cussion at a meeting to be held early in 1941. Following this meeting, the less readily accessible (chiefly unpublished) data will be sought by direct contact with individuals and geological survey organizations in every state and province.

The committee members are aware that, aside from the actual gathering and compilation of data, troubles await them in regard to stratigraphic correlation. It was partly for this reason that the membership was made as broad as possible, and representative of various opinions. The discussion of glacial problems that will take place repeatedly among members of the committee, and, it is hoped, with many others as well, should prove to be not the least valuable asset of the project. It appears likely that field conferences on critical or controversial problems may be desirable, leading toward a coordinated attempt to clear up major uncertainties.

It is the desire of the committee to make the map useful in as many ways as possible to as many interested persons as possible. To that end we cordially invite helpful criticism and specific suggestions regarding any part of the project, and we earnestly ask for contributions of unpublished glacial data suitable for inclusion on the map. Information for the map should be addressed to individual members according to the allocation given above. Information on Canadian areas should be addressed to Dr. Young.

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THE ORIGIN OF THE BALLISTOCARDIOGRAPH

WITH each heart beat, blood is propelled toward the head, and then, rounding the arch of the aorta, a lesser amount flows toward the feet. If a person's body is freely suspended so that external forces are minimized, its center of gravity will remain fixed. In this situation, to adjust for the pulsatile flow of blood from the heart, the body must move in an opposite direction to that of the blood mass: the body recoils from the flow of blood like a hydraulic gun.

Ingenious use of this principle has been made by Starr, Rawson, Schroeder and Joseph[1] to measure the outflow of blood for each stroke of the heart without disturbance to the subject. Their instrument, the ballistocardiograph, measures the movements of a light horizontal table on which the patient reclines.

Credit for the invention is given to Yandell Henderson,[2] who described an apparatus for recording the motions of the body in a vertical direction. Professor Henderson wrote: "So far as the writer has been able to learn, no observations on this subject are recorded in physiological literature, except a brief statement accompanied by a few tracings, which were presented by the writer before the American Physiological Society at its meeting in December, 1904."

I was, therefore, greatly interested to come across a complete description, overlooked by Henderson, of a simple but effective vertical ballistocardiograph in Leonard Landois' "Lehrbuch der Physiologie des Menschen," Vienna, 1880. The originator referred to is J. W. Gordon,[3] who in 1877 reported both a vertical and a horizontal ballistocardiograph, and correctly appreciated the latter's advantages. He recorded the vibrations of a rigid bed, suspended by four ropes, on a "sphygmograph" and wrote: "It does not appear that this phenomenon has heretofore been anticipated by any process of theorizing, or turned to any useful account."

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THE EARLY HISTORY OF RESEARCH WITH DROSOPHILA

THE recent death of Professor C. W. Woodworth, of Berkeley, California, calls to mind that while studying in the Harvard Zoological Laboratory in 1900–1901 he suggested to Dr. W. E. Castle that the rapid breeding pomace fly, Drosophila, had distinct advantages in breeding experiments over the laboratory mammals which Castle was then using.

Profiting by this suggestion, Castle and his pupils, F. W. Carpenter, A. H. Clark, S. O. Mast and W. M. Barrows, in the years 1900–1906, developed the banana technique for culturing Drosophila and carried out a series of experiments on the effects of inbreeding, crossbreeding and selection upon the fertility and variability of Drosophila.

At the opening of the station for Experimental Evolution at Cold Spring Harbor, Dr. F. E. Lutz took up the breeding of insects there, and to him Castle communicated information as to the breeding techniques in use at Harvard. Lutz worked with Drosophila for two or three years at Cold Spring Harbor, as reported in year books 6–8 (1906–9) and in Publication No. 143 of the Carnegie Institution of Washington, being concerned principally with the inheritance of wing variations.

While he was thus engaged, Professor T. H. Morgan visited his laboratory and was interested in the speed with which generations followed each other, and asked for material to use in his class to demonstrate heredity. Lutz gave to Morgan a stock of the red-eyed wild type, in which he had observed the occurrence of a white-eyed individual. This apparently was Morgan's

[1] Isaac Starr, A. J. Rawson, H. A. Schroeder and N. R. Joseph, *Am. Jour. Physiol.*, 127: 1, 1939.
[2] Yandell Henderson, *Am. Jour. Physiol.*, 14: 287, 1905.
[3] J. W. Gordon, *Jour. Anat. and Physiol.*, 11: 533, 1877.

first contact with Drosophila, which he and his pupils subsequently studied with such intensity and magnificent success.

Woodworth was thus the prime mover in what Sturtevant and Beadle in their recent text-book of genetics call "the domestication of Drosophila by Woodworth and by Castle in 1901," which in the work of their successors has had such tremendous scientific consequences. Dr. Castle has checked over this communication.

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QUOTATIONS

SCIENCE AND THE MORAL ORDER

IN spite of its claims and accomplishments science is to-day under sharp attack. The growing public realization that its powerful tools can be used for man's enslavement and destruction has given rise to bitter questions and charges; and we read to-day of "civilization betrayed by science" and of "a degraded science that shirks the spiritual issues and hypnotizes its victims with its millions of gadgets." In this hour of intellectual confusion and moral chaos the social consequence of science have been brought to the fore, and the question is persistently asked: Are these consequences so important, because of technical applications that the social interest is paramount over intellectual interest? Are there too many nations and too many people everywhere using the instruments of a civilization they have not achieved? Are bigger telescopes and cyclotrons needed in a world like this?

It would be presumptuous to attempt an answer to this question in a few brief paragraphs even if the writer were especially competent to make any answer at all. The question arises, of course, because science as a technique for gaining understanding of nature is also a technique for gaining control over nature—that is, it is a technique for gaining power. And power can be used by evil men to do evil even more obviously and dramatically that it can be used by men of good will to do good.

But this is true of many things in life. Sulfanilamide, perhaps the most amazing development of modern medical science, came from the German dye industry, but so did mustard gas. Exactly the same principles of physics are employed to point a 500-ton telescope at a star and a 15-inch naval gun at its target. Language is a powerful tool which can be used to mirror spiritual insight or to spread false and destructive propaganda. The possibility of misuse is not an argument for no use at all.

However, this point of view would scarcely justify science in dissociating itself from considerations of value and purpose. The disavowal of concern with social ends would seem to be a callous and irresponsible way to defend science against the charge that it provides man with forces which outstrip his powers of control. Such a defense in fact arises from too narrow a view of science. For science is more than the technologies which cluster about it—more than its inventions and gadgets. It is even more than the discovery and correlation of new facts. Science is a method, a confidence and a faith. It is a method of controlled and rechecked observations and experiments, objectively recorded with absolute honesty. It is a confidence that truth is discoverable. It is a faith that truth is worth discovering.

The contribution which this aspect of science can make to human problems is too often overlooked. Science has developed a specialized set of mental procedures and a noble tradition concerning their use. Confronted by a problem, the scientist begins by sorting out the pertinent factors. He discards the irrelevant, testing relevancy as critically and dispassionately as possible. Then with the relevant material in front of him he begins the painstaking tasks of describing, classifying, discovering correlations, constructing hypotheses, experimentally testing, discarding or adjusting these hypotheses—and extending them to new fields. It is of the essence of this whole process that he should suspend judgment until ponderable evidence is at hand, that he should continually reexamine underlying theories and definitions, that he should be prepared to abandon a position however attractive it may be, that he should be sanely skeptical of conclusions and that he should maintain complete dispassionate intellectual honesty.

Surely a technique of this kind has some meaning in the confused issues which we are now facing. We can scarcely afford to declare a moratorium on this kind of intellectual objectivity. It has undeniable social serviceability. It can create what John Dewey calls "a new morale," a new approach to the solution of the difficulties which now overwhelm us. It can be a nourishing atmosphere for the development of a factual outlook, of a healthy and flexible skepticism, of a disposition to seek for the causes of things and of objectivity and tolerance in the appraisal of evidence. As Professor Dewey says: "The future of democracy is allied with the spread of the scientific attitude. It is the sole guarantee against wholesale misleading by propaganda. More important still, it is the only assurance of the possibility of a public opinion intelligent enough to meet present social problems."

In giving expression to this faith one would wish to