testing on human embryos is “not an acceptable area of research” but may be justified on “a very small scale.” Until the success rates of IVF improve, the committee saw embryonic biopsy as infeasible, and gene replacement, whether therapeutic or not, would be precluded, for future review by a proposed licensing authority designed to regulate both research and infertility services.

The above recommendations follow from the committee’s view on “how it is right to treat the human embryo” and the status of the human embryo, particularly the legal status of the in vitro embryo. While the debate over origin or source of embryos used in research caused some dissent, the committee reached a consensus. Use of “spare” embryos from the IVF procedure would be allowed; deliberate or happenstance production of embryos would not. As a matter of good practice, the committee recommended obtaining informed consent of donors to method of use or disposal. No human embryos derived from IVF and not transferred to the uterus may be kept alive, nor used as a research subject, past 14 days after fertilization. The 14-day limit marks the beginning of individual development, seen by the committee as the formation of the primitive streak. Other groups, notably medical, agree to this limit because it marks the end of the implantation stage. The committee concluded that unauthorized (i.e., unlicensed research on or handling of any human in vitro embryo) as well as authorized research on embryos past developmental day 14 should be regarded as criminal. Thus the human embryo is “afforded some protection in law.”

The question of research on human embryos caused particular difficulty for the committee. In her introduction, Warnock notes that the committee had to distinguish what is morally right from what is morally wrong and also had to decide whether it is right to enforce a moral law. Dispute arose over the question of what value “should be attached to human life at its very earliest stage of development,” not to the value of human life in general. After resolving the dispute, the committee sought to formulate a law that would be beneficial, intelligible, and enforceable: the limit of 14 days past fertilization.

The reasoning behind the legislation is that society, from which public funding of most research comes, is entitled to know, and to some extent control, what research methods are used. In her conclusion, Warnock examines the committee’s societal role. Its report is only advice, neatly summed up in another separate chapter as 64 legislative recommendations gleaned from the text.

However, since publication the Warnock Report has moved the debate over embryo research more prominently into the public arena. The Warnock Report, like those emanating from other governmental and professional agencies, will not solve most of the issues it raises. However, it is likely to achieve important public education and thereby stimulate debate and eventually social decision on the new reproductive technologies.

SUSAN CARTIER POLAND
GARY D. HodGen
The Howard and
GeorGeTraNa JoneS Institute
for Reproductive Medicine
Eastern Virginia Medical School
Norfolk, VA 23507

BETWEEN THE COMPUTER
AND THE BRAIN


Cognitive science, Howard Gardner tells us, is a “contemporary, empirically based effort to answer longstanding epistemological questions—particularly those concerned with the nature of knowledge, its components, its sources, its development, and its deployment.” Fortunately he limits application of the term “chiefly to efforts to explain human knowledge.”

The topic is distinctly not cognitive psychology, but instead is antibehaviorist. Unlike cognitive psychology, which is developing into a standard field of science, cognitive science is an agglomeration of several disciplines taking bold new tactics toward solving ancient problems of the mind and how it comes to be furnished. The reintroduction of mind to science is a dramatic shift from an emphasis on performance.

The difficulty in defining cognitive science is evident in Gardner’s criteria. It must possess all or most of the following traits: an analysis of mental representations “wholly separate from the biological or neurological, on one hand, and the sociological or cultural, on the other”; a “faith that central to any understanding of the human mind is the electronic computer”; a de-emphasis of complicating factors, such as emotions, history, or context; the “faith that much is to be gained from interdisciplinary studies”; and the agenda set by “epistemologists in the Western philosophical tradition . . . dating back to the time of the Greeks.” These traits do not actually define a discipline, rather they characterize a mood.

The book is a history, not a text of cognitive science. In the first of three sections, Gardner describes the development of cognitive science in the middle to late 1950s as more a social than a scientific phenomenon. He effectively conveys the flow of personalities and coteries. He depicts the manner in which they found each other or were “managed” by foundations or patrons to set the stage for the exciting interdisciplinary fusion described in the third part of the book.

Gardner’s characterization of the interdisciplinary origins of cognitive science illustrates how science emerges out of human impulses. We find ourselves sympathetic with researchers and theoreticians chaffing at the boundaries of their disciplines and breaking into each other’s territory, eager to use each other’s conceptual and methodological tools.

In the middle section of the book, Gardner offers “brief targeted histories” of cognitive science’s constituent disciplines: philosophy, psychology, linguistics, anthropology, neuroscience, and artificial intelligence (protests of the mainstreamers in each of these disciplines notwithstanding). This central section of the book is frequently much less science than scientific journalism, and a bit overly enthusiastic at that.

In this diverse central portion, the oversimplification and selectivity of ideas is distracting, particularly to specialists in each of these areas.
HOT, COLD, AND WARM VENTS


Since they were first directly observed in 1977, hydrothermal vents have generated a great deal of scientific and public interest. This book contains papers on various aspects of hydrothermal vents, presented at a 1983 symposium. Three additional papers present major new discoveries since the symposium.

The book fittingly leads off with a section on geology and geochemistry. These papers provide a good introduction to the physical setting of hydrothermal vents; the tectonic processes leading to their formation; and the chemical changes occurring in seawater, oceanic basalt, and sediments during the passage of ambient bottom water through the upper crust and its transformation to hydrothermal effluent. A. Malahoff addresses the formation of massive polynematic sulfide deposits on the sea floor and compares them with apparently analogous terrestrial deposits that are mined commercially.

Hydrothermal vents have attracted an exceptionally wide range of biological interests, including prokaryotic and eukaryotic physiology, taxonomy, biogeography, evolution, ecology, microbiology, and biochemistry. There seems to be something of interest happening at hydrothermal vents for just about everyone.

In this book, a section on macrobiota contains descriptions of vent-associated organisms that are new to science at all taxonomic levels; M. Jones erects a new phylum, the Vesti­mentifera, for the conspicuous tubeworms. I especially enjoyed the essay by W. Newman, in which he argues that the high degree of endemism found at vents supports the idea that the fauna there are relics of the Paleozoic and Mesozoic eras. Other contributions in the section discuss what is known or can be inferred about the reproductive strategies of molluscs and decapod crustaceans living at vents. While the spatial and temporal discontinuities of vents indicate that they are ephemeral habitats, and as such would favor species with planktotrophic larvae capable of long-range dispersal, the evidence on hand is that there is no tendency towards any one reproductive mode. How new vent sites are colonized remains unknown.

The section on biochemistry and physiology describes the major adaptations for survival and obtaining energy in the unusual physico-chemical vent environment. The symbiotic associations between vent metazoans and their internal bacteria are reviewed. The evidence that the bacteria are capable of liberating the chemical energy from reduced compounds (notably hydrogen sulfide) present in vent fluids and coupling it to the reduction of carbon dioxide is summarized. While the quantitative contribution such bacterial production makes to the host’s nutrition is not known, this finding generated excitement initially because it suggests that these ecosystems are independent of photosynthetically fixed carbon. Since this discovery, several examples of animal-chemotrophic bacteria symbioses have been found in nonhydrothermal vent systems, and more are likely given the widespread occurrence of the appropriate environmental conditions in benthic habitats.

As a macrobiologist, I found the section on microbiology to contain...