mation touching the motion of the ether in the field around a rotating magnet.

Arthur L. Kimball

Amherst College,
January 20, 1913

SCIENTIFIC METHOD

To the Editor of Science: Permit me to protest vigorously against the exceedingly narrow conception of scientific method implied in Professor MacDougall's discussion of "neo-vitalism" in your issue of January 17. I am not a defender of neo-vitalism, and have no interest in the controversy between the neo-vitalists and their opponents; but I am interested in keeping the scientific method broad enough to apply to all phases of human experience. It is surely to be deplored that in this age, just when science is expanding to include all human life within its scope, a few scientific men should persist in interpreting scientific method in such a way as to limit its application to purely physical phenomena. If it is true that "natural science rests finally upon the assumption of mechanism [*i. e.*, rigid determination of all processes through the operation of mechanical causes] and excludes all other conceptions," then there can be no scientific treatment of religion, morality or any other phase of the mental and social life of man. Upon this assumption there can only be physical and biological sciences, and we must give up the hope of having mental and social sciences; for the impossibility of demonstrating mechanical causation in the mental and social realms is acknowledged by all careful thinkers and investigators.

Furthermore, the necessity of science assuming the universality of, and the rigid determination by, mechanical causation, is not evident, unless science wishes to transform itself into a system of monistic philosophy. Rather the pragmatic development of science would permit the assumption of one principle of explanation in one realm of phenomena where it works, and of another in another realm, where that works; for science is "a prolongation of common sense." Thus in the physical sciences no other principle than the mechanistic one is invoked, because mechanical cause and effect will work as a principle of explanation. But in a science like economics, for example, there is little use made of mechanical cause and effect as a principle of explanation because it will *not* work. All modern economics, as is well known, is built upon the conception of "value." Now, is economics a science, or not a science? To me the attempt to explain economic phenomena through mechanics is as absurd as the attempt to explain biologic phenomena through "entelechy." In either case it is the attempt to explain the known through the less known. The case is exactly similar with all the other social sciences. It may be replied that economics and the other social sciences are "sciences," but not "natural sciences." This reply, however, does not meet the issue, because no one can separate the natural sciences from other positive sciences unless the word "natural" be defined to mean the physical.

I am uncertain as to the purpose of Dr. MacDougall's argument, as to whether he wishes to limit greatly the scope of science (as do some philosophers), or to carry through the mechanistic conception as a universal principle of explanation (as do some scientists). In either case the argument practically denies the possibility of positive sciences of our mental and social life. To many people this is, of course, a welcome conclusion. But the whole development of modern science is against this conclusion. The extension of scientific methods to the mental and social realms of phenomena in the nineteenth century, without any use of mechanistic assumptions, was accompanied by as substantial triumphs in those realms as science has had anywhere. Is it not time to acknowledge this? It will not do to say that the assumption in all cases where science has made substantial advances in explaining mental and social phenomena has been that of mechanism; on the contrary, the mechanistic assumption, when brought in at all, has been brought in as a metaphysical "guess" which really explained

nothing. The use of such an assumption in most cases in the social sciences has usually turned out to be an attempt to explain the known in terms of the less known.

In conclusion, it seems to me that science *as science* may well beware of accepting as yet any universal principle of explanation. It can not accept such until it is demonstrated. The method of science is not, as some philosophers have proclaimed, to build itself up upon some universal assumption. Rather its methods are the pragmatic ones of observation, comparison, testing by experience and measurement. So far as science approaches exactness it is built up by the method of measurement; and many other things than mechanical cause and effect can be measured. It is decidedly premature as yet to say that science will approve any universal principle or method of explanation; and it is decidedly regrettable that any one who works in any of the sciences should, by a narrow definition of scientific method, rule out of the category of scientific works James's "Principles of Psychology" and the whole list of important contributions in the mental and social sciences not based upon the mechanistic assumption.

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UNIVERSITY OF MISSOURI,
January 20, 1913

"MORE LITTLE BEASTS"

TO THE EDITOR OF SCIENCE: Under the title of "More Little Beasts of Field and Wood," Mr. William Everett Cram, of Hampton Falls, New Hampshire, has given an account of various animals met by him in his walks through the woods, written in a pleasant fashion suggestive of Thoreau, though without Thoreau's touch of moral epigrams.

It is illustrated by a number of fairly correct wood-cuts.

A novel suggestion, at first sight not at all convincing, is this, that the group of hares and rabbits is not an off-shoot from the rodents, but from the family of cats, a rabbit in the long past being a cat, adapted perforce to a vegetable diet. A good many parallelisms between the cats and the rabbits are suggested, among others that cat flesh is sometimes substituted for that of rabbits in the inns of Europe.

DAVID STARR JORDAN

SCIENTIFIC BOOKS

The Horse and its Relatives. By R. LYDEKKER, F.R.S. New York and London, The Macmillan Company. Pp. vi + 286; Pls. XXIV., and 11 text figs. 1912. Price $2.60 net.

This extremely interesting volume is a companion to that on the ox and its kindred by the same author, and summarizes most admirably our knowledge of the members of the equine race, both living and extinct. In the opening chapter the place of the horse in nature is discussed, together with that of its few surviving relatives. The eight or nine species of horses, five of rhinoceroses and five or six of tapirs contrast strikingly with the great number of artiodactyles still living. The perissodactyles are therefore looked upon as a waning race, but the cause of their diminution in numbers is not yet determined.

In discussing the structure of the horse, especial emphasis is placed upon the high degree of specialization of feet and teeth. In the foot the variable degree of reduction of the splint bones is of interest, the great shire horse of England retaining the entire shaft together with remnants of the first and second phalanges of the lateral toes, all firmly welded together, while the Argentine horses show the greatest diminution of these bones. The longheadedness so characteristic of all horse-like forms is a very ancient character and gives space before the eyes for the development of the wonderful dental battery. The pit-like depression in front of the orbit sometimes seen in modern horses is supposed to have lodged a scent gland, of recognition value, similar to that of the deer. The leg callosities known as "chestnuts" are also decadent skin glands. The long columnar teeth with their complex infolding of enamel are admirably adapted to the harsh siliceous grasses which constitute the principal article of diet. They are much more perfect than in the cud-chewing ruminants, in which the food