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THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE ETHNOLOGICAL ANALYSIS OF CULTURE[1]

DURING the last few years great additions have been made to our store of the facts of anthropology—we have learned much about different peoples scattered over the earth and we understand better how they act and think. At the same time we have, I hope, made a very decided advance in our knowledge of the methods by means of which these facts are to be collected, so that they may rank in clearness and trustworthiness with the facts of other sciences. When, however, we turn to the theoretical side of our subject, it is difficult to see any corresponding advance. The main problems of the history of human society are little, if at all, nearer their solution, and there are even matters which a few years ago were regarded as settled which are today as uncertain as ever. The reason for this is not far to seek; it is that we have no general agreement about the fundamental principles upon which the theoretical work of our science is to be conducted.

In surveying the different schools of thought which guide theoretical work on human culture, a very striking fact at once presents itself. In other and more advanced sciences the guiding principles of the workers of different nations are the same. The zoologists or botanists of France, Germany, America, our own and other countries, are on common ground. They have in general the same principles and the same methods, and the work of all

[1] Address of the president to the Anthropological Section. Portsmouth, 1911.

five different species belonging to the phanerobranchiata, the cryptobranchiata, the lechriodonta and the mecodonta. He comes to the following conclusions in answer to the three questions postulated:

1. Osseous tissue is divisible into two distinct classes, coarse-fibrous and fine-fibrous. Coarse-fibrous bone is the more primitive of the two. It is formed beneath the periosteum from which at first it is not sharply separated, and in ontogenetically and phylogenetically primitive conditions the coarse fiber-bundles are usually interwoven in an irregular manner. In highly developed bone the fiber-bundles are more regularly arranged. Some fine-fibrous bone is usually interspersed among the coarse fiber-bundles. Sharpey's fibers are those bundles of coarse-fibrous bony substance which extend inwards perpendicular to the periosteum. The cement substance of the teeth and the substance of the basal plates in placoid organs of selachians are to be classed with coarse-fibrous bone. Fine-fibrous bone is laid down about the loose connective tissue which accompanies the blood vessels which are enclosed in the sub-periosteal bone or which penetrate the endochondrium. It is laid down in concentric layers about the spaces in which the blood vessels lie. No coarse fiber-bundles are ever interspersed among these concentric layers. The dentine of placoid organs and of the teeth is of a nature similar to fine-fibrous bone.

2. Compact bone is composed mainly of fine-fibrous bone and is a far higher type of bone than the primitive coarse-fibrous bone. The vascular canals in bone appeared at first as the chance accompaniment of the periosteal development of bone. They proved useful for the nutrition of the bone. Their importance became increased when fine-fibrous bone was laid down in concentric layers about their walls and when blood-corpuscle-forming bone-marrow was developed from the loose connective tissue accompanying the blood vessels.

3. Enchondral ossification represents the spread of the vascular canals from periosteal bone into axial cartilage. Marrow cavities arose through the anastomosis of branched vascular canals and were present even in the extinct ancestors of the present amphibians. The marrow cavity first appeared in the shaft, then extended into the epiphyses. The development in the epiphyses of special marrow cavities by the ingrowth of blood vessels from the surrounding periosteum represents a relatively advanced stage of development. The elements of the carpus and tarsus phylogenetically long remain cartilaginous. In some of the lower forms there is a slight periosteal ossification of these bones, but this is never extensive and is not found at all in the highest vertebrates in which the ossification of these bones is purely enchondral.

From this study of the development of the skeleton of the limbs in urodeles the author is inclined to take the view that the phanerobranchiates, the cryptobranchiates and siredon are derived from the caducibranchiates. The caducibranchiates, he thinks, are divisible into two groups, of which one, including the desmognathinæ and the plethodontinæ are distinguished from the second group, the salamandrinæ and amblystoma opacum, by a lesser development of marrow cavities, the simple structure of the carpal and tarsal bones, and the almost complete absence of fat cells in the bone marrow.

The monograph, as a whole, represents a careful and satisfactory study of the subject.

C. R. BARDEEN

SCIENTIFIC JOURNALS AND ARTICLES

THE twenty-second volume of the *Journal of Morphology* is a memorial volume in honor of Charles Otis Whitman. The third part, issued on September 20, contains the following articles:

"Some Problems of Cœlenterate Ontogeny," Charles W. Hargitt.

"Physiological Animal Geography," Victor E. Shelford.

"On the Olfactory Organs and the Sense of Smell in Birds," R. M. Strong.

"On the Regular Seasonal Changes in the Relative Weight of the Central Nervous System of the Leopard Frog," Henry H. Donaldson.

"The Physiology of Cell-division. IV., The Action of Salt Solutions followed by Hypertonic Sea-water on Unfertilized Sea-urchin Eggs and the Rôle of Membranes in Mitosis," Ralph S. Lillie.

"The Spermatogenesis of an Hemipteron, Euschistus," Thos. H. Montgomery, Jr.

"The Life History of the *Scolex polymorphus* of the Woods Hole Region," Winterton C. Curtis.

SPECIAL ARTICLES

ON SOME CONDITIONS OF TISSUE GROWTH, ESPECIALLY IN CULTURE MEDIA

In a paper on the regeneration of epithelium published almost fourteen years ago[1] I analyzed some of the internal and external factors in the growth of mammalian tissues and demonstrated the existence of stereotropism in regenerating epithelial cells. I also cited certain statements of other observers which suggested to me the existence of a stereotropic sensitiveness in other varieties of growing vertebrate tissues.

At that time I furthermore had the opportunity to observe that epithelium might grow and show its stereotropic reaction without relation to the underlying tissue, growing merely in contact with blood coagula. This observation suggested to me the possibility of cultivating tissues of vertebrates in culture media *in vivo* as well as *in vitro,* in a similar manner as bacteria had been cultivated. My previous observations on the importance of the contact with solid substances in tissue growth induced me to use solid coagula as the culture medium.[2] I published a communication concerning these first experiments (which had been carried out in Baltimore).[3] In further experiments accidental conditions made it necessary to study the growth of mammalian tissues in culture media with the animal body acting as an incubator. The results of these experiments have been published in detail.[4] To our knowledge in these earlier experiments, for the first time the attempt was recorded in the literature to grow tissues of higher animals under artificial conditions, to separate through culture media experimentally growing epithelial from connective tissue cells and furthermore to study the influence of the addition of certain chemicals upon the growth of tissues.[5]

Demands of other investigations prevented me from extending these experiments into various directions, as I had planned to do for a considerable number of years. Only recently I resumed these studies and I analyzed further the growth of tissues in solid coagula, especially differentiating between the reactions of stroma and parenchyma in tissue growth in culture media. Here I will add the results of some further studies which were made in conjunction with my collaborator, Dr. Moyer S. Fleisher, and a more detailed account of which will appear elsewhere.

1. We investigated to what extent oxygen is necessary for the growth of mammalian tissues in culture media, a problem which had interested me from the beginning of my experiments. In the case of certain higher plants it has been recently shown that a limited anaerobic growth is possible. We used various methods of anaerobic culture methods and we also studied the effect of a diminution in the supply of oxygen. Our results show that growth ceases if oxygen is lacking or noticeably diminished. This applies to various tissues. A noteworthy difference in the reaction of various tissues to lack of oxygen we could not observe. Under these conditions tissues not only cease to grow, but they die. It is much more difficult to determine the effect of an increase in the tension of oxygen on tissue growth. Our experiments, however, make it very probable that in certain cases the life and growth of tissues is favorably influenced if pure oxygen takes the place of air surrounding the culture media.

2. We studied the effect of the combined growth of an oidium-like organism[6] and of

[1] "Ueber Regeneration des Epithels" (chapter 13), *Archiv f. Entw'mech.,* Bd. VI., 1898.

[2] I referred to this circumstance again in a communication to the Society of Experimental Biology and Medicine, Proceedings of the 44th meeting, May 17, 1911.

[3] Chicago, 1907.

[4] *Archiv f. Entw'mech.,* Bd. XIII., 1902; *Journ. Med. Research,* Vol. VIII., 1902; *Journ. Am. Med. Association,* 1901.

[5] *Zeitschrift f. Krebsforschung,* Bd. V., 1907.

[6] This organism was studied in conjunction with Dr. George J. Moore, of St. Louis, and will be described elsewhere.