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WHERE ANGELS FEAR TO TREAD: A CONTRIBUTION FROM GENERAL SOCIOLOGY TO HUMAN ETHICS[1]

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INTEREST in the social impact of science in general and of biology in particular has been growing steadily in the last few decades. The problems imposed by the present war and by thoughts of the coming post-war world have increased this interest. My own active concern with various phases of the sub-social and social life of non-human animals has revealed enough of the complexities of these simpler social systems to make me well aware of my limitations when confronted with the modern social problems of men. It is the drive of immediate necessity rather than a feeling of competence that impels me to undertake the present discussion of the biological foundations for some fundamental phases of the social behavior of men.

[1] Proposed address as vice-president and chairman of Section F of the American Association for the Advancement of Science.

I. THE BIOLOGICAL EVIDENCE

In our laboratory we are making two experimental approaches to the phenomena of biological sociology, and each yields its very different aspect of truth. On the one hand, we have been studying for over a decade the dominance-subordination relations that are characteristic of many social groups. We know from personal observations, as well as from the literature, of nip-orders in fish, peck-orders in flocks of several species of birds and fighting orders in mice. Usually there is one dominant animal which can bite, nip or peck others without being attacked in return. Below it the others are ranked in various degrees of subservience. Similar dominance orders occur among such mammals as rats, cats, cows and men. Social organizations have also been reported with certainty

for turtles and for lizards, as well as for many species of birds and mammals besides those which we have observed.

These social organizations are based immediately on fighting or bluffing ability, on individual aggressiveness or meekness, as exhibited in pair contacts between the different members of the vertebrate group in question. Usually the complete social order within a small group is determined during the first few days of contacts; often, among hens, for example, in the first series of encounters. The order, once established, is not readily upset. With fish, changes occur fairly frequently; but with hens, we have observed the same peck order to persist unchanged for as long as a year, and this is a relatively long time in the life of a hen. These social orders are a real expression of crude, person-against-person competition for social status and furnish fair illustrations of the individualistic, egocentric phase of group biology. Here is an aspect of the individual struggle for existence, and as such it illustrates an important phase of the Darwinian theory of evolution.

High position in the social peck order confers privileges. We know that top-ranking animals feed more freely; that high-ranking males of rhesus monkeys, sage grouse and the common domestic fowl have more ready access to females. Low social status may lead to semi-starvation, to psychological castration among cocks, to ejection from coveys of quail; and among many species it forces the low birds into inferior territories. In some cases, high social rank carries responsibilities for leadership or for guard duty; in other instances no correlation with social duties has been demonstrated as yet. Among others, I have published research reports and discussions of many such relationships and need not dwell on them longer.

These studies of individual aggressiveness make one experimental approach to general and comparative sociology. Our second line of attack comes from a different quarter. For more than twenty-five years we have been experimenting with group-centered tendencies which long before my time were called cooperation. Careful students nowadays point out that, among lower organisms, cooperation is entirely non-conscious. In this phase of our study we are investigating natural cooperation somewhat as many other biologists have been concerned with natural selection. Natural cooperation in its simpler forms implies merely that the interrelations between cells, for example, are more beneficial than harmful for the individual, or that the interrelations between individuals are more beneficial than harmful for the given social group.

I have added to and reviewed repeatedly the modern evidence concerning the existence of such cooperation. Mere repetition does not necessarily make for acceptance, but a good purpose may be served by summarizing in outline form the types of modern evidence that I have found compelling; the details can be filled in from the extensive literature.[2]

(1) At all levels of the animal kingdom, and under a variety of conditions, there is added safety in numbers up to a given point. Animals from the protozoans to insects or man meet many adverse conditions better if optimal numbers are present rather than too few. There is danger also in overcrowding, but I am emphasizing just now the danger of the population being too sparse. For certain animals this sort of mass protection exists when the organisms are exposed to heat. Mass protection from cold is more common, as is protection from many poisons and from other harmful chemicals. Optimal numbers also protect from ultra-violet radiation, from radical changes in osmotic pressure and from many environmental deficiencies.

Macerated cells of a sponge will not regenerate if too few are present and the smallest embryonic grafts frequently fail to grow when somewhat larger ones succeed. If a natural population falls too low, it is in danger of dying out even though theoretically able to persist.

(2) In keeping with the relations just outlined, many organisms, both plants and animals, are able so to condition an unfavorable medium that others following or associated with them can survive better and thrive when they could not do so in a raw, unconditioned medium.

(3) Certain vital processes are adaptively retarded by increased numbers up to a given density. For example, scattered spermatozoa of many marine organisms lose fertilizing power more rapidly than they do when they are massed together.

(4) Other biological processes are accelerated, perhaps beneficially, in the presence of populations of optimal size and density. Such processes are slowed down both in over-sparse populations and in those that are overcrowded. Cleavage rate in Arbacia and certain other eggs follows this rule. Various kinds of Protozoa show acceleration in rate of asexual reproduction with medium rather than sparse population density, and similar phenomena may well have been a forerunner of

(5) The evolution of the cooperative processes which are associated with sexual reproduction.

(6) Colonial protozoa could hardly have evolved from solitary forms unless the simple colony of cells that remained attached after divisions had shown cooperative powers that were lacking when the cells were scattered singly. The evolution of the Metazoa from the Protozoa was probably based on similar relationships.

[2] W. C. Allee, "The Social Life of Animals." 283 pp. New York: Norton. 1938.

(7) Each advance in complexity of metazoan individuals came from the natural selection of an increased ability in natural cooperation on the part of the evolving stock; the greater natural cooperation came first, and then it was selected.

(8) Darwin[3] recognized that a relatively large population is a highly important factor in natural selection. Sewall Wright and others have evidence that evolution proceeds most rapidly in populations of interbreeding organisms that are intermediate in size, as compared with similar populations which are over-small or over-large.

(9) The interdependence of organisms is shown by the repeated observation that all living things, from the simplest to the most complex, live in ecological communities; this is plainly seen in the many biocoenoses, such as those of the oyster bed. Further, the evolution of truly social animals has occurred independently in widely separated divisions of the animal kingdom. These could hardly have arisen so frequently and from such diverse sources if a strong substratum of generalized natural cooperation were not widespread among animals in nature. In nature no animal is solitary throughout its life history.

(10) As with the individual organisms, each advance in complexity of the social life of any group of animals is based on the development of some means of closer cooperation between the individual units of the evolving group.

We have good evidence then that there are these two types of social or sub-social interactions among animals: the self-centered, egoistic drives which lead to personal advancement and self-preservation, and the group-centered, more-or-less altruistic drives that lead to the preservation of the group or of some members of it perhaps at the sacrifice of many others. The existence of egoistic forces in animal life has long been recognized. It is not so well known that the idea of the group-centered forces of natural cooperation also has a respectable history. I take time to give a bare outline of the growth of this idea and to mention some of its proponents because many professional and lay students are interested in the men who have accepted an idea as valid as well as in the evidence that supports it.

The germ of the concept of natural cooperation, along with that of natural selection, can be traced to the biologically absurd poetry of Empedocles about the middle of the fifth century, B.C. Thereafter the principle was kept feebly alive by the succession of thinkers from Aristotle to Herbert Spencer and beyond, who saw human society as a natural outgrowth rather than as an artifact.

More positive emphasis on the "altruistic" interpretation began with the third Earl of Shaftesbury who, about 1700, recognized clearly that racial drives exist which can be explained only by their advantages to the group. He thought that there is a natural goodness about men and recognized that other animals may be kind to associates of their own species. Adam Smith, in his "Theory of Moral Sentiments," wrote in 1759 of the same qualities under the heading of "sympathy" or "fellow feeling." His more famous "Inquiry into the Wealth of Nations" (1776) is based on the opposed forces of self-interest and he did not publicly reconcile the two. Later Comte (1798–1857) emphasized "altruism" as Feuerbach (1804–1872) did "love." These relationships are reviewed sympathetically by Lange (1875) in his remarkable "History of Materialism."

Herbert Spencer argued now for egoism and again for altruism. In 1901 he balanced the two following quotations from his "Principles of Ethics": "If we define altruism as being all action, which in the normal course of things, benefits others instead of benefiting self, then, from the dawn of life, altruism has been no less essential than egoism. Though primarily it is dependent on egoism, yet secondarily egoism is dependent on it."

Darwin, in the "Origin of Species" (p. 215) recognized that evolution within the worker caste of ants can be explained by remembering that selection can act on the family as well as on the individual and Weismann[3a] in 1893 underscored the point. Such ideas are in keeping with Darwin's use of the phrase "struggle for existence," of which he said: (p. 46) "I use this term in a large and metaphorical sense including dependence of one being on another and including (which is more important) not only the life of the individual, but success in leaving progeny."

In the "Descent of Man" (1874), Darwin gave Kropotkin-like naturalistic examples of mutual aid; and we can readily see that Darwin's whole thesis that man is descended from other animals requires that man's altruistic drives have precursors among his animal ancestors. Darwin clearly derives the moral sensibility of man from his "social instinct" played upon by reflective intelligence and states (p. 122): "The term, general good, may be defined as the rearing of the greatest number of individuals, in full vigour and health, with all their faculties perfect, under the conditions to which they are subjected. As the social instincts both of man and the lower animals have no doubt been developed by nearly the same steps, it would be advisable, if found practicable, to use the same definition in both cases, and to take as the standard of morality, the general good or welfare of the community. . . ." He recognized group-focused tendencies in the higher mammals. He did not, as

[3] "Origin of Species," Murray's Library Edition, p. 74.

[3a] August Weismann, *Contemp. Rev.*, 64: 309–338. 1893.

nearly as I can judge, sense the existence of the reservoir of sub-social and social tendencies of which Espinas[4] wrote in 1878.

Geddes and Thompson comment in their book called simply "Evolution" (p. 167), which was published in 1911, that "Darwin's characteristic fundamental idea of the intricacies of the interrelations in the web of life lies below the idea of natural selection." Later, in speaking of family and group selection, they continue: "Though Darwin did not wholly overlook this (indeed in one notable passage he expresses it) there is no doubt that the general tone and treatment of Darwinism, even hitherto, has been colored by the acute individualism of Darwin's and the preceding age."

Evidence that the egoistic emphasis was common in British scientific circles during Darwin's later life, and that group-centered interpretations were novel is found in a news note from *Nature* for January 21, 1880: "We notice an important communication by Prof. Kessler at the annual meeting of the St. Petersburg Society of Naturalists on January 8 [1880] on the 'Law of Mutual Help' as one of the chief agents in the development and progress of organisms. Prof. Kessler, although an able follower of Darwinism, thinks that the struggle for existence would be insufficient to explain progress in organic life, if another law, that of sociability and mutual help, did not powerfully work for the improvement of the organism and for strengthening the species."

Espinas (1878), two years before Kessler's lecture, had given a similar interpretation which he supported by the best observations then available. Espinas emphasized the naturalness of the cooperative, social drives. Geddes and Thompson reaffirmed a similar conclusion in 1911: "We may therefore restate the concluding thesis of our 'Evolution of Sex' (1889) since elaborated in various ways by Drummond, by Kropotkin and others. It is that the general progress both of the animal and plant world, and notably the great uplifts, must be viewed not simply as individual but very largely in terms of sex and parenthood, of family and association; and hence of gregarious flocks and herds, of cooperative packs, of evolving tribes, and thus ultimately of civilized societies. . . ."

The idea did not catch general scientific attention despite the emphasis placed on such an interpretation by Delage and Goldsmith (1912),[5] Reinheimer (1913, 1920), and William Patten, who in 1920 made the cooperative principle the central point in his "grand strategy of evolution." The neglect continues despite the repeated emphasis given by William Morton Wheeler (1923, 1930), despite my own summaries of supporting evidence and the more recent adoption of this point of view by Emerson (1942), Gerard (1942) and others whose opinions should carry weight. Today, as in Darwin's time, the average biologist apparently still thinks of a natural selection which acts primarily on egoistic principles, and intelligent fellow thinkers in other disciplines, together with the much-cited man-in-the-street, can not be blamed for taking the same point of view. Personally, I was well and thoroughly trained in this orthodox biological doctrine. For example, it was clearly stated in the first chapter of a book published in 1913 by my stimulating friend and former teacher, Professor V. E. Shelford.[6]

As was shown earlier, both egoistic and group-centered forces exist in nature and both have been brought under experimentation. I had wondered for years whether we could experimentally test for possible relationships between these two basic phases of animal behavior. Might organized groups of birds, to take one possible instance, have survival values for the group in general as a result of their organization, even though there were no signs of an organized group defense? It will be remembered that such a group organization is based on individual aggressiveness and yields survival values for the high-ranking individuals in the peck order.

I have not yet been able to devise an elegant experiment to test the point. The best one I have been able to think up has been in progress for over nine months. Briefly, we have three flocks of line-bred hens which have been allowed to become organized and are kept as controls. In a similarly housed neighboring flock of the same stock, a new hen is added daily or every second day and the hen which has been longest with the flock is removed and placed in isolation for twenty-one days or more before she is again introduced into the experimental flock. By that time, apparently, she has forgotten all other hens as individuals; hence the experimental flock is in a state of continual reorganization.

I can not take time for details and without them you will be unable to make a critical judgment con-

[4] A. V. Espinas, "Des sociétés animales." 588 pp. Paris. Librairie Ballière.

[5] Y. Delage and M. Goldsmith, "The Theories of Evolution." 352 pp. London: Palmer. 1912. H. Reinheimer, "Evolution by Cooperation; a Study in Bioeconomics." 200 pp. London: Paul, Trench, Trübner and Co., Ltd. 1913. H. Reinheimer, "Symbiosis, a Socio-Physiological Study of Evolution." 295 pp. London: Headley Brothers. 1920. W. Patten, "The Grand Strategy of Evolution." 429 pp. Boston: Badger. 1920. W. M. Wheeler, "Social Life among Insects." 375 pp. New York: Harcourt Brace. 1923. W. M. Wheeler, "Social Evolution." Chapter IV in "Human Biology and Racial Welfare." 612 pp. E. V. Cowdry, ed. New York: Hoeber. 1930. A. E. Emerson, "Basic Comparisons of Human and Insect Societies." Biol. Symposia VIII, 163–177. 1942. R. Gerard, "Higher Levels of Integration." Biol. Symposia, VIII, 67–87. 1942.

[6] V. E. Shelford, "Animal Communities of Temperate America." 362 pp. Univ. of Chicago Press. 1913.

cerning the value of the experiment. An individual can effect the quality of the group life in these flocks; still, despite differences in individuals, the indications are that, regardless of the individuals that may be present, the organized flocks eat more, maintain weight better and spend less energy in fighting, bluffing and pecking each other than is the case with the flock that is daily subjected to reorganization. The strong suggestion is that an organized flock of hens has survival value as a flock which is lacking among an otherwise wholly similar group of hens, that is never allowed to become socially stabilized.

With all its imperfections, the experiment suggests that person to person competition, if not too severe, may lead to group organization which increases the effectiveness of the group as a cooperating social unit in competition or cooperation with other social organizations. Such a conclusion had been suggested by naturalistic evidence. Other data, certain types of which have already been summarized, indicate that cooperation at the individual level may also yield groups with increased competence in competition or cooperation at the group level. Any group organization, however achieved, may be helpful under many conditions. There is suggestive evidence that the relations between individuals which form a simple group of the first order are repeated between such groups when compounded into a unit of a higher social order. Even when society becomes still more complex, the relationships remain essentially similar. Throughout the higher social categories, there may be group-centered egoism and tendencies toward inter-group cooperation at one and the same time.

With cosmopolitan species, whether of human or of non-human animals, in last analysis, the cooperative units tend towards being world-wide in scope. If in its spread over the globe the common house sparrow becomes a new host for a virulent disease organism, the welfare of the whole species may be affected. Sessile eel grass has been devastated on the Atlantic coasts of Europe and of North America by the same mycetazoan parasite. The conclusions that I have been discussing are based primarily on objective studies with non-human animals. They are supported by much evidence from the interrelations of men; and the global scope of the cooperative interests of *Homo sapiens* are more obvious and have more possibilities for development than have those of any other species.

The picture that emerges from the cumulative studies on social biology is one in which cooperations and their opposite, disoperations, both exist. There are both egoistic and altruistic forces in nature, and both are important. The question arises insistently as to which of these is more fundamental and potent. Any such evaluation must be based on both short-run and long-run effects. After much consideration, it is my mature conclusion, contrary to Herbert Spencer, that the cooperative forces are biologically the more important and vital. The balance between the cooperative, altruistic tendencies and those which are disoperative and egoistic is relatively close. Under many conditions, the cooperative forces lose. In the long run, however, the group-centered, more altruistic drives are slightly stronger.

If cooperation had not been the stronger force, the more complicated animals, whether arthropods or vertebrates, could not have evolved from the simpler ones, and there would have been no men to worry each other with their distressing and biologically foolish wars. While I know of no laboratory experiments that make a direct test of this problem, I have come to this conclusion by studying the implications of many experiments which bear on both sides of the problem and from considering the trends of organic evolution in nature. Despite many known appearances to the contrary, human altruistic drives are as firmly based on an animal ancestry as is man himself. Our tendencies toward goodness, such as they are, are as innate as our tendencies toward intelligence; we could do well with more of both.

II. Some Implications

Now I come to the more delicate part of my task. In discussing the further implications of the evidence and conclusions just presented, I am, as much as is possible, speaking in my private capacity as an American citizen with generations of American ancestors. I am both a mature biologist and a working member of a religious organization. The ideas I shall express are not necessarily those of the American Association for the Advancement of Science or of any of its sections; neither are they to be interpreted as the views of the university at which I work or of any other formal or informal organization. If at times I seem to place myself as a spokesman for all scientists or for biologists in general, please remember that I am giving my personal views and am not attempting an authoritative interpretation of the opinions of others.

As I see it, our present-day civilization is based primarily on religion, on other forms of tradition and on science. The arts furnish color and interpret the behavior and thinking of the human participants. Philosophy busies itself, or should, with trying to understand and explain the whole. The functioning of our type of civilization, if it is to be properly effective, calls for the cooperation of all these forces.

To-day, as in the past, religion wastes valuable time and energy quarrelling with science about their relative importance and over the proper division of functions, a quarrel which nowadays scientists largely ignore. Philosophy stages jurisdictional disputes with both. Too often art becomes cynical and irresponsible,

and philosophy scolds all and sundry, sometimes in no friendly voice, for the general unwillingness to let philosophy direct the whole.

Philosophy insists, even yet, on its discredited age-old claim of having a special short cut to knowledge. Particularly philosophy scolds science, the most recently revitalized force in civilization; and modern religion, having attempted to use science to establish its claims, tries to carry on alone in some of the most vital activities of our times.

Here, as elsewhere in human efforts, it is easier for closely knit elements in a situation to develop and react to frictions among themselves than it is to disregard relatively petty internal troubles and make common cause against serious opposing forces. The forces in opposition to the better aspects of our none-too-perfect civilization are strong enough to demand united efforts from the arts, philosophy, science and religion if they are to be properly met. Perhaps plain speaking from a somewhat unorthodox friend of all these elements of civilization may be helpful.

Religion has much to learn from science in objectivity, in willingness and courage to follow evidence fearlessly and even in judging what constitutes valid evidence. Particularly religion can learn from science the advantage of giving up the thundering "thus saith the Lord" in favor of the more humble and essentially more effective summary of "this appears to be the evidence." In short, religion can profit by becoming intellectually more sound without losing for a moment its proper emphasis on the deep emotions of man.

And science has much to learn from religion. I mean from real religion, not from the pseudo-science of theology which, too often, consists mainly of expert verbal manipulations, related to scholasticism rather than to science.

Apparently I must take time to suggest what I mean by religion. Religion is ill-served by past and present emphasis on mystical and supernatural improbabilities. To me "God" is a possibly permissible name for the personification of all the best that the human race has been able to think and do and of all the beauty we have created, together with all the natural beauty we can appreciate. Such a conception transcends tradition and mere emotion and has both power, and dignity. While by no means final, this is as close an approach to the truth as real evidence permits at present.

Science has much to learn from such a religion as I have just outlined, a religion characterized by unselfish living and honest thinking combined with propaganda of the deed. More specifically, scientific men can profit by greater humbleness in the face of our immense ignorance about matters well within our several fields of professed competence. We can also dispense with excessive pride in the usually small discoveries we are able to make.

We scientists can profit by a frank admission of our awe and admiration for the pervading beauty of the phenomena we study, the charm of which often escapes us because of our preoccupation with details. We will profit by being less certain that the more unpalatable the interpretation, the closer the approach to truth. We will gain in the long run by working in our chosen fields more inconspicuously and quietly. Science, and mankind too, will profit by scientists who live closer to the ideals expressed and practised by the more devoted men of science or of religion.

I could make these suggestions in stronger language were it not for the fact that from a fairly wide and close acquaintanceship with many kinds of people, individual exceptions aside, scientists in general and biologists in particular seem the best people I know. This may be an expression of prejudice based on congeniality of temperament. I am inclined, however, to regard the difference between my scientific and my other friends as real and to attribute it to the training furnished by scientific practises.

The biological sciences impose an especially effective discipline in that they combine an impressive amount of precision in detail with a large content of imponderables. The combination is the more effective in that a mistake in judgment concerning the imponderables is usually exposed relatively soon by some precision measurement. The continuous checking of ideas against evidence does something to make conscientious followers of the scientific method essentially more honest and less given to the self-deception, which is one of the weaknesses among those skilled primarily in the manipulation of ideas or of words.

As with followers of other disciplines, we scientists are very human. Our frequent preoccupation with "my status," "my experiment," "my theory," "my priority" and even with "my little bug" is a source of weakness for which correction can be found in a closer approach to the ideals of science or of religion.

Despite my firm belief in the essential goodness of my biological colleagues, I must admit that advanced laboratory study and the introduction to research does not automatically produce some of the higher types of altruism. When recurrent opportunities come to recommend some one to teach biology in a deserving though struggling Negro college, or in remote, ill-equipped, much-needed Chinese or Hindu laboratories, I have learned to turn to students with a strong religious background for men with vision enough to see that the opportunities may, in the long run, repay the sacrifices.

Let us take another approach. No one of us passes much time without being reminded that we are living

in a world at war and in a country that is closely engaged in that war. We went into this present conflict with, on the whole, commendable calm, and the war is being prosecuted more efficiently because wartime emotions are at a minimum as yet. It is questionable how long this frame of mind will continue. Our sons and friends and students are engaged on many fighting fronts and tension mounts as the casualty lists trickle through. We need to examine frequently our responsibilities as biologists in our world to-day, for, like other animals, biologists do not live in a vacuum insulated from the impacts of their time.

It has come as a shock to many that their hard-won biological skills are of so little direct use in the war. The closer the approach to preventative or curative medicine, the greater the immediate applicability of our biological training. It is true that in the war effort there have been some fairly amusing practical applications of highly impractical phases of biology, for it is impossible to predict what bit of pure science of to-day will be the basis for the applied science of to-morrow.

For most, particularly for those of us in the upper-age brackets, we must continue for the foreseeable future at our present jobs or at something closely approximating them. We may need to shift teaching and research somewhat; many have already done so. Primarily, however, our main job must be to remain steadfastly at our usual, routine tasks. These are by no means unimportant even for a world at war. The younger generation needs as many steady points of reference as possible in their rapidly shifting world. This need is tacitly admitted when they come, as they do, to talk themselves quiet in the presence of a sympathetic, calm, older person in whom they place some confidence.

We have a heavy responsibility to our younger friends and students in the armed forces of the world, in the civilian public service camps, in concentration camps or in prisons, so to act that they have a recognizable world to which to return. We, as well as they, have our responsibilities to defend and later to rebuild our civilization, using the techniques we know best. Our phase of the task is as important as it is undramatic.

In the present and immediate future we have the task of helping maintain our forms of government both locally and nationally. Closer home, we have the pressing work of maintaining academic standards and the honesty of academic credits, certificates, fellowship and other awards and even of academic degrees.

In addition to attempting to maintain present levels of competence in intellectual training, we need to give full play to all usable forces that make for emotional stability. Admittedly we are highly ignorant concerning methods for the education of the emotions at the college or graduate level. Mainly we trust to the added stability that comes with maturity. We need to pool our ignorance and attempt positive steps towards training emotion as well as intellect. We have some hints on which to work. Project methods of laboratory study can be helpful as can volunteer summer work camps, honest competitive group sports and many kinds of informal group living. The difficulty of the task and ignorance of how to educate the emotions does not warrant us in continued neglect of this important phase of education.

For the somewhat more remote future, there is an obligation that rests with especial weight on biologists to attempt to make sure that mankind does not lose the peace that will follow this war. We have less hope of winning the peace if all of us become emotionally engulfed in the war. Among other consequences of this duty not to lose the peace, we have an obligation to keep fundamental research projects going even in wartime. I am fully convinced that those nations will have the best opportunity to win the peace who emerge from the present conflict with their program of basic research most nearly intact. This includes the necessity for maintaining a supply of trained research workers in the basic disciplines and the retention of enough of the brilliant younger men to ensure a steady trickle of researches in a great variety of academic fields, many of which are far removed from the immediate war.

Biologists, as their part of the war effort, are searching with almost frantic haste for new techniques for patching up men's bodies and for solving problems of adequate nutrition for ourselves and our associates. This introduces another phase of the relation of science to war that must be faced honestly. Science is the maker and user of gadgets as well as the discoverer of the shadowy outlines of the tools of the future. Science is fighting this war in laboratories all over the world that were built to search impartially for basic evidence, for the truth, as we naively used to say, and for all people, not for one group or another.

The success of scientists in helping to win the war will be used to blame science itself later. When the war is over, the scientists who are now so praised and courted on almost all sides will be told in no uncertain terms, as we have been in the past, that the war itself was all our doing. And there will be insistent calls from many whose motives are not altogether disinterested, for a moratorium on scientific research lest bigger and more destructive wars have to be fought in the future. Such anti-scientists will forget the long series of vicious wars that were fought before science became a major force in our civilization. There will be some truth in the accusation, for biological science is not wholly free from war guilt. This is not only

because we have been the inventors of tools for mass destruction but because we have been responsible for giving interpretations to some aspects of Darwinian theories of evolution that provide a convenient, plausible explanation and justification for all the aggressive, selfish behavior of which man is capable.

Herbert Spencer in 1901 in his "Principles of Ethics", gave a mild statement of this doctrine (p. 189): "But to say that each individual shall reap the benefits brought to him by his own powers, inherited and acquired, is to enumerate egoism as an ultimate principle of biological conduct. . . . Under its biological aspect this proposition can not be contested by those who agree in the doctrine of evolution."

T. H. Huxley[7] asserts the same principle and characteristically steps up the emphasis. In speaking about primitive men and "their less erect and more hairy compatriots," Huxley's statement was: "As among these, so among primitive men, the weakest and stupidest went to the wall, while the toughest and shrewdest, those best fitted to cope with their circumstances, but not the best in any other sense, survived. Life was a continual free fight and beyond the limited and temporary relations of the family, the Hobbesian war of each against all was the normal state of existence." Huxley's general position was that amelioration of this egoistic struggle was a contribution made by "ethical man" despite his animal ancestry. Ernst Haeckel[8] took a wholly similar point of view.

According to this interpretation, the altruistic drives of man are primarily human attributes that arise from the development of sympathies at the human level and are connected with the mass of animal behavior by a very slender stalk. We know, for example, that the aggression of hens high in the peck-order may be modified by individual tolerances towards certain of their subordinates in a manner that strongly suggests human personal preferences. Also it appears that male chimpanzees show a chivalry pattern towards females that are in oestrus. Such modifications of aggressiveness are weak foundations on which to base the idea of a natural drive toward altruism among men. In fact, it is a fairly common interpretation that such altruistic drives as exist are based primarily on some sort of enlightened selfishness.

It is not to be wondered that apologists for human behavior seized on the doctrine so authoritatively set forth, as a proof that man, having descended from other animals, had inherited fighting tendencies which it was almost useless to resist. The natural fate of all was to engage in a physical struggle for existence softened only by slight checks imposed by more or less artificial rules for human conduct.

The biological support for this fatalistic view regarding, among other things, the inevitableness of intra-species human conflict, is now opposed by strong evidence which indicates that the idea of a ruthless struggle for existence is not the whole, or even the major contribution of current biology to social philosophy and social ethics. This newer evidence, which was outlined earlier, does not cast doubt on the existence of the human vices of pride, covetousness, lust, anger, gluttony, envy and sloth and it does not remove indications that they find natural roots in infra-human behavior. The newer findings do strengthen decidedly the older evidence for a biological basis for the human virtues of faith, hope and love and supply renewed indications that men inherited these tendencies too. This strongly suggests that the present high state of development of the seven capital sins just named is mainly a result of man's learned devilishness rather than his inevitable response to inherited nature. On the other hand, we know too that man has been able to enlarge greatly his natural drives toward being godlike.

From such considerations, I insist again that the data of biology, if properly understood, do not furnish sound support for a social philosophy based primarily on the idea that might makes right in interpersonal contacts or in international relations. Those who assert that the whole trend of science is to lend support to the present war system in settling international disagreements are relying on a mistaken, outmoded phase of biological thought to bolster up a much older and unreasoned drive toward conflict. The philosophy that condones war is not based on all the biological evidence or on recent interpretations made in the light of that evidence. Science is indeed largely responsible for designing the tools with which men fight and for undue emphasis even in the recent past on some of the implications of the Darwinian doctrine. Otherwise scientists as such bear only their proportionate share of the responsibility for the misuse man is making of the powers we have discovered and placed in his hands.

When this war does end, the intelligent public should have much to say about the terms of a just and workable peace. Happily there is interest in this subject among responsible biologists and I want to encourage continued consideration of all its complicated ramifications. Such a study will emphasize again the unity of all the forces that make for civilization. For example, certain phases of modern biology furnish a basis of objective evidence for the age-old religious insight that the fundamentals of a just and enduring peace are to be found in a positive ap-

[7] T. H. Huxley, "Evolution and Ethics and Other Essays." 333 pp. (pp. 203–4). Macmillan, London. 1894.
[8] Ernst Haeckel, "Freie Wissenschaft und freie Lehre." 106 pp. (p. 73). Stuttgart. 1878.

plication of the rule: behave towards all others as you would have all others behave towards you.

Speaking for the moment as a humanist, rather than primarily as a biologist (the two points of view are not unduly dissimilar) there are some implications of this ethical rule as applied to the coming peace which I shall outline. It should be understood that the biological drives toward natural cooperation support the general tenor of the following program without favoring this or any other precise formulation of proposed social action.

(1) We are not to look forward to punishment for defeated *peoples* at the close of the present war.

(2) In under-nourished Europe and elsewhere as needed, administer relief according to ability to furnish it and to need only, not according to politics or boundaries.

(3) Set up a world organization which will, in principle from the start, and in detail as much as possible, treat victors and vanquished alike. This implies similar treatment of all peoples with regard to:

(a) Disarmament; if we disarm other nations, we must be willing similarly to disarm ourselves.

(b) International police; if we subject any major portion of the world to the control of an international police force, we, ourselves, should accept a similar control on the same general principles.

(c) Curtailment of sovereignty; national governments of powerful, along with those of weak peoples, must discontinue the present policy of determining their own actions in all matters deemed by themselves to lie within the limits of their own national interests.

(d) Educate all alike for the processes that make for change by the use of peaceful, non-violent techniques. All nations and many classes within nations do and will continue to need such education for a long time to come.

(e) Behave towards the defeated peoples from the outset more as the English treated the Boers or the United States treated the Filipinos at the turn of the century rather than as our carpet-bag governments coerced the South after 1865 or as England governs troublesome India; and by all means not as Nazi Germany has treated her victims.

We should not overlook the existence of strong, competitive, egoistic drives among all animals, ourselves included. These must be duly considered in any workable plan for a world order. Our job is to keep them in their true place, somewhat subservient to the even more fundamental cooperative, altruistic forces of human nature. They should not again be allowed to steal the international show. These competitive urges can serve mankind well if turned to their original function of driving man in his struggle against his enemies among other species of living things. This struggle is on a global scale, and the members of all countries and races can unite in it. Each can compete against the others for racial, national or personal preeminence in this common task. Competitive drives for worthy ends have real strength. I have only to mention the word priority to a biological audience to make the point.

Consideration of these egoistic drives brings us back again to the hen coops from which we started. Man, like so many of his fellow vertebrates, has a strong tendency to set up social orders among individuals and between groups. In the past, man has made repeated trials of informal and finally of a more formal world organization based on dominance and subordination. There have been the hen-like peck orders of the early world empires to which the atavistic Nazi system is an attempted return. Until recently these rigid peck orders were being replaced by the more democratic dovelike give and take of territorial orders, in which, certain empires aside, each nation had the peck-right over all comers in its home territory. With nations, as with many territorial birds, when space became crowded, the dove-like peck dominance changed to the more despotic peck right.

To-day, a major biological contribution to the discussion of a post-war world is that, solidly as the peck-right system is grounded in animal behavior, it is not the only pattern for human action that biology has to offer. Other animals show a somewhat stronger tendency toward essential cooperations than they do toward struggles for egoistic power. Man can, if he chooses, focus on his innate drives toward cooperation and attempt to set up a new order based primarily on some altruistic pattern such as I have outlined. The task will be easier since modern biological teachings in these matters resemble many of the social doctrines of the ethical religions.

The difficulties in the transition from the power politics of the international peck order to a system based on international cooperation are impressive. The change is possible. If the attempt is deferred for the present, it will most certainly come in the future and I prefer to start toward the future now. If we again turn toward the solutions of the past, we face the disheartening certainty that power politics have never avoided war for more than a few decades and will not avoid war again. We are aided in working toward a more rational goal by the fact that, one or two nations aside, there is a general and strong mind-set toward peace throughout the peoples of the world. Our task as biologists, and as citizens of a civilized country, is a practical engineering job. We need to help arrange so that the existing trend toward a workable world organization will be guided along practical lines which accord with sound biological theory. And we must remember always that in such matters the idealist with the long-range view is frequently the true realist.