodies. This condition exposes the red corpuscles and the endothelial cells to

proteolytic destruction (hemolysis and autolysis) along with the pathogenic substances or bacteria.

As a summary of a simplified conception of immunity Sajous refers briefly to the following factors:

"1. Certain leucocytes (the finely granular oxyphiles) secrete in the blood their nucleoproteid granulations, the phosphorus of which, when oxidized, liberates heat. 2. The final bacteriolytic or antitoxic agent (complement or phagocytic cytase) is, in keeping with prevailing teachings, a trypsinlike ferment whose activity is increased by heat. These features completing the needs of the defensive process, we may proceed to summarize it.

"There occurs, at first, what might be termed the 'preparatory' stage, the purpose of which is to increase the defensive constituents of the blood and other body fluids. This is brought about as follows: The toxin (certain toxins, wastes, drugs, etc.) excites the immunizing center. This center in turn stimulates the thyroparathyroid glands and adrenals, thus causing them to supply the blood (and to a certain extent the lymph and serous fluids) with an excess of *thyroiodase* and *adrenoxidase.* Metabolism being enhanced in all tissues by these substances, the pancreas also secretes an excess of *trypsic ferment,* while the leucocytogenic tissues (bone marrow, lymph glands, etc.) produce an increased number of leucocytes, mainly *finely granular oxyphiles and phagocytes.* The blood and other body fluids being now provided with all the active agents of the defensive mechanism the process itself is started. It is briefly, as follows:

"The thyroidase (opsonin, agglutinin) sensitizes and softens the pathogenic agent while the adrenoxidase (amboceptor) oxidizes the phosphorus of the nucleoproteid granulations, liberating heat; the activity of the trypsic ferments (plasmatic and phagocytic complement) being correspondingly increased, the pathogenic agent is converted into benign and eliminable products."

PARASITISM AND NATURAL SELECTION.

R. G. Eccles[1] discusses the part played by animal and vegetable parasites in the evolution of the animal kingdom. Parasitism is due to a struggle for existence among the lowest classes of animals and evidences of it are found in the fossil remains of the geologic ages. Without doubt the diseases produced by such parasitism have destroyed large numbers of animals, and the survival of the species which are now on the earth must be to a large extent due to their adaptation to the presence of parasites either by the development of protective structures or of powers of neutralizing their poisonous secretions. The development of the successful survivors of the attacks of these parasites has made their tissues no longer habitable by them so that many parasitic forms have perished. Others have adapted themselves to their hosts and still survive as the exciting causes of present day diseases. The course of evolution has been accompanied by the development of specific characters among the parasites as well as among their hosts. Eccles illustrates these facts by a table showing the relations of the protozoa in the form of a tree. He concludes that disease has had its function in securing the higher development of animal species and of man in particular. He says: "It thus seems probable that what we have hitherto deemed altogether a thing accursed—disease—may yet be proved to be a blessing in disguise. It can truly be said of all our race that 'These are they that came up through great tribulation' but without such tribulation there could have been no such perfection of beauty and of form as we find on the earth at present."

PHYSICAL DEGENERATION.

W. Coates[2] points to a steadily increasing physical and mental deterioration in the British nation as is shown by the stature and weight of recruits for the army. The conditions in the navy are shown by the fact that while on an average 5,000 boys are needed annually, 33,000 are

(1) Med. Record, July 31, 1909.
(2) British Medical Jour., May 1, 1909.

rejected in order to get them. The following figures are given for the army: The minimum requirement in height has been reduced in the last 50 years from 64 to 63 inches. Previous to 1883 a recruit could not enter the army unless his minimum chest measure was 34 inches; he can now enlist into some units with a chest measure of 31½ in. provided he has 2 in. expansion.

In 1862, 416 recruits per 1,000 weighed under 130 pounds.

In 1907, 657 recruits per 1,000 weighed under 130 pounds.

In 1862, 52 recruits per 1,000 weighed under 110 pounds.

In 1907, 83 recruits per 1,000 weighed under 110 pounds.

Fifty years ago, when the physical requirements for enlistment were much more stringent than now, 37% only of the recruits examined were unfit for service. In 1907, 38% were rejected by the medical officer; and General Sir Frederick Maurice considers that, when the numbers that are sent away by the recruiting sergeants and those dismissed as unfit after 3 months' service are taken into account, at least 60% are now lost to the army through physical unfitness.

The author thinks that by judicious efforts on the part of the medical profession much can be done to lessen this progressive degeneracy. He proposes an increase in judicious physical exercise, the institution of playing fields, the better physical training of children in school and on play grounds and the institution of universal military drill.

One of the most encouraging facts with regard to the possibility of restoring the health and strength of a nation is to be seen in what has happened in Sweden. Seventy or eighty years ago the Swedes were fast becoming a degenerated race, but they appreciated their condition before it was too late. They reformed their licensing system, planned their towns so as to secure much vegetation and ample open spaces, and gave the youth of the country a sound gymnastic training on the system which is now recognized to be the best. They are now the finest race in Europe, and, what is most remarkable, the men of the