The Earth-monitoring Triana satellite mission was recently endorsed by the National Research Council, but "by focusing exclusively on 'scientific merit,' the NRC report neglected two important aspects of program evaluation: the cost-effectiveness and opportunity costs associated with the mission...." The role in the evolution and success of vertebrates of the peripheral myelin sheath, which allows for rapid nerve conduction, is examined. A strategy for maintaining a dynamic, online resource while preserving the authenticity of citations to it is described. And the possible mechanism of action of a drug found to slow the onset of a disease in mice similar to "mad cow disease" is discussed.

Science Policy and the NASA Triana Mission

The recent events concerning the National Air and Space Administration's (NASA's) Triana mission discussed in the News of the Week article "Endorsement for controversial satellite" (Andrew Lawler, 17 Mar., p. 1905) raise some issues about the role of the National Research Council (NRC) in providing advice to Congress. Specifically, NRC program evaluations—like its review of the Triana mission—rarely provide a comprehensive perspective needed to effectively inform national science and space policies.

In the case of Triana, by focusing exclusively on "scientific merit," the NRC report neglected two important aspects of program evaluation: the cost-effectiveness and opportunity costs associated with the mission—which are particularly important given that no recently published NRC reports called for a mission such as Triana as part of the nation's remote sensing strategy (*1*). The opportunity costs of Triana go beyond those expressed in budgets to include research community time and focus, adherence to scientific goals, and ultimately scientific credibility. To provide two examples of questions that should have been addressed: Would national needs be better served if the resources devoted to Triana were instead focused on the widely supported goal of a synthetic aperture radar satellite mission? A series of successful Earth Science Enterprise satellite missions is providing a deluge of new data to the scientific community: Might national needs be better served by additional funds for analysis and applications of these data?

But the NRC panel did not address such broader issues, stating that it "lacked the proper expertise, resources, and time to conduct a credible cost or cost-benefit analysis...or an analysis of the mission goals and objectives within the context of a limited NASA budget or relative to other Earth Science Enterprise missions" (*1*). It is exactly these issues that matter most in science and space policy decision-making.

By focusing only on scientific merit, the NRC not only neglected the needs of decision-makers for a comprehensive perspective, but it provided an opportunity for the misuse of the report. Immediately after the NRC report was released, partisans were "spinning" it as an endorsement of the mission, misrepresenting the report's narrow focus on scientific merit under an assumption of successful implementation. Whether or not Triana makes sense as a component of the nation's remote sensing agenda would require consideration of the issues neglected by the NRC panel, including Triana's contributions to meeting its other rationales, such as education and space weather forecasting.

Congress, the Administration, and the NRC should heed the words of Vice President Albert Gore, who wrote in his 1993 report on reinventing government that "If agencies are to set measurable goals for their programs, Congress must demand less and clarify priorities more....In the private sector, leaders do not simply drop goals on their organizations from above. [They] involve their full workforces in identifying a few goals that have top priority....This process enables the people directly responsible for meeting the goals to help set them. It also ensures that every part of an organization aims at the same goals, and that everyone understands where they fit in" (*2*).

We have no reason to believe that Triana should not be a component of the nation's remote sensing infrastructure; however, the existing process has not shown why the mission should play such a role. The Triana experience provides a clear example of how the scientific community too often neglects asking and answering the difficult, but necessary, questions involved with effectively advising policy-makers on the nation's scientific priorities. Ultimately the soundness of the nation's scientific endeavors is at stake.

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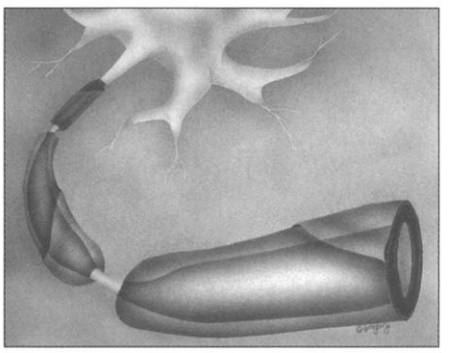
Origins of Vertebrate Success

The News Focus article "In search of vertebrate origins: Beyond brain and bone" by Carl Zimmer (3 Mar., p. 1576) highlights recent findings of the progressive acquisition of bone and brain structures. These findings support Gans and Northcutt's theory (*1*), which postulates that the emergence of vertebrates was made possible by the invention of neural crest cells (embryonic cells that give rise to many peripheral tissues including the eyes, nerves, and skull), and specifically, this then led to the development of evolutionarily advantageous complex head structures. We agree with the importance of the neural crest in this regard, but wish to point out the contribution of one important neural crest



In jawed vertebrates, myelin ensheathes nerve fibers and permits rapid conduction of nerve impulses.

derivative—the peripheral myelin sheath—to the success of the vertebrates. Without this structure, the vertebrates as we know them simply could not exist (*2*).

Invertebrate axons are ensheathed by supporting cells but do not have a compact myelin sheath. As a consequence, action potentials (electrical pulses) that propagate along invertebrate axons are generally conducted at a speed of about 1 meter per second or less, fast enough for animals of small size to survive. However, as body size increases, a proportionate in-

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crease in action potential velocity down very long nerves is required. Rapid nerve conduction is critical for escape maneuvers as well as for effective predation. In cephalopods, the conduction problem has been solved by vastly increasing the diameter of those axons for which fast conduction is essential. Certain of these single axons can be as thick as a few millimeters in diameter. In contrast, vertebrates have developed a much more efficient system that creates a thin, compact membrane sheath around their axons—myelin—allowing them to conduct action potentials with speeds of 50 to 100 meters per second along an axon with a diameter of only 1 to 40 micrometers (see the figure). The myelin sheath is synthesized by oligodendrocytes in the central nervous system and by neural crest–derived Schwann cells in the peripheral nervous system.

With respect to Gans and Northcutt's theory, it is interesting that protovertebrates (lancelets, hagfishes, and lampreys) are not myelinated. The presence of the myelin sheath exactly parallels the development of the jaw. The oldest contemporary vertebrates that are myelinated are the jawed cartilaginous fishes (sharks and rays), consistent with the concept that a large-bodied, fast-reacting predator requires myelin-mediated, highly rapid conduction of the action potential. One might retrodict that the jawless ostracoderms and conodonts were not myelinated, and so would not have been successful competitors with other fish (for example, placoderms) that had developed neural crest–derived myelin, and jaws.

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Dynamic and Permanent

Donald A. Windsor's letter titled "A question of permanence" (3 Mar., p. 1592) points out that the immutability of an academic paper is essential to the network of citations that is so important to scientific communication. He expresses worries about citing "ephemeral" online articles now that even prestigious journals such as the *British Medical Journal* are allowing authors to make changes to their papers online.

At the *Stanford Encyclopedia of Philosophy* (SEP), we have found a solution to this problem. The SEP is a dynamic encyclopedia by which the philosophy profession collaboratively maintains an up-to-date reference work. It deals with many scientific and technical topics, and the authors are not just permitted but are required to revise their entries and submit them for editorial review on a 3-year rotation in order to ensure their currency and accuracy. To preserve the authenticity of citations to SEP, it is our policy to publicly archive the entire contents of the SEP every 3 months. All proper citations to encyclopedia articles must be specific to a dated archived version. (This citation policy is described in detail at http://plato.stanford.edu/cite.html)

A great strength of the Internet is its dynamic nature. By providing a means to cite the public archives of the SEP, we believe we are able to reconcile the view of younger generations, who are likely to see the Internet as the preeminent source of scientific information, with those of self-described old-timers such as Windsor who