While we must realize that we can not exactly simulate natural conditions in the laboratory, it would seem that organisms which had been leading a saprogenic life for years would be more resistant to the conditions of the experiment than would the same organisms in a highly virulent parasitic condition.

The Plymouth typhoid epidemic was caused by a fresh and vigorous strain, as is indicated by the severity of the early cases. It is not likely, therefore, that it was caused by organisms which had been in a frozen medium for any length of time. I would suggest the theory that the epidemic was caused by the organisms in the feces which were deposited within a few days of the time the reservoir was opened, about the time of, or after, the thaw.

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ANALYZED SOUND

IN the issue of SCIENCE for July 4, 1924, an interesting discussion of "Analyzed sound" by Alexander Forbes appeared. This description of the several instances coming to his attention brought to mind an experience of mine with a similar phenomenon occurring at Oxford, Massachusetts, many years ago. Having very carefully kept journal records almost daily since 1898 of my thoughts, experiences, etc., in contact with all natural phenomena, I made a search of my journal and found the following record which I will copy just as written:

Aug. 11, 1902. Oxford, Mass.

As an early train passed by this morning, I noted a most remarkable echo every time it whistled. The first echo was immediate, sharp and distinct, appearing to rebound from a neighbor's buildings nearby. Some seconds after all was quiet, another faint, far-away musical echo came stealing up the valley, apparently emanating from a wooded hillside far away. The echo ever increased in intensity until it seemed to pervade every corner of the landscape, filling it with a wonderful harmony of sound that beat upon the air in ever fainter waves, ever becoming farther away, until the sounds could no longer be heard. At no time were the sounds loud but seemed to fall upon the ear in infinite waves, as if thrown back from some invisible dome overhead. It did not seem to be a terrestrial echo, but seemed to fill the skies overhead with sweet, spiritual sounds, that seemed also to reecho far back in the skies, one could not tell where. I think some obscure atmospheric condition overhead was responsible for this remarkable echo, the most exquisite, the most sweetly celestial sound I have ever heard in the skies.

At the time I was greatly impressed with this remarkable sound phenomenon, but I have never since heard anything even approaching this strange breaking up and reflection of a sound into musical tones such as occurred in this instance.

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IN connection with the article in SCIENCE of July 4, 1924 (page 5), on "Analyzed Sound," attention should be called to Lord Rayleigh's discussion of the phenomena half a century ago (*Nature,* 1873, Vol. VIII; "Theory of Sound," Chap. XV) under the title "Harmonic echoes." His conclusions from a mathematical investigation of the reflection of sound-waves from small surfaces, as tree trunks, were that the intensity of the reflected wave varied inversely as the fourth power of the wave length. The overtones in the echo of the voice would therefore be very much stronger relatively to the fundamental than in the original sounds and the effect might easily be called a change to the octave.

Many years ago there was such an echo at the Adirondack resort, Loon Lake, Franklin County, N. Y.

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SCIENTIFIC BOOKS

Extinct Plants and Problems of Evolution. By D. H. SCOTT. Pp. xiv + 240. Macmillan & Co. London, 1924.

THIS little book, founded upon a course of lectures given at the University College of Wales in 1922, is a largely non-technical and very readable account of the main points in our knowledge of fossil plants, written for the non-specialist.

The first chapter is an all too brief, but very illuminating, sketch of the present status of the various theories that have been advanced to explain the facts of evolution. A consideration of extinct floras is preceded by a very brief sketch of recent floras, and the former are taken up in the sequence from youngest to oldest. The great transformation periods of floral history are considered to have been the middle Devonian, the Permian and the mid-Cretaceous, ushering in respectively the so-called Carboniferous flora, the Mesozoic flora and the flowering plants. The consideration of the early Devonian flora is almost entirely devoted to considerations growing out of the recently discovered petrified material in the Rhynie chert, and showing certain bryophytic and algal characteristics. It seems to the reviewer that a somewhat misleading impression is given of the extent of the Permian transformation, which was really a gradual process when viewed in the true geological perspective. The consideration of the Mesozoic floras is largely taken up with the Cycadophytes, and the author is seemingly greatly impressed with the analogies between the bisporangiate fructifications of the latter and those of certain angiosperms. The treatment of the flowering plants is very brief and, although avowedly incomplete, does not indicate any great knowledge of, or even interest in, the literature of the subject.

As is eminently proper in a book designed for a general audience, the author very fairly states all controverted questions and rightly refrains from arriving at decisions, which are indeed impossible in the present state of our knowledge. Without prejudice to his position he may, I think, be fairly said to favor the following propositions: That land plants probably arose from various specialized algal ancestors somewhat after the manner set forth in Church's speculations; that the vascular plants were consequently polyphyletic in origin and that the Rhyniaceae may have been reduction products of some algal stock; that the true ferns and the seed ferns were of independent origin; that there was a community of origin between the seed ferns and the Cordiatales, and that the conifers and the ginkgos took their origin from some cordiatalean-like ancestors; that there was a community of origin between the flowering plants and the Mesozoic cycadeoids, finally that on the whole the evidence is favorable to the truly Darwinian conception of an orderly and gradual evolution of the various plant phylae.

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SPECIAL ARTICLES

A MECHANISM FOR THE COORDINATION AND REGULATION OF THE MOVEMENT OF CILIA OF EPITHELIA

THAT the movement of cilia in epithelia is coordinated is a fact of universal observation, but a structural mechanism in epithelia, by which this coordination of movement is conditioned and facilitated, has not hitherto been demonstrated.

Many biologists, especially physiologists, finding nothing in the structure of living epithelia suggestive of a coordinating mechanism and no reference in the literature of morphology concerning a durable, structural organization adequate to account for coordination of ciliary movement, have concluded that such a mechanism is not essential and does not exist. To account for the observed coordination of ciliary movement in epithelia, G. H. Parker,[1] in 1919, definitely formulated his theory of "neuroid transmission" according to which the coordinating impulses that pass from cilium to cilium are conducted, not by structurally differentiated paths, but by virtue of "that elemental property of protoplasmic transmission from which true nervous activity has been evolved." According to Parker ciliated epithelia present favorable conditions for the study of this elemental form of transmission.

The regulation and control of ciliary movement, such that it is correlated with the changing conditions of the environment and physiological states of the organism, is also a fact that is established by observation and experiment, although there are biologists who assert that such regulation does not exist; ciliated epithelia, according to their view, being purely automatic in their movements and not adjustable to the changing states of the organism as a whole. J. L. Kellogg[2] holds to such a view, at least so far as the ciliated tracts of the palps of lamellibranch mollusks are concerned.

During the past year we have made careful cytological studies of ciliated cells and epithelial of the gills of several species of fresh-water mussels of the genera, Lampsilis and Quadrula, and have been successful in finding well-differentiated systems of fibers which fully satisfy all the requirements of coordinating and regulating mechanisms.

The differentiated mechanism we have been able to demonstrate in the latero-frontal ciliated epithelium of the gill of a species of Lampsilis is shown in Fig. 1, and is schematically represented in Fig. 2.

The cilia (C), in this type of epithelium, are paired, and members of pairs are fused at their tips (X). The number of pairs of cilia is approximately the same as the number of nuclei in the syncytial epithelium. A specialized cuticle is present at the external surface of the epithelium in which the cilia and their basal corpuscles (b) are implanted. In the proximal zone of cytoplasm, between the cuticle and the row of nuclei, a system of intra-cellular fibers or ciliary rootlets is chiefly distributed, although fibers belonging to the system may penetrate the cytoplasm between nuclei, and perhaps even to the basement membrane and the sub-epithelial layer of bipolar cells. This system of intra-cellular fibers may be analyzed as follows: each cilium splits, just below its basal corpuscle, into two fibers (m and n) which diverge at angles varying from 20 to 30 degrees, one to the right and one to the left in the plane of the row of cilia. The right hand branches (m and m′), originating from the members of a pair of cilia,

[1] G. H. Parker, "The elementary nervous system," Lippincott Company, 1919.

[2] J. L. Kellogg, "Ciliary mechanisms of lamellibranchs, with descriptions of anatomy," *Journ. Morph.*, Vol. 26, 1915.