It is a matter of record that the dates were not determined at the University of Chicago laboratory, as Hibben, in correspondence, has recognized. No other laboratory is known to have determined radiocarbon dates until the Lamont laboratory began operations in 1951. Bryan died on 22 August 1950.

None of Bryan's intimate associates, including reputable archeologists and geologists, some of whom were deeply concerned with the development of radiocarbon dating, can recall having heard Bryan mention the samples or the dates to which Hibben refers. Furthermore, Bryan's records have been searched and no reference to the alleged Sandia samples has been found. The dates must be struck from the record before they cause further confusion.

Other confusing evidence indicates that the dates lack a proper source and record. Hugo Gross quotes "Dr. Frank C. Hibben, oral communication," as the authority for the statement that ". . . this method (radiocarbon dating) recently indicated an age of 11,000 and 19,000 years, respectively, for the Folsom and Sandia layers in Sandia Cave" (*2*). These dates, published in 1951, differ significantly from those published by Hibben in 1955—that is, 17,000-plus and 20,000-plus years ago. The latter dates were alleged to have been determined on charcoal said to have come from two fire hearths of only the Sandia level. The discrepancies in figures and the attribution to levels throw great doubt upon the statements in Hibben's article in *Science*.

The repudiation of the dates quoted by Hibben as originating with Bryan has no bearing on the dates from Sandia Cave determined by H. R. Crane (*3*). Such dates indicate the radiocarbon content of the samples delivered to the Michigan laboratory. Whether or not these samples are contemporaneous with the Sandia level is a completely different, unrelated question.

FREDERICK JOHNSON
Robert S. Peabody Foundation for Archaeology, Andover, Massachusetts

References

1. F. C. Hibben, *Science* 122, 688 (1955).
2. H. Gross, *Bull. Texas Archeol. and Paleontol. Soc.* 22, 114 (1951).
3. H. R. Crane, *Science* 122, 689 (1955).

8 November 1956

In regard to the two samples of charcoal from Sandia Cave collected by the late Kirk Bryan, there has been a dearth of evidence as to where and how Bryan dated these samples. I am in agreement with Johnson that these dates should be removed from the record. This removal, of course, in no way invalidates either the very fine geologic work of Bryan or the dating of the Sandia deposits themselves.

The dates referred to by Hugo Gross were extracted from a series of lectures one of which was given by me at the University of Erlangen, Germany. These dates were derived from Bryan's geologic work and were extremely tentative. Dating by geologic means and carbon-14 were undoubtedly confused. Gross is in error in his dates of 11,000 and 19,000 years, respectively, for the Folsom and Sandia layers of Sandia Cave. The original dates given in the Erlangen lecture were 11,000 B.C. for a Yuma site, 9000 B.C. for Folsom layers in Sandia Cave, and 17,000 B.C. for Sandia level in Sandia Cave. All these dates were derived by stratigraphy and not by the radiocarbon method. As yet no carbon-14 date has been derived from the Folsom level of Sandia Cave.

Removal from the record of the radiocarbon dates attributed to Bryan does not invalidate the dates determined by H. C. Crane from mammoth ivory from Sandia Cave. These are substantiated by other evidence.

FRANK C. HIBBEN
Department of Anthropology, University of New Mexico, Albuquerque

26 December 1956

Theory of Ice Ages

The theory of glacial and interglacial periods during the Pleistocene offered by Ewing and Donn in a recent issue of Science (*1*) is very provoking. It is certainly true that the melting of an Arctic Ocean ice sheet such as exists at present would, by making the Arctic Ocean ice-free, provide an increased source of moisture for the polar atmosphere, and it is true that this could have been accomplished through a greater interchange of water between the Atlantic and Arctic oceans. Whether this greater interchange would be associated with a cooling of the Atlantic, as the authors maintain, and also whether the open Arctic Ocean with its new moisture supply would favor the growth of glaciers over the areas to the south, is, however, a matter for further consideration.

While all the evidence as far back as the 1930's points to a warming of the Arctic Ocean, the more recent evidence shows a simultaneous though less marked warming of the Atlantic as well (*2*). Equally, the extensive deglaciation that has occurred within the past 50 years or so, particularly in the 1930's, coincided with a sharp decrease in the thickness of the Arctic ice pack from a value of approximately 3.6 m, which was measured by the Fram expedition, to a value of only 2 m, which was obtained by the North Pole expedition in 1937 and also coincides with a shrinkage of its area by more than 10 percent from the earlier to the more recent period. Consequently, if the process were to continue, an open Arctic Ocean would be associated with increasing deglaciation and eventually with no ice whatsoever.

It is acknowledged that a very substantial lowering of sea level would, by restricting the interchange of water between the Arctic and Atlantic oceans, make it possible for the Arctic Ocean to freeze over. However, a frozen Arctic Ocean would, according to the authors' view, only stop the glaciation from growing through the cutting off of the new moisture supply. For a waning of the glaciation itself, to make the cycle complete, the authors assume a starvation of the ice. This might be true of the inland ice in a very limited measure, but not of the glaciers whose waning is accompanied by a recession.

Rather, I think that the same agency that is responsible for the simultaneous warming of the Arctic and Atlantic oceans and for the shrinkage of the arctic ice pack is also responsible for the deglaciation, and that this is due primarily to a rise in temperature. In accepting the authors' claim that an open Arctic Ocean provides a new supply of moisture for the polar atmosphere and for an increase in precipitation, I suggest that this precipitation is in the form of rain, not only over the adjacent lands to the south, but also over the Arctic Ocean.

The fact that within the recent period the temperature of the South Atlantic Ocean has also increased suggests that the agency responsible operated on a broad scale and from outside the earth.

I. I. SCHELL
Department of Geology, Tufts University, Medford, Massachusetts

References

1. M. Ewing and W. L. Donn, *Science* 123, 1061 (1956).
2. J. Smed, *Cons. perm. intern. Explor. Mer. Rapp. proc. Verb.* 125, 21 (1949); I. I. Schell, *J. Cons. perm. intern. Explor. Mer.* 18, 1 (1952); H. J. Bullig, *Deut. Wetterd., Seewetteramt.* No. 5, 1 (1954); H. Riehl, "Sea-surface temperatures of the North Atlantic, 1887–1936" (Dept. of Meteorology, Univ. of Chicago, 1956).

10 October 1956

Presence of Serotonin in Lung and Its Implication in the Anaphylactic Reaction

Serotonin (5-hydroxytryptamine) is known to be widely distributed in the animal and plant kingdoms. In animals it has been reported to be present in gastrointestinal tract, blood platelets, spleen, and brain (*1, 2*), and possible functions for serotonin in each of these tissues have been suggested. There has been speculation for some time whether serotonin may

Table 1. Serotonin and monoamine oxidase in lung. The figures for serotonin content represent the average values obtained in several animal experiments, and those in parentheses give the number of animals used. The figures for monoamine oxidase activity represent the average values obtained on two or more animals.

Species	Serotonin content (μg/g)	Monoamine oxidase activity (μg destroyed/ g hr)
Mouse	1.9 (12)	960
Rat	2.3 (9)	960
Rabbit	2.1 (11)	1200
Guinea pig	0.2 (10)	1800

be responsible for some of the manifestations of the anaphylactic reaction. Humphries and Jaques (*3*) demonstrated that addition of purified antigen and antibody to normal rabbit platelets suspended in plasma released both serotonin and histamine from the platelets. Herxheimer (*4*) reported a relationship between tolerance to serotonin and desensitization in the guinea pig. Waalkes *et al.* (*5*) have recently shown that serotonin, as well as histamine, is released in rabbit blood (*in vitro* and *in vivo*) during anaphylactic shock.

Since serotonin is a potent bronchoconstrictor (*6*), the studies reported here were undertaken to determine whether it may play a part in the pulmonary aspects of anaphylaxis.

The serotonin content of lung homogenates was determined spectrophotofluorometrically (*2*). 5-Hydroxytryptophan (5HTP) decarboxylase activity was measured by the procedure of Clark *et al.* (*7*), and monoamine oxidase activity was measured by the procedure described by Sjoerdsma *et al.* (*8*).

Serotonin was found in relatively high concentration in lung. The amounts present in lung of several animal species are shown in Table 1. Not only was serotonin itself found to be present in lung, but also the enzymes which make it (5-hydroxytryptophan decarboxylase) and destroy it (monoamine oxidase). The latter was found to be present in high concentration (Table 1). The decarboxylase activity was relatively weak, less than 15 μg of 5-hydroxytryptophan being converted to serotonin per gram of lung, per hour, in any of the species investigated.

It is of interest that guinea pig lung contains little if any serotonin, whereas mouse lung contains relatively large amounts. It is known that mouse lung contains little histamine, whereas the histamine content of guinea pig lung is relatively high (*9*). These findings may explain some interesting observations that have been made in the past. Thus, in guinea pigs, the pulmonary aspects of anaphylactic shock appear to be completely explained on the basis of histamine release, and antihistaminic agents can block the effects almost completely (*10*). On the other hand, antihistaminic agents have little influence on anaphylactic shock in the mouse (*11*). Lysergic acid diethylamide, an inhibitor of the actions of serotonin on smooth muscle, has been reported to protect against an anaphylactic-type response (*12*). In rats and rabbits and in other species in which both serotonin and histamine are present in lung, both agents should be considered in explaining the pulmonary effects seen in anaphylaxis.

HERBERT WEISSBACH
T. PHILIP WAALKES
SIDNEY UDENFRIEND

Laboratory of Clinical Biochemistry and *Laboratory of General Medicine and Experimental Therapeutics, National Heart Institute, National Institutes of Health, Bethesda, Maryland*

References

1. I. H. Page, *Physiol. Revs.* 34, 563 (1954); V. Erspamer, *Pharmacol. Revs.* 6, 425 (1954).
2. D. F. Bogdanski *et al.*, *J. Pharmacol. Exptl. Therap.* 117, 82 (1956).
3. J. H. Humphries and R. Jaques, *J. Physiol.* 128, 9 (1955).
4. H. Herxheimer, *ibid.* 128, 435 (1955).
5. T. P. Waalkes *et al.*, *J. Pharmacol. Exptl. Therap.*, in press.
6. J. H. Comroe *et al.*, *Am. J. Physiol.* 173, 379 (1953).
7. C. T. Clark, H. Weissbach, S. Udenfriend, *J. Biol. Chem.* 210, 139 (1954).
8. A. Sjoerdsma *et al.*, *Proc. Soc. Exptl. Biol. Med.* 89, 36 (1955).
9. S. M. Rosenthal and H. Tabor, *J. Pharmacol. Exptl. Therap.* 92, 425 (1948).
10. P. Armitage, H. Herxheimer, L. Rosa, *Brit. J. Pharmacol.* 7, 625 (1952).
11. M. A. Fink and M. V. Rothlauf, *Proc. Soc. Exptl. Biol. Med.* 90, 477 (1955).
12. M. A. Fink *ibid.* 92, 673 (1956).

14 November 1956

First Discovery of Marine Wood-Boring Copepods

Marine wood borers are known to occur in the following animal groups: Pelecypoda (for example, *Teredo, Bankia,* and *Martesia*) and the crustacean orders Isopoda (for example, *Limnoria*) and Amphipoda (for example, *Chelura*) (*1*). The wood-boring habit has not been previously reported for the crustacean order Copepoda; however, Bocquet (*2*) recently described an algal-boring harpacticoid copepod, *Diarthrodes feldmanni,* from France.

While studying the biology of marine wood borers (*3*), we discovered several species of copepods that had wood material in their digestive tracts. These copepods were found in culture dishes in which populations of *Chelura terebrans* Philippi had been maintained but had died. Despite cleaning of the dishes, new woody fecal matter continued to be deposited and copepods were found browsing on the surface of the wood in a manner similar to that of *Chelura terebrans* (*4*).

Individual copepods were isolated and reared through several generations in petri dishes that were supplied only with sea water and chips of Douglas fir. Fecal matter similar in composition to that of *Chelura terebrans* (*4*) was produced by the copepods. Unlike the active borers *Teredo* and *Limnoria,* the copepods made no discrete holes.

Five species of wood-boring harpacticoid copepods belonging to the genera *Tisbe, Amphiascus,* and an unknown genus were isolated from test blocks collected in Los Angeles and Long Beach harbors, California (*5*).

Wood blocks were suspended at ten stations in Los Angeles and Long Beach harbors for 28-day intervals from November 1955 to November 1956. Copepods were observed throughout the year at many of the stations. However, the greater number of specimens was taken during the winter months. This may be the result of lower water temperatures, generally higher amounts of dissolved oxygen, and lesser quantities of fouling organisms settling on the blocks. It is possible that the copepods need certain amounts of debris or fouling organisms for protection. Test blocks that were grooved prior to use contained a greater number of specimens than smooth blocks; this was similar to what was observed with *Chelura* (*4*). Correlation with temperature and dissolved oxygen in Los Angeles and Long Beach harbors showed that the animals were present on the test blocks when the sea water temperature ranged from 15° to 20°C and when the dissolved oxygen content of the water was above 1.1 ppm. The animals did not occur on the wood blocks when the dissolved oxygen was lower than 1.1 ppm at the time of collection.

J. LAURENS BARNARD
DONALD J. REISH

Allan Hancock Foundation and *Department of Biology, University of Southern California, Los Angeles*

References and Notes

1. W. T. Calman, *Brit. Museum Nat. Hist. Econ. Ser.* 10, 1 (1936).
2. C. Bocquet, *Bull. soc. zool. France* 78, 101 (1953).
3. This report is contribution No. 188 from the Allan Hancock Foundation, University of Southern California.
4. J. L. Barnard, in *Essays in the Natural Sciences in Honor of Captain Allan Hancock* (Univ. of Southern California Press, Los Angeles, 1955), p. 87.
5. A report on the systematics and the biology of these copepods is in preparation.

10 December 1956