$$\Psi = \exp(2\pi i W/h)$$

W may be considered as a generalization of Hamilton's principal function, $-Et+S$, where S is the action. The writers feel that much good would come from the establishment of committees on mathematical notation in each of the national societies dealing with physical and chemical science, and trust that this note will evoke discussion directed toward this aim.

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MONOLITHIC SOIL PROFILES

EVER since the serious study of soils began, the preparation of portable monolithic soil profiles has been a time-consuming task. The department of agronomy of the North Dakota Agricultural College and Experiment Station has developed a rapid method of taking monolithic soil profiles to the depth of forty inches in stone-free soils.

Bore a hole forty-six inches deep with a nine-inch basket type post-hole auger. With a spade, dig a rectangular recess two to four inches in depth opposite the portion of the exposed soil to be sampled. After removing the débris from the hole, square the surface opposite the recess and place the open side of a rectangular trough of eighteen gauge galvanized steel two inches by four inches by 40 inches against the prepared surface. Place rigid backing against the steel trough to prevent its buckling under pressure. After placing footing in the recess introduce a short jack with three-foot handle (known as a balloon tire jack) between the footing and the trough and apply pressure near the bottom end of the trough and again near the top of the trough. If pressure is applied in excess of the pressure needed to fill the trough, layers develop in the soil at right angles to the direction of the pressure facilitating the removal of the filled trough. Placing the spade in the soil two or three inches from the open side of the trough pointing toward the trough and extending gentle pressure toward the excavation, the profile is easily broken away.

A monolithic profile may be taken from stone-free soils in one to one and a half hours. All students of soil phenomena will find this method worthy of trial.

A more complete description of this method and its adaptation to glacial soils will appear later.

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AN EXTINCT CAMEL FROM UTAH

IN SCIENCE for July 6 my friend Dr. Alfred S. Romer gave us an interesting account of the discovery of a skull of a camel, probably *Camelops hesternus*, in a dry lava-flow cavern near Fillmore, Utah. According to the statements furnished, the partial skull was buried at a depth of three or four feet in a fine eolian dust, about two hundred feet back from the mouth of the cavern. The bone had undergone no fossilization and there adhered to it a fragment of organic matter regarded as muscle. Dr. Romer holds that this discovery shows that this species lived in the west up to a relatively late time, only several centuries or at most several thousands of years ago. The present writer suggests that the recent deposits along the streams of the Great Basin be carefully scrutinized for additional remains of these modern camels.

Dr. Romer further concludes that my theories about the succession of Pleistocene vertebrates are thereby rendered much in need of revision. If I may judge from his suggestions that the fossils found at Lake Lahontan, Rancho La Brea and Frederick, Oklahoma, may be of a rather late date, his revision of Pleistocene history will restore the happy time when any species whatever of Pleistocene mammal might be expected to occur in any late Pleistocene deposit whatever, especially if its occurrence appeared to have any bearing on human history. A revision of that kind would evidently bring relief to some geologists and to many, if not to most, of our anthropological colleagues.

The determination of the geological age of the skull in question will turn upon two considerations. The first has regard to the length of time organic matter can endure in the conditions described by Dr. Romer. He grants that it might last indefinitely if bacterial action be prevented. Why not then a half million years? If the flesh has lasted until it has become covered with fine dust three or four feet thick, how are the destructive bacteria to reach it? Even if the dust were to be wet the bacteria would be filtered out before reaching the putrescible substance. Aqueous solutions of organic matter will endure indefinitely if bacteria are excluded. And probably that dust has never been wetted since it was deposited.

Dr. Romer is sure that the muscle could not have resisted decay for a half million years because that climate enjoys an annual rainfall of fifteen inches. From Bigbone Cave, Van Buren County, Tennessee, Dr. Harlan obtained megalonyx bones which, buried in fine dust, retained patches of cartilage, shreds of ligaments and pieces of the horny nails; and this was in a region where there is an annual rainfall of fifty or more inches.

The second consideration bearing on the age of the camel is the age of the cavern; and Dr. Romer, basing

his view on Gilbert's monograph on Lake Bonneville, appears to be certain that the cavern is a product of the Wisconsin glacial stage. Gilbert knew of only two glacial stages, but it is now believed that there were four or even five; and the Bonneville high water may have occurred during one of the earlier ones. The writer is of the opinion that it corresponds more nearly to the Aftonian interglacial stage, and the finding of the camel skull is evidence for this view. The cavern should be explored. It probably constituted the den of some ancient carnivore and the camel may be found to have been associated with other early Pleistocene remains, not with ranch cattle or even recent native mammals.

As a corollary of his determination of the age of the Bonneville beds Gilbert referred the Fossil Lake vertebrates to the latter half of the later glacial epoch. I shall be greatly interested in reading Dr. Romer's defense of that proposition. How will he account for a percentage of at least 50, perhaps of over 65, of extinct animals? Where in deposits overlying Wisconsin drift will he find such a high proportion of extinct forms? If he can support his thesis he will have four more camels to his credit. Furthermore, would not the climate at Fossil Lake during the Wisconsin stage have been rather cool for some of those camels, those peccaries and that ground-sloth? He appears to believe also that the fossils found at Frederick, Oklahoma, are of a late date. I shall be delighted to listen to his elucidation of the geology and paleontology of that region, where some hundreds of feet of deposit have been swept away since those animals lived there and here he will have to explain why all the species are extinct. He is mistaken in thinking that my study of the Iowa Pleistocene led me to believe that camels ceased to exist after the first glacial stage. It was there that I learned that they existed during that stage. Failure to find them in other deposits that could be demonstrated as of later age has been my reason for concluding that they did not long survive the first interglacial stage.

Furthermore, I do not rely on camels alone for my views of Pleistocene history. There are probably fifty species of important vertebrates with which camel remains are commonly associated which appear to have become extinct at the same time. If Dr. Romer holds the opinion that all the fossil vertebrates found at the localities he mentions lived only a few thousand years ago, will he not tell us what kinds of animals lived during the early Pleistocene and where their remains have been collected?

The writer will continue to hope that the geologists, the paleontologists and the anthropologists who do not like his opinions on Pleistocene geology, paleontology and anthropology will speedily collaborate and impart to us their conclusions and their reasons therefor.

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CENTERS OF RESEARCH

UNDER the above title, Professor S. R. Williams, in SCIENCE for July 20, deplores "the paucity and mediocrity of the research produced by some of the graduate schools of our large universities," and suggests that the remedy for this deplorable condition is to centralize the direction of research in each department under one man, permitting, indeed, the other members of the staff to carry on their own research if time and circumstances permit, but denying them the privilege and stimulus of directing students in research.

With Professor Williams's judgment that much that passes for research does not measure up to the standards of good scholarship there will be little disagreement. But his analysis of the cause of this condition is far from convincing, and from his proposed remedy there should be sharp dissent. He suggests that if one were to set down a list of research centers and classify them according to whether the work sent out is done under the leadership of one man or of several, the results will be surprising. I have tried this for the field of botany, and I am sure that the results would be surprising to Professor Williams. Such a list must, of course, be very largely a matter of personal opinion, but personal opinion is scarcely sufficient to justify a proposal for a radical change in the organization of American universities. It is at least probable that the underlying difficulties with American scholarship are to be sought for in social and economic conditions far more fundamental than matters of departmental organization, and there is no convincing evidence that the substitution of dictatorships for such measure of democracy as we now enjoy would materially remedy the situation. This is not to deny that great teachers and investigators may and should dominate an individual department. They have done so in the past by virtue of their own innate qualities, and there is no reason to doubt that they will continue to do so on the same grounds. But that is a very different thing from a proposal to centralize such power in men who, even if they be good investigators, may be narrow-minded, selfish or autocratic. Even assuming that such a policy of intellectual fascism might result in certain local gains in efficiency, it is difficult to see how the loss of freedom and initiative on the part of the great mass of subordinate workers could result in anything but a further lowering of the general standard of scholarship.

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