necessary thickness for these caps I have estimated 20,000 feet, which is by no means out of the question, both in view of the thickness of the present Greenland cap and of the necessary thickness of a cap which covered Mt. Washington near its outer margin. In the near future I expect to publish considerable evidence in support of the glacial lowering as one of the factors in the production of canyons.

The paper by Hess and MacClintock represents an unfortunate tendency among scientists to jump hastily to conclusions without a careful examination of the facts of the case. New suggestions of this sort are often valuable and frequently should be set forth without too much delay, but if the authors do not have time to check the factual basis for their ideas should they not at least consult some one who is familiar with the subject?

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STELLAR DISTANCES AND THE EXPANDING UNIVERSE

I WOULD draw attention to a fallacy in the fashionable concept of an "expanding universe"; linked as it is to the older and even more widely held illusion as to stellar distances—errors due to faulty thinking.

For we can not tell the present position of any star or nebula. And thus can not tell their distances from each other or from us. So that through lack of any possible spatial relations—of expansion, contraction or relative motions of any kind—all talk of the "expansion" of the "island universes" system of nebulae, each with a "light-years" value differing by many millions of years, is folly. The "red-shift," that we tentatively interpret as a swift recession from us of this nebula at so many kilometers a second so many million years ago, and of that other at so many more kilometers a second so many more million years ago, lacks the "whole" in a common time-setting that would make such an expansion intelligible.

Obviously, a thing must exist, or be in time, before it can occupy any place in space. And thus two or more things must be contemporaneous, or coexist in the same instant, before there can be any spatial relation in that instant between them. An imaginary triangle, say, connecting the earth with two stars—one, say, 60 light-years away and the other 100—is wholly fictitious, since its three apices—the earth and the two stars—are given us in widely separated time-settings. A man in a Chevrolet motor car was driving eastward from 18th to 17th Streets, along Pennsylvania Avenue in Washington, D. C., at forty miles an hour at 10:30 A. M. of the forenoon of January 30, 1936, and another man was similarly driving a Ford westward along the same section, from 17th to 18th, at 30 miles an hour at 4 P. M. of the afternoon of August 10, 1913. How swiftly are the two cars approaching? The question is obviously meaningless. The two cars are not approaching, nor in any way spatially related, for they are not in the same time-setting.

Again, taking the distance from 17th to 18th as, say, 900 feet, you were standing, at noon of March 15, 1936, on that same section of Pennsylvania Avenue, 300 feet from the 18th Street crossing, and thus 600 feet from the 17th one. You know precisely how far you are from where the two cars were, six weeks, and 23 years previously, corresponding exactly to the "light-years" determinations for various stars. But it would be folly to assert that you were therefore 300 and 600 feet, respectively, from the two cars; or that those cars were 900 feet apart; either now, or six weeks, or 23 years ago. Quite similarly we can calculate that, say, 100 years ago a certain star was blazing at a point 100 light-years distant (or the equivalent number of miles or kilometers) from where we are now. But it is impossible to interpret this as meaning that we are that number of miles or kilometers from the said star; either now, from the point where we are at present, or 100 years ago from the unknown point where we then were.

If the heavens were static it would be permissible. But, unfortunately for our purpose, the stars and nebulae are all traveling at dizzy speeds along unknown and unpredictable paths; and each in a different direction, whereof we can merely deduce the radial component at some long past instant.

Were we to limit ourselves to our "home grounds"—the solar system—we can, in that simple "frame of reference," approximately plot, with no great difficulty, the elliptical paths of our planetary family, and thus determine our rapidly varying several positions at any given common instant, so that our distances from each other, and from our sun, can have a real meaning. But when we pass to the starry heavens as a whole, with our solar system as itself a star, all sweeping with terrific velocities along their several complicated and compounded unknown paths, there is no longer any possibility of our being able to evaluate relative positions, at some common instant, for lapsed hundreds, thousands and even millions of years. And yet unless we could, in this manner, or some other, secure relative positions at the same moment, all talk of distances is meaningless, and the popular statements as to the distances of stars and nebulae, the size of the galaxy, and especially the "expansion of the universe" as a whole, are foolish.

We can trace the origin of the blunder to the quite human error of wrongfully applying in the heavens concepts that are quite valid in the widely different terrestrial sphere. For from the dawn of life until

now, and from our earliest infancy to this moment, a constant and invariable earthly experience has driven into our subconsciousness the conviction that light is instantaneous, and that what we see now, exists now—an assumption that is pragmatically correct and that works in our daily life, but which is thoroughly false and misleading when we consider the stars and nebulae. As physicists our educated brains accept the fact that light has an exact, though still high, finite velocity, which, while still practically instantaneous in our daily lives, yet becomes of paramount importance in the vast abysses of space. Furthermore, in any earthly landscape not only are the time differences between the farthest and the nearest objects inappreciable, but our vision occupies some little time; certainly several seconds, being composed of perhaps 5 per cent. visual impressions and 95 per cent. our interpretations thereof through experience. Our ordinary seeing, then, is never momentary; but deals with a broad band of contemporary events; homogeneously blended from all parts of our landscape, which we therefore view as a legitimate whole and can validly determine distances and relative movements.

But in considering the stars and nebulae, their vast time differences totally exclude any possibility of such an overlapping and unifying band of the "same time." And thus we are completely barred from stating anything as to their positions, distances or relative movements. And certainly have not the contemporaneous "whole" that the hypothesis of an "expanding universe" would demand.

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FLOODS AND DUST STORMS

UNDER "Science News" in the March 27, 1936, issue of SCIENCE, Paul B. Sears attributes floods and dust storms to the removal of the top layer, or "A-horizon," of the soil, indiscriminately applying his thesis to the floods which have just ravaged the North Atlantic states. It is unfortunate that Dr. Sears has tried to inject the important question of soil preservation into a situation where it has absolutely no application, for this type of undiscriminating enthusiasm merely befogs the flood problems which confront the northeastern section of the country and invites unwarranted suspicion of the demand for soil preservation.

Dr. Sears may have traveled in one of the oldest farming sections of the East, but it is obvious that he knows little concerning New England. During my twelve years of residence in New England, there have been two major floods; one in November, 1927, the other in March, 1936. Both affected regions in which there is more woodland than farm country, and where spongy vegetation and top-soil have maximum absorptive capacity. In 1927 seven inches of rain fell upon soil covered by a mat of leaves and already saturated by the abnormally high precipitation of a wet summer and fall. A saturated sponge can hold no more water. In 1936, there were four inches and more of rain upon one to four feet of rapidly melting snow, with a deeply frozen top-soil beneath. A frozen sponge can hold no water.

As an observer of floods from Canada to the Tropics and of dust storms from the Connecticut Valley to California, I find Dr. Sears's viewpoint that soil preservation will solve the problems connected with both much too elementary; and government agencies for flood control are not going to get very far unless they see the problems whole and tackle them along the whole of a very complicated front. Surely Dr. Sears knows that there were deserts on the march before the white man farmed the prairie—witness the loess; and that there were floods on the rampage before mammals discovered the flood-formed Great Plains.

Much as we may applaud the eloquent and, it is to be hoped, effective effort he is making to save our greatest economic asset, the soils, one must deplore a lack of discrimination or penetration, which may at once undermine public confidence in his own thesis and nullify the equally legitimate efforts of those who are approaching flood-control from a different but fully as valid standpoint.

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AN EXPLANATION OF ADRENALIN ACTION

A FURTHER study of the K action, as described by McGuigan and Higgins,[1] has led us to conclude that most of the changes effected by adrenalin are actually produced by K. The following facts are offered to substantiate this conclusion. Adrenalin effects an increase in serum K.[2,3] K salts injected intravenously effect changes identical with those produced by adrenalin. This is true not only as far as the cardiovascular system is concerned but also on the intestinal tract, urinary bladder, kidney, bronchiole muscles. Cocaine does not potentiate with K. The action occurs after removal of the adrenal glands. K also effects a fleeting hyperglycemia, but if a large amount of K is present sugar readings are low. Relatively large amounts of K added to a known sugar solution decrease the readings. A complete analysis of this subject is in preparation for publication.

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[1] McGuigan and Higgins, *Amer. Jour. Physiol.*, 114: 207, 1935.

[2] De Silva, *Jour. Physiol.*, 82: 393, 1934.

[3] Schwartze, *Arch. f. Exp. Path. u. Pharmakol.*, 177: 628, 1935.