

entists have discarded for many years.

Teachers and scientists have been trying for sixty years that I can remember to simplify the language in introductory science courses. Scientists have modified terms such as energy, atom, and species, for example.

Because a term is confusing and used with different meanings is no excuse for not making the term understandable with one meaning.

D. and H. cited one reference to support the multiple meanings of theory, hypothesis, law, etc. The misuse of these terms is not a sound reason for misusing them in freshmen classes. D. and H. should also have cited Gibbs, A. and A. Lawson, 1992 (*The American Biology Teacher*, 54, 137–152). On page 143 they define a list of general science terms for use in introductory courses. The list includes theory, hypothesis, and law.

Teachers should do what most scientists do—clarify the terms they use.

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Haeckel's Embryos in Question

Dear Editor:

In a recent article (Wells, *ABT*, May 1999) dealing with Haeckel's embryos and evolution, the author states:

"But human embryos do not really have gills or gill slits: like all vertebrate embryos at one stage in their development, they possess a series of "pharyngeal pouches," or tiny ridges in the neck region."

No. The ridges in the neck region are *not* the pharyngeal pouches! The latter are not visible externally. The ridges are the *branchial arches* containing the blood vessels (aortic arches) and skeletal primordia that develop

into the gill circulation and gill arch supports in the fishes and are partly coopted in terrestrial vertebrates for the aorta, pulmonary arteries, the hyoid apparatus and various cartilages in the throat region. These arches are separated from each other by inward growing *branchial grooves* which meet outward growing *pharyngeal pouches* from the inside. When these two structures meet and their epithelia perforate, a gill slit is formed. These persist in the fishes but eventually close in amphibians, reptiles and birds. In the mammals these epithelia normally do not perforate resulting in a "closed" gill slit. Occasionally, however, open slits do form and remain open resulting in a newborn infant with one or more cervical fistulae (holes in the neck) which have to be repaired surgically (Arey 1946, p. 179).

What I have said above is not based on any work of Haeckel. Any textbook of vertebrate developmental anatomy (example: Patten 1931, 1951) would have its own detailed drawings and photos of these structures. And any student taking a course in vertebrate embryology (at least in the first six decades of this century) would have spent a great deal of time studying the anatomy of the chick embryo and the fetal pig in detail and would have seen these structures first hand.

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References

- Arey, L.B. (1946). *Developmental Anatomy: A Textbook and Laboratory Manual of Embryology*, 5th edition. Philadelphia: W.B. Saunders Company.
- Patten, B.M. (1931). *The Embryology of the Pig*, 2nd edition. Philadelphia: The Blakiston Company.
- Patten, B.M. (1951). *Early Embryology of the Chick*, 4th edition. Philadelphia: The Blakiston Company.



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