tionships between the natural constants which have been found in the study of radiation, as can be afforded by the orbital atom. If this is granted we may proceed with greater confidence to the further study of the group of atoms which we call the molecule, and to the nature of valence. I can not repeat here the reasons which I have given in another place for believing that it is these very electrons held in rigid positions in the outer shell of the atom which may, in case of chemical combination, become the joint property of two atoms, thus linking together the mutually repellant positive atomic kernels and themselves constituting the *bond* which has proved so serviceable in the interpretation of chemical phenomena. In some molecules, such as those of nitrogen, the linking electrons are held by powerful constraints. The molecule is inert and incapable of taking part readily in chemical reaction. In others, like those of iodine, in which the bond is said to be weak, the connecting electrons are held by loose constraints and the molecules are extremely reactive. But whether the bond be weak or strong, we may feel pretty sure that it solely consists of those electrons which are held as the joint property of two atomic shells and constrained to definite positions by forces which we do not at present understand, but which do not obey the simple law of inverse squares which characterizes the attraction or repulsion of charged bodies at relatively large distances from one another.

Gilbert N. Lewis
University of California

ZOOLOGICAL RESEARCH[1]

I speak with mixed emotions. I long ago planned to attend this spring meeting of the Indiana Academy of Science, the first I have been able to attend in several years. I was asked to assist at the dedication of a new biological building, and find I am one of the orators on the rare occasion of the unveiling of a monument to a man still alive and present. It is not possible to speak in the presence of so lively a corpse of the appropriateness of having your newest and best building named in honor of Stanley Coulter. If he were not present and listening with such apparent anxiety, I should like to recall his many good qualities and my good fortune in being associated with him for a third of a century. In these years we have traveled together, played together, worked together, fought together and against each other, and I think I am beginning to know him in part. It would make him too vain were I to say all of the nice things I should feel more than justified in saying, if his family were in mourning. As it is, I can only commend the authorities in honoring the teacher, the director of the Indiana Biological Survey, the charter member of the Indiana Academy of Science, the leader in nature study, the investigator, the dean of the school of science of Purdue University, and over and above all, the real human being.

It will not detract from his merits if I tell you in confidence that he deserves but part of the credit for what he has done. The poet truly said: "There is a Divinity that shapes our ends." At least half the credit should go to his wife, who has made him possible, and whom those of us who know her love even more than we do Stanley. I hope, I am sure the Academy as well as Purdue University hope, that they will long be able to work in the building so well named. The best of it is that the building was not needed to perpetuate the memory and influence of our friends.

The dedication of this, your best building, in part to zoology is a just recognition of the importance of the subject. It is quite proper, therefore, that we should consider what we mean by zoology, for our interpretation determines the nature of the work to be done within the walls of Stanley Coulter Hall.

Zoology is a study of animals. The study of

[1] Remarks at the dedication of Stanley Coulter Hall, the new biological building at Purdue University, during a meeting of the Indiana Academy of Science.

zoology as an intellectual pursuit gives liberal cultural training as well as a fuller appreciation of our fellow mortals. This fact in itself is a full justification of its study. But, in addition, zoology may be and is studied for the grounding preliminary training of certain of the professions, notably medicine and agriculture. The premedical man finds in zoology the basis for his future appreciation of the anatomy of man. Man carries many reminiscences of his lowlier ancestors. Even the over-devout believers of special creation seem to have had an inkling of this fact. On the walls of the sacred cemetery in Pisa a painter has represented the creation of man. On the left is the Lord, in the center is the man partly formed. To fill a gap in his canvas the painter placed a palm tree on the extreme right of the picture. A monkey is climbing the palm. Thus while the Lord is creating man "in His own image" a monkey is gamboling before his eyes—the result is only what might have been expected.

Zoology has an additional importance to the doctor of medicine. Man, himself a zoological garden, is involuntarily harboring within, and frequently without, many of his zoologically more humble contemporaries. It must frequently be a question whether the malady is due to the anatomy and physiology of the patient himself, or to the depredation of the invaders.

Here at Purdue University it is quite proper that another phase of zoology should receive full recognition. The firing line in the most important struggle for existence on the globe is not along the Marne, but in man, in his flocks, his cultivated fields and forests. The supreme struggle is not between autocracy and democracy, but between man and insects and still lower creatures. Insects keep many large parts of the globe as free from man as No Man's Land, much freer than the submarine zone. Insects and still lower animals levy their enormous tribute at the source. Some day we may issue liberty bonds to open the lanes of travel in other parts of South America as we have opened those of Panama, and to free us from the tribute we are compelled to pay to the Hessian fly, the gypsy moth, the San José scale, the Mexican cotton-boll weevil, the English sparrow, the Colorado beetle, the German carp, and a host of other invading and native marauders.

A few years ago I had the pleasure of sailing to St. Thomas, St. Croix, St. Kitts, Santa Lucia and other West India Islands as holy as these, though not yet sainted. Some had elaborate barracks, but fortifications were being abandoned and attention lavished on botanic gardens and experiment stations. The change was a recognition of this ancient, but only recently fully recognized, firing line. We certainly have abundant excuse, if excuse is needed for this new biological building.

But there is another use for this building. It is no merit to call the doctor when the stomach aches. It *is* a supreme merit to investigate causes and prevent future stomach aches while we are enjoying our daily overabundant meals.

We must investigate zoology from its pure and abstract side, developing as a by-product of our investigations the future Pasteurs, Kochs and Darwins; we must extend human knowledge. All institutions must cooperate in this, must grow at the tip. Investigation is the truest preparedness, and the democracies ought at least to encourage research as much as the autocracies, known for their noble contributions in this direction.

In this connection I would like to quote (with slight modifications) from a letter to President Stanley Hall, of Clark University, written in answer to a questionnaire on the general subject of what can be done to increase research in American universities.

BLOOMINGTON, IND., Oct. 25, 1916

My dear Dr. Hall: It would be very easy to point out why the American universities do not do more for research, why you must ask the first of your questions. But, my dear President Hall, a candid statement would be sure to be resented by one or another university active in the councils of the Association of American Universities. To call attention to self-evident facts would seem like interference on the part of one institution with the internal policy of another. In criticism of the policy of American universities in regard to research, the head of one of the great research en-

dowments remarked that his institution was appropriating more money to carry on research in one of the great universities than the university itself is devoting to this purpose. In visiting alumni associations the ambassador of another great institution bragged about the millions that were going into new buildings. At the same time there was internal complaint that research was being hampered by the lack of funds! Instances where research is eking out its hampered existence by the side of a great athletic plant or by the side of splendid costly halls, if not between the two, are not unique. As I am not permitted to stir up the animals—the very expression so unacademic—I will, in as academic and wooden a way as possible, discuss some of your questions, and point out in a mild way how the Nirvana of the research man may be approached, if not attained.

The first point in your circular letter raises the question of the function of the university, and of the university professor. Minot said that the function of the professor is "to carry on research and to teach others to do the same." If research is the function of the professor, *ipso facto*, it must be the function of the university. I think Minot's definition should include the central idea on which a prominent research institution was founded, if not conducted; to find the exceptional man and enable him to do the work for which he is best fitted. We will grant for the time, then, that it is the function of the university to find the exceptional man to carry on research, to enable him to make the most of his ability, and in his turn, to find exceptional men and enable them to do their utmost.

To this, the primary function of the university, as a close second comes the function of finding the other exceptional man, who can appreciate pure research and who is willing to let the university be the mediary between his own dollars and the university's research man.

If we grant all of the above, the answer to your first question becomes easy. If it is the function of the university to carry on research, there is evidently no reason why it should not engage men to carry on this function. Whether such men, or such a man, should devote part of his time, all of his time, or sporadically all of his time during leave of absence, are subsidiary questions, once it is granted that it is the function of the university to carry on research. University presidents, I fear, are usually too prone to believe in the efficacy of devotion, only so long as it is offered within hearing of the college bells. . . . The Carnegie Foundation has been criticized because it no longer pensions university professors with research proclivities at the end of twenty-five years of teaching. But, if it is the function of the university to carry on research, why should such men be pensioned? If the man is so wrapped up in research that he is willing to retire on decreased pay, that he may be able to devote himself exclusively to research, why not let him continue in one of the chief functions of the university on full, if not increased pay? The universities are trying to shirk when they criticize the Carnegie Foundation, because it refuses to help them carry on one branch of their work.

It goes without saying that the research man needs appropriations for apparatus or collections, or assistants or traveling expenses, and for publication. He can get some, if not all of these things, by cooperation with other institutions, the Carnegie Institution, the Elizabeth Thompson Science Fund, the Bache Fund, the American Association for the Advancement of Science, not to mention some others which help with money, or which cooperate in the matter of publication. The necessity for and existence of these research funds and institutions lies in the fact that the universities themselves failed to appreciate the necessity for research, failed to make adequate provision for it. The research funds stand in the same relation to the universities and to the public, that the interurban railways stand to the steam railways and the public. Frequently the time of the research man consumed in diplomacy, in getting the cooperation of people and institutions inclined for the most part to pull in different directions, could have been spent to better advantage in other ways. Digging the bait is more laborious, and always more tiresome, than fishing.

If it is the function of the university to carry on research and to teach others to do so, then of course, the university should discriminate between those gifted in teaching and those gifted in investigation. Your very question, "Must the many other research institutions outside the universities be mainly relied upon for this work?" is sin against the Holy Ghost.

The centers of some lines of pure research, cytology and genetics for example, had shifted to America before the great war. With the untempered democracy of high explosive shells of both contestants, which kill the most highly trained specialist by the side of the day laborer, it will naturally become the duty as well as the privilege of America, to still further enter into

friendly rivalry with Europe—for it is to be hoped that in the field of scientific research, there will be no trace of any but friendly attitude toward any of the European countries.[2] America will ultimately lead in idealistic endeavors. It would have done so, war or no war. The thing that will help more than any other to give leadership, is to have the universities make a special effort to gather the funds needed, to enable the men specially gifted in research to do their utmost.

Having secured the building, Mr. President, I hope you will provide the money to enable the men who are to be housed in it to do their best.

C. H. EIGENMANN

SCIENTIFIC EVENTS

RECONSTRUCTION HOSPITALS AND ORTHOPEDIC SURGERY

THE Surgeon General of the Army, Major General William C. Gorgas, authorizes the publication of the statement that the whole conception of governmental and national responsibility for caring for the wounded has undergone radical change during the months of study given the subject by experts serving with the Medical Officers' Reserve Corps and others consulting with them. Instead of the old idea that responsibility ended with the return of the soldier to private life with his wounds healed and such pension as he might be given, it is now considered that it is the duty of the government to equip and reeducate the wounded man, after healing his wounds, and to return him to civil life ready to be as useful to himself and his country as possible.

To carry out this idea plans are well under way for building "reconstruction hospitals" in large centers of population. Sites have been chosen, though not all finally approved, in the following cities: Boston, New York, Philadelphia, Baltimore, Washington, Buffalo, Cincinnati, Chicago, St. Paul, Seattle, San Francisco, Los Angeles, Denver, Kansas City, St. Louis, Memphis, Richmond, Atlanta, and New Orleans. Those in Boston, New York, Washington, and Chicago will probably be constructed first. Each will be built as a 500-bed hospital, but with provision for enlargement to 1,000 beds if needed.

These hospitals will not be the last step in the return of the wounded soldiers to civil life. When the soldiers are able to take up industrial training, further provision will be ready. The injured man may be retrained to his previous occupation to conform with his handicapped condition or retrained for a new industry compatible with that condition. Additional education will be given to those fitted for it, and men may in some cases be returned to more valuable work than that from which they were called to war. Workshops will be provided at the hospitals, but arrangements will also be made with outside industries whereby more elaborate methods of training may be carried on. An employment bureau will be established to place men so trained in different parts of the United States.

This whole matter comes under the department of military orthopedic surgery recently organized in the Medical Department of the Army. The following officers of the Medical Reserve Corps are in charge of the work: Major Elliott G. Brackett, of Boston, director of the department of military orthopedics to the Surgeon General; Major Joel E. Goldthwait, of Boston, director of military orthopedics for the expeditionary forces; Major David Silver, of Pittsburgh, assistant director of military orthopedics to the Surgeon General. The following, in conjunction with the above staff, compose the orthopedic council; Dr. Fred H. Albee, of New York; Dr. G. Gwilym Davis, of Philadelphia; Dr. Albert H. Freiberg, of Cincinnati; Dr. Robert W. Lovett, of Boston; and Dr. John L. Porter, of Chicago.

Arrangements have been made by the department of military orthopedics to care for soldiers, so far as orthopedics (the prevention of deformity) is concerned, continuously until they are returned either to active service or civil life. Orthopedic surgeons will be attached to the medical force near the firing line and to the different hospitals back to the base orthopedic hospital, which will be established within 100 miles of the firing line. In this hospital, in addition to orthopedic surgical

[2] This letter was written before the United States entered the war.