At the dedication of the new pathological laboratory of the Philadelphia General Hospital the principal address was delivered by Dr. William H. Welch, of The Johns Hopkins University, who spoke of the important part played by morbid anatomy in the advancement of medicine. Drs. Arthur Dean Bevan, Chicago, and Louis B. Wilson, Rochester, Minn., also spoke.

Nature records the death on November 25 of Frederick Webb Headley, at the age of sixty-three years. Mr. Headley spent nearly forty years of his life as an assistant master at Haileybury College, where he succeeded in maintaining a body of active boy-naturalists in the college. He was the author of "The Structure and Life of Birds" and "Life and Evolution."

UNIVERSITY AND EDUCATIONAL NEWS

Mr. John Markle has agreed to provide the sum of five thousand dollars a year for five years beginning January 1, 1920, for the continuation of the mining engineering course at Lafayette College, which was suspended during the war.

It is planned to establish a school of engineering under the joint direction of the Carnegie Institute of Technology, Pittsburgh, the U. S. Bureau of Mines and the coal operators of the Pittsburgh District.

Delegates from French and Swiss universities met recently at Geneva and made arrangements for interchange of students and professors with credits for corresponding work.

Dr. Meyer G. Gaba, who was an instructor in mathematics at Cornell from 1915 to 1918, has been appointed associate professor of mathematics at the University of Nebraska.

Dr. James Playfair McMurrich, professor of anatomy in the University of Toronto, has been elected dean of the faculty of arts.

Dr. T. Harvey Johnston has been appointed to the new professorship of biology at the Queensland University. Dr. Johnston was one of the traveling commissioners sent abroad by the Queensland government to investigate the Prickly Pear problem.

At the University of Cambridge Dr. F. H. A. Marshall, fellow of Christ's College, has been appointed reader in agricultural physiology, and Mr. P. Lake, of St. John's College, reader in geography.

DISCUSSION AND CORRESPONDENCE

THREAD MOULDS AND BACTERIA IN THE DEVONIAN

While making a comprehensive survey of the comparative histology of the skeletal parts of ancient vertebrates, in conjunction with the study of paleopathology, my attention was attracted to the enlarged and distorted shapes of many lacunae in the carapace of *Borthriolepis* and *Coccosteus*. Closer examination under the oil immersion revealed the occurrence of thread moulds and bacteria in the almost disrupted lacunar spaces, and since these organisms have never before been noted in the osseous elements of such ancient vertebrates, a brief description will be given of them here. There is a great gap in our knowledge of ancient bacteria especially between the Pre-Cambrian bacteria described by Walcott and the Carboniferous forms described by Renault, so that we know nothing of the occurrence of bacteria especially in bony material during the early and middle Paleozoic.

The occurrence of thread moulds (*Mycelites ossifragus*) in the hard parts of invertebrates and vertebrates, from molluscs to man, has been noted for more than eighty years and the literature is very extensive. The canals made by the penetrating moulds, known as the *canals of Roux or Wedl,* have been noted by Kölliker in the hard parts of invertebrates, fossil and recent, by Triepel in recent human bones, by Shaffer in ancient human teeth, by Sonders in a Neolithic skull, by Roux in the skeletal parts of vertebrates, Carboniferous to recent. They have been recently seen in the bony parts of Devonian vertebrates, doubtless they have a very wide distribution and may be regarded as one of the most ancient types of organisms in existence There is nothing peculiar in

their occurrence in the ancient vertebrates except that their course of growth is modified by the histology of ancient bone. In the absence of definite lamellæ the mycelia often seek out a lacuna, enter it and growing out along the direction of the brief canaliculi, expand both the lacuna and canaliculi until the entire structure is disrupted and the canals meet other canals growing out from adjoining lacunæ. In modern human bone the mycelia very often follow the interlamellar spaces, but ancient bone has seldom any definite spaces of this kind and more often is to be regarded as an osteoid substance. That the appearances described for the enlarged lacunæ are not normal is easily checked by a study of normal lacunæ in the adjacent material. A single microscopic field will show both normal and invaded lacunæ. The canals, from 2–4 *micra* in diameter have an undulating course and offer easy channels of entrance to invading bacteria.

The presence of these thread moulds would seem to indicate that the piece of bone showing them was preserved in a moist sandy or muddy place close to the shore, thus agreeing with our previous conceptions of the preservation of fossil material. It is difficult to see how the moulds would find entrance if the material were embedded under sand or silt in deep water. The ancient Egyptian mummies, buried for thousands of years in the dry sand of Nubian deserts do not show such canals, nor do the Cretaceous vertebrates from Kansas show them. Seitz has figured them, though apparently did not recognize their nature, in the bones of Labyrinthodonts and dinosaurs, and I have seen evidences of them in sections from the vertebra of an American sauroped dinosaur.

The bacteria doubtless have entered the bone along the course of the *Canals of Roux* and may be detected at first by the beady, nodular appearance of the canal. Often the bacteria, in *Bothriolepis,* for instance, have invaded a canaliculus which the *Mycelites* did not find. The small clumps, or nodes, may clearly be regarded as colonies of bacteria and doubtless as a form of the *Micrococcus,* described by Renault in the canaliculi of Permian fish bone. The beady appearance of an invaded *canal of Roux* or canaliculus recalls exactly the picture of the invaded dentinal tubules in cases of human dental caries. We are, of course, in this case, as in the case of other ancient phenomena, arguing from the known to the unknown. Here is an ancient situation which parallels a similar modern situation and the argument is sound because on it for over one hundred years we have built the science of paleontology.

These conditions can not be regarded as disease in any sense, but are rather to be regarded as the agents of decay in ancient times. They are the agents of decay and disruption at the present time and from present evidences the same agents of decay have been at work for many millions of years, at least since Devonian times.

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VIBRATION RATE OF THE TAIL OF A RATTLESNAKE

THROUGH the courtesy of Professor H. R. Dill, curator of the natural history museum, opportunity was offered to make a brief study of the rate of vibration of the tail of a diamond back rattlesnake, *Crotalus Adamanteus.* This specimen came from Texas on September 15, 1918, but had been in captivity for some time previously. Its age is not known, as that can not be accurately determined from the number of rattles, some of which are known to have been broken off, and two of the nine or ten remaining are in poor condition. A new rattle is formed with each moulting, a process which has occurred twice during the nine months that the animal has been in the laboratory; the second moulting occurred six months after the first. The snake is about five feet four inches in length and rather thin, since it refuses food. It accepts water, however, and in the latter part of March two sparrows were forcibly fed to it. It is exceedingly alert and vigorous, and frequently strikes at any object that is near its wire cage. It has learned some discretion, and does not risk the resultant bump against the wire unless