Abraham Trembley and the Hydra

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Abstract

Abraham Trembley studied and experimented with the hydra, a small, fresh water animal, in the eighteenth century. The methods of locomotion used by this simple animal are complex, giving evidence for an intelligent Designer. An overview of Trembley's discoveries and experiments is presented. Also included is a discussion of his outstanding methodology, as a result of which he is today regarded as the "father of experimental zoology." Trembley's role as an educator is also considered, as well as the influence of his religion on his work.

Hydras

Hydras are small (about .5 to 10 mm. in length) fresh water animals. They can be found in ponds, attached to plant stems and the under side of leaves. They are assigned to phylum Cnidaria (Coelenterata), a group of very simple animals characterized by possessing stinging cells on tentacles. Cnidarians also include the well-known jellyfish, corals, sea anemones, and the Portuguese Man-of-War. The hydra was discovered in 1702 by Anton von Leeuwenhoek, the "father of microbiology." The genus name, *Hydra*, was assigned to this animal in 1758 by Carolus Linnaeus, the scientist who devised our system of classifying organisms. The name *hydra* has as its source a monster from Greek mythology. This imaginary beast had nine extremely poisonous serpent-like heads. If one of the heads was cut off then two more would grow back! Hercules killed the monster by burning the beast where he had cut off each of its heads, so that they would not grow back. Once we understand more about the real hydra, we can appreciate how appropriate its name is.

One remarkable behavior of the hydra is how it moves about. Our Creator has made animals with a great variety of methods of locomotion (moving the whole body from one place to another). Hydras use a number of different strategies to accomplish this. These were studied by Abraham Trembley in the eighteenth century. His care and patience enabled him to observe these behaviors. In his book, *Memoirs Concerning the Natural History of a Type of Freshwater Polyp with Arms Shaped Like Horns* (published in 1744 before the animals were named hydras), he described and illustrated some of these methods (Lenhoff and Lenhoff, 1986, p.44).

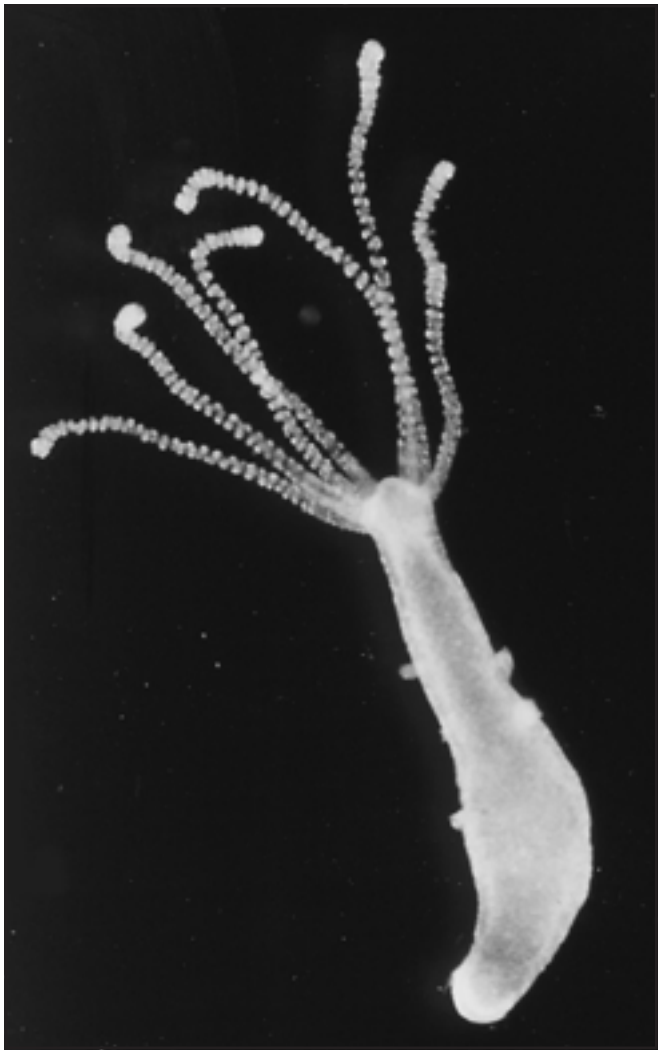

Figure 1. Hydra (*Hydra littoralis*). The small lumps on the sides of the main part of the body are testes and ovaries. Photograph by Runk/Schoenberger of Grant Heilman Photography, Inc.

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The first method consists of bending down the "head" end to the surface, attaching the tentacles, then detaching the base and drawing it to the head end, like an inch worm. Then it detaches the tentacle end and assumes the original position. This is accomplished extremely slowly.

The second method consists of bending down the "head" to the surface, attaching the tentacles, then detaching the base and lifting it above the head so that the animal is upside down, and then lowering the base to the opposite side of the "head" from which it started, attaching the base, detaching the head and moving into its normal position above the base. The animal actually moves by somersaulting! Quite a feat for an animal which does not even have a brain. The credit for this acrobatic performance must rightly go to the Creator. Trembley also describes how the hydra can move itself into position to hang upside down from the surface of the water and then use some of its tentacles to attach itself to the sides of the jar like anchors.

Trembley's Experiments

Abraham Trembley of Geneva, Switzerland, lived from 1710 to 1784. Because of his work with hydras, he has been called the "father of experimental zoology." He studied samples of water from local ditches. He kept the water samples in jars which enabled him to observe the hydras in their natural environment. This proved to be a relaxing past time from his occupation as a tutor for Count William Bentinck's children at the estate near The Hague, Holland.

Since the hydras were green (from the presence of algae) and were attached to objects by their base, Trembley assumed that they were plants. Then in June, 1740, he noticed them contract and extend. Several days later he actually observed them move from one place to another—very strange behavior for a plant! He decided that they must be animals. After noticing that they seemed to move toward light, he decided to conduct some experiments with them. These experiments confirmed his suspicion that these eyeless creatures actually move toward light. This was the first animal that had ever been seen to behave this way.

After noticing that some hydras had more tentacles than others he was puzzled since this made the organism seem more like a plant than an animal. He decided to see if the hydra could regrow parts that had been cut off. If it could do so to a great degree, this would be strong evidence that it was a plant, since animals are very limited in this ability (e.g., a lizard can regrow its tail). His first such experiment was to cut the hydra completely in half—separating its top from its base. Each half actually grew back the missing other half! Was this organism a plant or an animal? Trembley soon saw a behavior which definitely established that hydras are animals—he observed one use its tentacles to capture a prey and then proceed to eat it by stuffing it down a mouth located at the base of its tentacles. So Trembley became the first person to show that some animals can be made to reproduce by dividing them in two. This ability is called regeneration. He even split the tentacle end of a hydra only part-way down and each half regenerated the other half, resulting in a two-headed monster. He continued to split the heads and let them regenerate until he had a seven-headed hydra!

Abraham Trembley continued to do more experiments with hydras. He observed a small hydra growing on the side of a larger one. It continued to grow and develop until it finally detached to become an independent organism. He conducted experiments to prove that this type of reproduction did not start from an egg. This is called budding.

Trembley succeeded in turning a hydra inside-out and found that it could still live! He also experimented with grafting. In grafting, scientists remove a branch from one individual plant and attach it to another individual. It then grows out and becomes part of the other plant. But, could this work with an animal as well? Trembley demonstrated that it could with the hydra. He placed one hydra into the mouth of another and observed it attach and become part of the other's body!

John Baker, in his biography of Abraham Trembley, listed his chief discoveries. These were (1) his discoveries about budding in animals; (2) his discoveries about animal regeneration and grafting; (3) his discoveries about protozoan reproduction and his being the first person to observe true cell division; (4) his descriptions of protoplasm; (5) his discoveries about bryozoans.

Baker also mentions a "large number of lesser discoveries..." including work with rotifers and parthenogenesis (Baker,1952, p.170).

Abraham Trembley—Scientist

Sylvia and Howard Lenhoff, in the preface to their book about Trembley, tell us that "In recognition of his accomplishments, he was elected to the Royal Society of London and in 1743 was awarded its prestigious Copley Medal, considered then to be one of the highest accolades in science"(Lenhoff and Lenhoff, 1986, p.ix).

What attributes made Trembley such an outstanding scientist? Baker mentions several. First, Trembley described processes, rather than merely describing structures. Second, he was flexible; "...when he saw that chance had presented him with a problem of particular interest, he switched over to its investigation, and planned the necessary observations and experiments with thoroughness" (Baker, 1952, p.171). Third, "the accuracy of his observations is perhaps the most striking feature of Trembley's

work" (p.174). Fourth, his desire for his results to be confirmed by others. He "...took every opportunity to show them to others, and to get others to repeat them" (p.179). Fifth, his logical mind. Sixth, giving detailed explanations of how he obtained his results. Baker quotes Trembley as saying, "It is therefore insufficient to say that one has seen a certain thing. That conveys nothing, if one does not at the same time indicate how one saw it and does not put readers in a position to judge the method by which the facts that are related have been observed" (p.180). Seventh, his clear, unequivocal writing. In addition, Howard and Sylvia Lenhoff extol Trembley's persistence. They quote him as stating, "One should not become disheartened by want of success, but should try anew whatever has failed. It is even good to repeat successful experiments a number of times. All that is possible to see is not discovered, and often cannot be discovered, the first time"(Lenhoff and Lenhoff, 1988, p.113).

Abraham Trembley—Educator

Abraham Trembley was the father of five children which were all born within a seven year time-span. The first was born when Trembley was 49 years old. From their birth until his death at the age of 74 they were the "...absorbing passion of his life..."(Baker, 1952, p.188). Trembley actually wrote much more on education than on science. He thought much about educational methods and developed an original system. He also included moral principles in the education of his children. He used living things in teaching and felt there was much benefit in doing so since they were effective in exciting the children's curiosity, which he thought was very important. "He also strove to inculcate a sense of wonder or awe at the immense complexity of the universe"(Baker, 1952, p.194).

> Trembley was far from wanting merely to stock his pupils' minds with knowledge. He tried to provide them with opportunities for distinguishing truth from falsehood and certainty from uncertainty; he taught them to weigh the degrees of probability, to suspend judgment, even to moderate their impatience for knowledge; for he regarded it as very important that children should realize the limitations of the human mind, and thought that this realization of man's ignorance and mental imperfection could become a source of true knowledge.(Baker, 1952, p.193).

Abraham Trembley—Christian

The following information regarding Abraham Trembley's religion is gleaned from Baker's biography (1952). Trembley professed to be a Christian and "...accepted as genuine the prophecies of the Old Testament and the miracles of both Old and New"(p.224). In 1779 he published *Instructions from a Father to His Children Concerning Natural and Revealed Religion*. This large book included a straightforward account of the biblical record. However, it should be mentioned that he was not a member of any sect of Christianity and some of his beliefs would not be considered orthodox.

> When he began to undertake the education of his children, Trembley devoted less of his time to science and became progressively more and more absorbed in religion; and this was his dominant interest during the latter part of his life. It permeates all his educational works. The *Instructions from a Father to his Children, Concerning Nature and Religion* (1775) begins and ends with religious teaching, and in the intervening scientific part he turns repeatedly to the same theme (Baker, 1952, p.218).

Trembley taught his children science "...largely because he thought it would direct their minds toward religion" (p.219). He emphasized in his teaching to his children that design in nature requires there to be a God. In addition, he used reason to appeal to his children to accept the Bible as true.

Was Trembley's religion a hindrance to his science? Baker stated that Trembley's religion was the very basis of his science (Baker, 1952, p.218). Lenhoff and Lenhoff agree, declaring that, "We suspect that Trembley's admirable scientific objectivity stemmed in part from his piety. He believed all marvels were possible in God's magnificent universe"(Lenhoff and Lenhoff, 1988, p.113).

Here is how Abraham Trembley concluded his remarkable scientific book on the hydra:

> We still know too few parts of the admirable Whole which is the Work of a Being infinite in all respects. What little we know of the parts in not enough for us to be able to explain all the facts presented to us.
>
> In order to extend our knowledge of natural history, we must put our efforts into discovering as many facts as possible. If we knew all the facts that Nature holds, we would have the explanation of them, and we would see the Whole which these assembled facts fashion. The more we know of them, the more we will be in a position to delve deeply into some parts of this Whole. Thus we cannot work better to explain the facts we know than by trying to discover new ones. Nature must be explained by Nature and not by our own views. These are too limited to envision so grand a Design in all its immensity. The beauty of Nature certainly shines forth all the more when what we know about it is not mixed with our fancies. Seen clearly, Nature inspires within us ideas more worthy of the in-

> finite wisdom of its Author and thereby more suitable for shaping our spirits and our hearts. This thought is what we should keep before us in all our researches.(Lenhoff and Lenhoff, 1986, pp.187–188).

So to those who would declare that religion and science should be divorced—that it is impossible for a true scientist to be religious—we must direct your attention to the "father of experimental zoology", an extraordinary experimental scientist of the first degree, as an outstanding counterexample, more than sufficient to refute such a notion.

References

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Book Reviews

How Now Shall We Live? by Charles Colson and Nancy Pearcey
Tyndale House Publishers, Wheaton, IL. 1999, 574 pages, $23

The title is derived from a classic earlier book and film series by Francis Schaeffer (1976). Colson and Pearcey trace the negative impact of a secular worldview on Western culture over the last quarter century, where Schaeffer left off. This includes the consequences of Darwinism, sociobiology, New Age nonsense, liberal theology, and the sexual revolution. But there is hope. Many personal stories are related of people who have overcome great odds and succeeded in making a difference with God's help. Included are several prison rehabilitation stories, as expected from Chuck Colson.

Colson and Pearcey see far beyond the need for personal conversion. They believe, with scriptural backing, that Christians need to confront the secular world in all areas of life. They see the need to redeem both the creation and the culture in a gracious yet bold manner (p. 296).

The book contains 45 short chapters. Many of these resemble transcripts from Colson's daily "Breakpoint" radio program, aired on 1,000 stations. Nancy Pearcey is executive director of this program. The book exposes the weaknesses of evolution and promotes creation. There is an emphasis on the Intelligent Design Movement. One inconsistency is the promotion of the big bang theory (p. 58). The authors apparently have not thought through the many biblical contradictions of a big bang origin and its accompanying long ages.

Charles Colson and Nancy Pearcey are excellent writers with a worldwide audience. It is a blessing to have them promote creation in this book and in their ministries.

Reference

Schaeffer, Francis. 1976. *How Should We Then Live?* Fleming H. Revell, Old Tappan, NJ.

Don B. DeYoung

The Mythology of Modern Dating Methods by John Woodmorappe
Institute of Creation Research, El Cajon, California. 1999, 118 pages, $13

Radiometric dating is considered by many creationists and most uniformitarians as the single greatest body of evidence for an old earth. Creationists have critiqued it in a variety of ways, but none has done as thorough and convincing a job as that contained within the pages of this excellent monograph by John Woodmorappe. Woodmorappe takes a decidedly different slant from many other creationists who see inherent structure and organization in the raw data and are searching for a non-chronometric or an alternate chronometric explanation of the perceived organization in the data. The RATE research project, underway at the Institute of Creation Research is an example of this type of approach. Woodmorappe instead seeks to demonstrate that the elegant conjunction of the numerous data points presented in the literature is an artifact of multiple overlapping subjective factors in data selection and presentation, and a probabilistic agreement that would be statistically expected. The basic premise of this book is sound. If the results of isotopic dating cannot possibly be wrong (due to numerous *ad hoc* explanations), then they cannot possibly be scientifically valid or of evidentiary weight.

As the title advertises, the structure of the work is developed along the presentation of numerous "myths" of isotopic dating, organized into the various chapters, and