grade of paper for reprints, without consulting the author, in consequence of which illustrations may suffer very seriously in the reproduction.

I am not sufficiently familiar with paper to be able to suggest the most economical size of reprint from that standpoint, but I hope that publishers of scientific literature will some day be able to adopt more uniform sizes, for in this case standardization not only will effect economy in time and materials but it will also greatly extend the life of reprints. I am certain that others than myself will be duly grateful for this change.

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SCIENTIFIC RESEARCH IN THE UNITED STATES

A GROUP of distinguished scientific men and publicists, under the auspices of the National Academy of Sciences, has formed itself into a board of trustees of a National Research Endowment, and plans to raise a large fund for the encouragement of research in pure science. We are all in agreement in regard to the fundamental place of research in our civilization and the need of every effort to facilitate the work of those qualified to contribute to the advancement of science. I venture, however, to question the wisdom and the truth of the implication of the first declaration made by the board, as printed in last week's issue of SCIENCE, which reads:

> The Trustees of the National Research Endowment, recognizing that human progress depends in large degree upon research in pure science, declare their conviction:
>
> (1) That the United States, which already occupies a leading position in industrial research, should rank with the most enlightened nations in the advancement of pure science.

This follows the reecnt statement by Secretary Hoover, who is chairman of the new board, to the effect that the United States is behind most European nations in its contributions to pure science. It appears to a psychologist to be better policy to tell people from whom money is wanted of what we have accomplished, rather than to complain that we are behind other nations, even if this were true. What evidence is there for its truth?

While a nation such as Holland is contributing more to science in proportion to its population and wealth than the United States, Great Britain or Germany, these three nations are far in advance of any others in their total productivity. It is my general impression, which may or may not have more validity than the assumption of Secretary Hoover and the distinguished board of the National Research Endowment, that the United States is in advance of Great Britain and Germany in the biological and geological sciences and in astronomy, behind them in physics, chemistry and physiology, about on even terms with them in mathematics and the medical sciences.

In the case of psychology some evidence can be adduced. Counting up the reviews in the first twenty-five volumes of the *Zeitschrift für Psychologie*, I found that the United States led all nations in the number of contributions to experimental psychology, selected by the Germans as most worthy of review, exceeding Great Britain in a ratio of ten to one. "Who's Who in Science," published in Great Britain in 1913, attributed 84 of the world's leading psychologists to the United States, as compared with 31 to Germany, 27 to England and 13 to France. Since then the number of psychological workers of the United States has about doubled; the number in Germany and Great Britain has remained nearly stationary. The work in France and Italy has regressed. If it is said that we may do more work, but that it is not outstanding in character, then I ask for the name of a foreign psychologist comparable in genius to William James. There is none except Francis Galton, who is not usually regarded as a psychologist.

I venture also to question the validity of the distinction made by the trustees of the National Research Endowment between "industrial research" and "the advancement of pure science." Research in the industrial laboratories may make fundamental contributions to constructive science; a university doctorate dissertation may be nearly as trivial as the score in a game of golf.

We ought certainly to obtain scientific information on these subjects; it would be desirable to spend a minute part of the fifty million dollars that the board proposes to collect in determining whether the first statements that it makes are correct.

J. MCKEEN CATTELL

QUOTATIONS

THE TORCH OF PURE SCIENCE

MR. HOOVER touched an important truth when he told our mechanical engineers recently that pure science receives shamefully meager support compared with applied science, and that the National Academy of Sciences could not undertake a better crusade than its present effort to raise money to restore the balance. We spend large federal appropriations for research in agriculture and technology. We establish rich foundations, like the Rockefeller Institute, for practical inquiry. Business is endowing laboratories, like those of the General Electric and the du Ponts, of unprecedented size. Our university scientists are expected, in the intervals of grading papers, to pro-

duce something that pays. In this lop-sided scientific development there is a heavy spiritual and intellectual loss.

It is true, as Mr. Hoover says, that there is also a practical loss. The pure science of to-day is changed into the practical science of to-morrow. The discovery of the Hertzian rays was pure science, but it gave us Marconi's wireless. Becquerel's discovery of radioactivity was pure science, but to-day every large hospital has its radium tubes. Present-day studies in photosynthesis are academic, yet if we ever manufacture carbohydrates synthetically it will be upon the basis of such studies. The great principles of pure science, like Mendel's laws and Dalton's atomic theory, have been keys to unlock whole treasure-houses of practical advantages. As yet the United States has produced few men eminent in this field. Of nearly fifty Nobel prize winners in chemistry and physics but two have been Americans.

The best argument for pure science, however, takes little account of its value in dollars. A nation that pours out billions on movies, chewing-gum, radios and automobiles can afford to endow the search after truth for truth's sake more generously. We should feel a sufficient interest in the widening of the bounds of the human mind to give such a search both more applause and more support. Pure science insists upon the pursuit of wholly disinterested objects; upon sincere and fearless work; upon only one standard—the highest standard. These are aims which America emphasizes all too little for its moral and intellectual good.—*The World,* New York.

SCIENTIFIC BOOKS

Traité de Géographie Physique. Tome Premier, Notions Générales—Climat—Hydrographie. Quatrième édition. pp. xii, 496. EMMANUEL DE MARTONNE. Librairie Armand Colin, Paris. 1925.

ABOUT sixteen years ago Emmanuel de Martonne, professor of geography at the Sorbonne, published the first edition of his well-known treatise on physical geography, a single volume of 910 pages. To-day the fourth edition of this work is appearing in three volumes, largely rewritten and greatly increased in size, in response to the insistent demand that more and more knowledge be covered by that pancosmic subject.

The book begins with the pertinent question: What is geography? The reply, covering twenty-five pages, with twenty-eight references to eminent authorities, discusses the growth of that knowledge called geographical, and the evolution of its treatment from the days of Homer, stage by stage, to the very present.

For a long while, a time that some of us still remember, geography was the naming of capitals and the bounding of countries, but to-day it is, at least, the distribution over the face of the earth of all phenomena, physical and biological; how they got where they are, and their relations to each other. Clearly, therefore, a real up-to-date geographer must be master of many subjects and Jack of all the rest. I once remarked to an eminent professor of this science that according to this modern concept one might teach even theology as a branch of geography, and his instant reply was: "I do, I do. Religion affects human distribution, and religion involves theology, which therefore I must teach."

The next seventy-five pages are given in approximately equal parts to astronomy, map projections and geophysics. This is followed by an account, covering 225 pages, of the climates of all parts of the earth. The rest of this first volume discusses oceans, lakes and rivers, and the phenomena connected with them.

Every page is clearly written and interesting, but, however urgent the need, there is no trace of mathemathics anywhere, save one very short equation, on page 160, in which the symbol signifying the angular speed of terrestrial rotation, by some curious slip, is called gravity acceleration. This absence of all mathematics is, perhaps, necessary for the average student of geography, but if so, more is the pity, for in many places the subject is such that it can not be understood without resort to this powerful aid to clear thinking.

Professor Martonne's treatise has the exceptional merit of being so excellent as to deserve perpetuation and improvement. With this object in view, I shall, therefore, call attention to a few minor points that deserve, perhaps, a little further consideration:

On page 77, it is stated that a decrease of the carbon dioxide in the atmosphere by 55 to 67 per cent. would cause a lowering of the temperature of the air by 4° C. to 5° C., and a doubling of the carbon dioxide an increase of temperature by 7° C. to 8° C. Perhaps so, if carbon dioxide were the only absorbing element surrounding the earth, but with water vapor always present, and much more effective, the changes in temperature thus produced certainly would be far less. Water vapor leaves but little radiation for the carbon dioxide to absorb.

The explanation of the diurnal variations of pressure, as given on pages 172–173, is entirely inadequate. It also contains two slight errors in detail. The observations referred to were not by sounding balloons, as stated, but by kites; and the temperature wave was not over the sun, but at the surface of the earth.

On page 179 relative humidity is defined as the