

there was such similarity between papers coming from the same school that it seemed there must have been undue help given by the teachers. We trust that on this occasion the papers sent in will represent the unaided efforts of the pupils. All we ask of the teachers is that they encourage them to compete and that they read the papers and send us what they adjudge to be the best three papers in each of the two divisions. Three book prizes will be given for each division. Father James O'Neill has provided for prizes for the senior division, and we will see that the juniors shall also have their books. After the results are made known we hope to publish the best paper in each class. On the last occasion the prizes were won by pupils in different parts of the Dominion, the winners coming from Invercargill, Dunedin, Alexandra, and Dannevirke. Those who were successful then are eagerly looking forward to winning more prizes, but with a fair field and no favor there is no reason why every young reader of *The Story of Ireland* should not have a good chance. Remember that each paper must be signed with the name and address of the competitor and that it must be headed "Senior Division" or "Junior Division" according to the Standard of the pupil.

Facts and Theories of Modern Biology

(By U. A. HAUBER, in the *American Ecclesiastical Review*.)

Theoretically science deals with natural phenomena, religion with the supernatural. Science is systematised and organised human knowledge; it has limitations, as all human things have, and is rightly supplemented by revealed truth.

In practice, however, scientists often make excursions beyond their acknowledged sphere of investigation, particularly when they do not believe in revealed religion. This is not surprising, since the human mind is not satisfied with anything short of an ultimate explanation of things. When, therefore, scientists of to-day advance opinions concerning the nature of God or the origin and destiny of man, they are within their rights, provided they do not present such opinions as the findings of science. They are speaking as men interested in facts that lie beyond the scope of science.

The danger is that one cannot separate the scientist from the man; whatever authority and prestige goes with the pronouncements of the scientist speaking *ex cathedra* clings to him when he steps from his official chair. And yet his researches in the natural world give him no better insight into the metaphysical or supernatural than that possessed by his less privileged brethren; on the contrary, continued close application to the microscope is distinctly unfavorable to clearness of vision in the world outside.

The object of this paper is to present a bird's-eye view of one province of the domain of science, that of biology; to indicate how and for what reasons workers therein so often transgress their legitimate boundaries and enter territory with which they are not familiar; and finally to suggest an attitude that Catholics may take toward biology, toward its genuine conclusions as well as toward its questionable theories.

At the University one takes a course of Embryology. Eggs are put in an incubator and taken out at regular intervals of about twelve hours to study their development. By means of microscopes and proper technique—the latter itself a marvellous triumph of modern science and skill—one can observe all that goes on inside the egg. At first there are only a few microscopic cells, one just like the other, lying on the yolk. There is nothing particularly remarkable about them. But presently this little speck of living material begins to grow; that is, the original cells divide and multiply until there are hundreds of them. In other words the life in that egg increases in size. But it does no more than that. To begin with, there is only a single layer of cells. This folds over nicely as a piece of cloth might be folded over by a tailor who intends to make a pair of trousers. Then there are two layers. The upper layer next gets a downward crease in it. This

crease gets deeper, sews itself together, as it were, along the top edge, and then cuts itself off from the main cloth; and lo and behold! we have a tube which is the primitive spinal cord with the brain at one end of it. While the upper layer has thus been initiating a nervous system, the lower one folds in a similar manner, sews itself up, is cut off from the main piece of cloth, and our chick has a stomach and an intestine. In the meantime a third layer has been forming in between the other two. One part of this folds over, closes up, and there is a heart which promptly begins to beat. Another part becomes arranged in regular rows and forms the muscles of the back. In like manner the development of every organ and every part of that chick is accurately traced and described. A complete mastery of such intricate and minute details is one of the boasts of modern biological science.

I have taken pains to put in non-technical language this sample of the kind of work the student of biology does, for two reasons: first to help us realise that one has some very definite things to learn before he can claim to know biology, and that in the main these things are facts not hypotheses; secondly I wish to use this illustration to make clear what the theory of evolution means.

In brief, then, the evolutionist believes that just as the chick in the egg underwent a *natural* development from a very simple, unorganised condition until it arrived at the status of an adult barnyard fowl, so the whole class of animals we call birds descended or developed from a simple ancestor in *natural* fashion. Put as bluntly as that, it may seem unintelligible, almost ridiculous. It is indeed merely a hypothesis, but a hypothesis with facts to bolster it up. Unhappily the facts are all taken from the field of biology itself and are with difficulty available to convince the sceptic.

Another task that the biologist has to accomplish before he is acknowledged worthy of the name is this: he must familiarize himself with the structure and functions of every type of living thing from the microscopic bacilli that float in the air and the minute slimy things that crawl in the mud, to the highest forms of life of which the chick or the human being are representative examples. And when he has done that he has a complete series of living things, which, properly arranged, resemble strikingly the successive stages of a developing chick.

He must know still more. He must be familiar with the kinds of living beings that existed in past ages and are now extinct. Paleontologists have studied diligently former life on this globe as recorded in the rocks. They know its main features. They are not guessing or surmising. The man who is studying extinct life is studying facts as well attested as any facts can be. His researches have revealed a large number of very distinct periods of geologic history, each characterised by its own fauna and flora. We know the order of succession of these periods, even if we can only guess at the duration in years of each one of them. If we limit our survey to the vertebrate types, we find that the earliest strata yield only aquatic, fish-like forms; higher up, in the coal seams, amphibians, half-water half-land animals appear; still later the reptiles, and lastly in the Tertiary rocks the mammals, the highest forms, come to predominate. Now then, a mammal in its uterine development passes distinctly through the fish and amphibian stages before it takes on mammalian characteristics.

Such considerations suggest the evolutionary doctrine. No one claims that they establish it. But once accepted as a tentative working basis, everything seems to fall in line with the theory—vestigial organs, embryonic structures, connecting links; the biologist sets about looking for something that should be there with almost uncanny foresight. The theory proves out, in much the same way as astronomical postulates resulted in the discovery of Neptune, or as new chemical compounds have been discovered after it was shown by theoretical formulas that they should exist. I may refer to the origin, partial development, and then total absorption and disappearance of certain complex structures in the embryo. Father Wasmann was so impressed by one instance of this kind that he considered it alone indisputable proof of the evolution of the particular insect before him from another insect of an entirely different species. Any other