the serum of tumor bearing chickens. The result of this test may be interpreted as indicating either that the active agent carries a negative charge and is attracted to the positive pole, or, as seemed more probable, that the precipitate around the positive pole is brought about by the greater concentration of acid salts in this region. In fact the latter interpretation appears to be the correct one, for by lowering the isoelectric point of the concentrate with weak acid, the same kind of precipitate is thrown down, carrying with it the active agent contained in the fluid. Furthermore this precipitate may be dissolved and reprecipitated without loss of its activity.

The degree of purity of the protein fraction which carries the active agent has not yet been determined. Preliminary tests seem to eliminate the presence of mucoprotein, as was first considered probable for no reducing substance is found after hydrolyzing with sulphuric acid. The presence of the purine bases and phosphorus suggests that the major portion of the fraction consists of a nucleo-protein. The fraction gives also a uniform Feulgen reaction[1] of the so-called thymonucleic acid group.

Although no definite conclusion can be drawn at the moment from the results reported, yet when they are considered in the light of known properties of the chicken tumor agent, the probability of its enzyme-like nature is strengthened.

JAMES B. MURPHY
O. M. HELMER
ERNEST STURM

THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH

A "FOSSIL" CAMEL RECENTLY LIVING IN UTAH

THE fragmentary skull described below was submitted to the writer for examination by Professor A. L. Mathews, of the University of Utah, at present lecturer in paleontology in the University of Chicago. It consists of a practically complete braincase and most of the palate. The bone is perfectly fresh in appearance; no replacement has occurred; a bit of dried muscle is still present on the basioccipital. Concerning the find Professor Mathews states:

> The specimen was discovered by two high-school boys of Fillmore, Utah, who, at the time, were exploring the igneous buttes some twenty miles south and west of that village. It was found about two hundred feet back in a cave, buried under about three or four feet of fine dry eolian deposit, which was easy to excavate. The cave is one of the many caverns formed in the old lava beds of the district, which, according to Gilbert,[1] are post-Bonneville in age.

All its characters, including those of the teeth and tympanic region, show it to belong to the Camelidae. Its size is about that of the existing old world camels and this, together with a number of anatomical features, rules out reference to the South American llamas. The most obvious explanation seemed to be that the skull was that of one of the imported dromedaries which were released in the southwest in the 70s.

This is not the case. Comparison has been made with both the dromedary and the bactrian camel, through the kindness of Dr. Osgood, of the Field Museum of Natural History, and a large number of differences became apparent, some of which are noted below. While it seemed absurd that this fresh skull was that of a Pleistocene form, it agreed so well with Merriam's figures of La Brea camelids[2] that comparison with the Pleistocene *Camelops* from that locality was arranged through the kindness of Dr. W. D. Matthew, of the University of California. With the skulls of both the living camels and the La Brea type before me, the identity of the Utah specimen with *Camelops* is unmistakable. Some fourteen points of comparison have been noted; a few of them are presented here:

(1) The lateral occipital openings are large in the Utah specimen. They are large in the La Brea forms; small in the old world camels. (2) The paroccipital process and mastoid are closely united externally. The same is true of the La Brea forms. The two diverge, leaving a groove between them, in the old world camels. (3) The basisphenoid-presphenoid in the Utah specimen form a prominent V-shaped ridge, as in *Camelops*. They are smoothly rounded in the living camels. (4) The glenoid is high up on the skull, about one and one half inch above the level of the basisphenoid, in the Utah specimen and the La Brea forms, while in the living camels this point is almost on the level of the basisphenoid. This causes a striking difference in the contours in the side of the skull, the origin of the zygomatic arch, etc. (5) In both the Utah specimen and the La Brea camels the post-glenoid opening is small, and an additional foramen (noted by Merriam) is present at the outer end of the glenoid. This foramen is absent in the living camels and the post-glenoid foramen is large. (6) While the edge of the orbit is not shown in the specimen, the anterior end of the masseteric rugosity and the situation of the portion of the maxilla enclosing

[1] We are indebted to Dr. E. V. Cowdry for calling our attention to this reaction.

[1] Gilbert, G. K., 1890. Lake Bonneville. Mon. U. S. Geol. Surv. 1, 329–332.

[2] Merriam, J. C., 1913. Univ. Calif. Bull. Dept. Geol. 7, pp. 305–23.

the second molar show that the orbit can not have been situated as in *Camelus,* but much higher and more posteriorly. This compares exactly with the La Brea specimens.

The Utah specimen differs from the dromedary in eleven of the fourteen points studied, from the bactrian camel in ten, from Merriam's *"Camelops* near *hesternus"* in two, from *C. hesternus,* as identified by Merriam, in no important feature whatsoever. This skull is unquestionably to be referred to the Pleistocene *Camelops* and probably *C. hesternus.*

This genus, however, is assumed to have been extinct for a period of (roughly) half a million years. Hay, as a result of his study of the Iowa Pleistocene, concluded that camels had ceased to exist in this continent after the first (Aftonian) interglacial stage. This view has gained general acceptance, and the presence of a "camel" in a fauna has usually been sufficient cause for assigning it to an early position in the Pleistocene sequence. This may be true for the eastern United States; but in the west, at any rate, the story of the camel must have been an entirely different one.

The exact conditions under which the skull was discovered are unknown; it is highly desirable that they be carefully investigated. The cave is situated in a lava flow which, as Gilbert has shown, occurred after the highest ("Bonneville") stage of Lake Bonneville. This stage is generally believed to have been contemporaneous with the last (Wisconsin) glaciation,[3] and there is no definite evidence for placing it at an earlier date, other than a discovery of fossil bones in the Lake Lahontan basin discussed below. We can not conceive of a first interglacial animal being present in a cave formed after the fourth glaciation, except by reburial; and this skull is much too fragile to have been transported by natural agencies.

The muscle tissue has been submitted for examination to Dr. F. C. Koch, of the department of physiological chemistry, who reports:

> A very small particle of the brown material taken from the basioccipital region of the skull, when heated upon platinum foil, gives the typical test of a protein. That is, the typical odor, the charring, and the final burning. This certainly indicates that the material is chemically of organic nature and probably protein in character.

How long can organic material be preserved as such on the skeleton of a dead animal? In the entire absence of water, as in a dry cave in desert country, bacterial action can be prevented and it might last almost indefinitely, as mummification shows. But this region is not desert; the annual rainfall at Fillmore is about fifteen inches, similar to that of much of the plains country, and in the past the climate appears to have been much more humid than at present. It is very probable that this skull is several centuries old; it is possible that it is several thousands of years old; but that it dates back half a million years or so to the first interglacial is utterly impossible.

The Pleistocene "camel" appears to have survived in the Great Basin region until recent times. Other discoveries in the last few years have also tended to shake our belief in the great antiquity of the camel and other extinct forms. For example, J. C. Jones in a recently published[4] study of Lake Lahontan, in Nevada, concludes that bones in a lake deposit which have been identified by Merriam as including a "camel" as well as the native horse and a Pleistocene "lion" can not be more than a thousand years old. In Arizona Bryan and Gidley[5] have discovered bones of the "camel," etc., seemingly associated with a dry lake whose shorelines are so fresh that they are unable to account for the presence there of a form which should date it to the early Pleistocene.

It thus seems that our present views of the succession of Pleistocene vertebrate faunas are much in need of revision. It is highly probable that, with the stumbling block of camelid antiquity removed, a more recent date may be assigned to some of our Pleistocene faunas, such as that of the Rancho La Brea.

This point has a bearing on another question—the antiquity of man on this continent. Whenever human artifacts are found with the remains of extinct animals the anthropologist springs to arms to repudiate the association. This point of view is not unreasonable in view of the usual implication that this connotes a considerable antiquity. As an illustration, the apparently certain association of stone implements and a fossil fauna in the Frederick (Okla.) gravel pit is attacked by Dr. Spear in a recent number of this journal[6] since the fauna (containing the "camel," etc.) is assigned by Dr. Hay to the first interglacial, while the artifacts are of a type which, even in Europe, are only present during or after the last glaciation. But may it not be true here (and presumably in other similar cases) that the true situation is not that man reaches to a remote antiquity in this continent, but that the camel and perhaps other Pleistocene forms have survived until a much later date than has been believed previously?

ALFRED S. ROMER

UNIVERSITY OF CHICAGO

[3] Hay, O. P., 1927. Publ. Carnegie Inst. Washington pub. 322B, p. 141.

[4] Carnegie Inst. Washington publ. 352, 1925, pp. 1–50.

[5] *Amer. Jour. Sci.,* 5th ser. 11, 477–488, 1926.

[6] SCIENCE, n. s., XLVII, 1928, 160–161.