The number of subscriptions so lost would certainly be very small however. The management of a journal could recoup itself for this loss and even make a small profit by charging for the reprints several times the cost of output—and they might still be quite inexpensive.

For the reprints to be of real service to workers in one field of knowledge, most of the leading journals in that field should offer them. This would require something approaching concerted action on the part of the journals and such action will perhaps be difficult to secure.

This appeal is written with the principal object for the present of arousing, if possible, widespread consideration and discussion of the desirability of having the reprints. If, upon consideration, a large proportion of scientific workers come to believe that the reprints would be of service and should be available, then the journals would probably offer them provided the journals were apprized of the generality of this belief. Further discussion of the subject on the part of others than the writer in the columns of SCIENCE or elsewhere would no doubt help in the apprizing. Or, if representatives of departments or laboratories would write, on behalf of the groups which they represent, to the various journals whose reprints they would like to have, this would be a beginning. The journals might be induced by such letters to make inquiry among the libraries on their subscription list to determine approximately the total number of reprints wanted. However, it may develop that the very demand would require cultivation. Is it too much to hope that one or more journals may undertake this cultivation by offering the reprints over a period of years? Be this as it may, I personally feel convinced that the reprints are something we should have; if others who now feel or come to feel likewise, will put forth some small effort which they consider suitable by way of agitating the matter, perhaps we shall some day have them.

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MITOCHONDRIAL BEHAVIOR

AN article on "Mitochondrial Behaviour during the Life-cycle of a Sporozoon (Monocystis)" in a recent number (July, 1929) of the *Quarterly Journal of Microscopical Science* suggests several queries. The paper states that material was obtained from "the sperm-sacs of the common Australian (European) earthworm." "Sperm-sacs" presumably refers to those organs which oligochaetologists call seminal vesicles, although the term sperm-sac has also been used for testis-sac or testicular chamber as well as for spermatheca. But what is meant by "the common Australian (European) earthworm"? Again presumably this refers to one of the peregrine Lumbricids that have been imported into Australia and which have become acclimated in settled areas around towns and cities. But which one? At least six species of Lumbricids have been recorded from Australia: *Eiseniella tetraedra, Eisenia foetida, Allolobophora caliginosa, Bimastus parvus, Bimastus constrictus* and *Octolasium lacteum*. These worms when found elsewhere are usually present in considerable numbers, so that to each one of them the adjective common might be applied. Thus an investigator who procures his earthworms from manure piles might regard *E. foetida* as the common species, while another investigator who gets his material from the very same locality but at a distance of a very few feet from the manure piles would probably find another species to be the common form. Similarly, a thick grove or river bank only a short distance from both the preceding places might have still other common species. The phrase "the common earthworm" in such a region must therefore be nearly as meaningless as "the common bird" or "the common fish" would be. It is of course possible that of the earthworms in the vicinity of Melbourne such an overwhelming majority belong to one particular species as to justify use of the words "the common" in referring to it, but no evidence for this has been found in the literature, and even were this the case, outsiders can hardly be expected to know what the common European earthworm of Australia might be.

In this connection may I call attention to a few sentences in Stephenson's "The Oligochaeta" which, because of their situation in the preface, may not receive the consideration to which they are entitled.

> While on the subject of nomenclature, may I suggest, more particularly perhaps to some of the authors who write on physiological subjects (although morphologists are not invariably above suspicion in the matter), that they should identify, or get identified, their material? It is not nowadays sufficient to talk of "the earthworm"; there are 1,800 species. . . . "The common earthworm," too, is meaningless—what is the common earthworm in one part of the country is not so in another; while the specious appearance of exactitude given by the phrase "the common earthworm, *Lumbricus terrestris*," is (at least as a rule) entirely fallacious.

Furthermore, the author of the paper under consideration did not state which one of the species of *Monocystis* that occur in the seminal vesicles of earthworms he studied. The importance of such systematic precautions is made quite evident by the fact that "there may be as many as five different species pres-

ent at the same time, as is the case in the seminal vesicles of *Lumbricus terrestris.*"[1]

Of course, the behavior of mitochondria during the life cycle may be exactly similar in all species of *Monocystis,* but this has not yet been proved. In the meantime, until the particular species both of host and parasite investigated by the author be known, his results are invalidated by the possibility of the confusion of several species of *Monocystis,* the behavior of the mitochondria of each of which may be entirely different. As in other cases that might be mentioned, corroboration of the results obtained is impossible because of the anonymity in which the particular animal concerned is shrouded.

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BENTONITE IN THE ORDOVICIAN NEAR COLLINGWOOD, ONTARIO[1]

EXAMINATION of samples from the Robert Cherry No. 1 well on the shore of Lake Huron about 2½ miles southeast of Collingwood, Ontario, showed bentonite in one sample from a depth of 320 feet. The material is light gray, soft, with a greasy feel. In water it expanded considerably and disintegrated rapidly. The residue after panning showed pyrite with biotite flakes up to 0.2 mm with subordinate amounts of zircon, apatite and tourmaline. Dr. C. S. Ross, of the U. S. Geological Survey, confirmed the bentonitic character of the material. He reported that the structure was very similar to that of the Ordovician bentonites found in Tennessee and Virginia, more especially to that found at Catawba, Virginia, that it showed the character of fine-grained pumice and that it was similar in physical properties and in contained biotite grains. An analysis for potash made by the Mines Branch, Department of Mines, Ottawa, Canada, showed 6.08 per cent. K_2O on material dried at 105° C.

The well samples show limestone down to the bentonite bed and for 35 feet below it to the basal sandstone resting on the Precambrian. The driller reported shale at 315 to 327 feet. The sample of bentonite was quite pure. It is possible therefore that the bentonite bed is several feet thick. The well started in the Trenton limestone but below the top of this formation which, together with the underlying Black River limestone, has a thickness at Collingwood of about 550 feet as shown by well records. No fossil evidence was obtained from the samples, and the exact horizon at which the bentonite occurs is not known. It probably occurs in the upper part of the Black River limestone.

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THE RELATION OF THE PARANASAL SINUSES TO THE SINGING VOICE

ONE of the problems encountered in the teaching of singing is the determination of the potential range of the voice. It has been a matter for the ear of the teacher to decide, and in many cases the decisions have not been correct.

Many theories have been advanced regarding this phase of vocal work, among them that of laryngeal differences. None of them have proved conclusive to any degree of accuracy.

After some years of experimental research, using the x-ray as the exploring medium, the writer has made several discoveries that seem significant.

First, that the range of the voice seems to be governed by the length of the resonating space in the frontal sinuses. Practically all the cases examined have shown a direct relationship between the range of the voice and the size and shape of the frontal sinuses, sopranos having long, narrow, frontal sinuses, mezzo-sopranos shorter and broader ones, and altos very short and almost round ones. The cases examined have run unusually true to type.

Second, the size or weight of the voice seems to be governed by the size of the antri, clear light sopranos having smaller antri than those having larger, heavier voices.

Third, the naturally beautiful voices seem to have arches, palatal and pharyngeal, that are symmetrical in their make-up, well-arched cases having more beauty in their voices than those having flat arches.

In cases where technical difficulties have been encountered by students examined by the writer and who had the advantages of study and training by excellent teachers, malformation of the frontal sinuses was apparent. In several cases a variance in the length of the right and left sinuses seemed to be the cause of irregularities in the vocal scale.

The same anatomical differences with consequent vocal changes appear in male voices.

A thorough investigation is under way by the writer, and plans are now being formed to radiograph a large number of distinguished singers' heads.

In all cases great care must be used in making all films with definite angles as the work can be accomplished only through comparisons.

Any comment, critical or otherwise, will be welcomed.

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[1] Calkins and Bowling, *Biol. Bull.*, 51: 387, 1926.

[1] Published with the permission of the director of the Geological Survey, Canada.