the mammalian zygote. Similarly, a widely accepted attribute is sentience, or behavior that suggests it. Scientifically, we have good reason to expect that sentience is not present until the nervous system reaches some necessary level of maturation.

Science cannot make the decisions appropriate to the political process. But if sensitively applied to appropriately framed questions, science can substantially assist jurisprudence. Science and jurisprudence partake of different "honorable traditions." But they exist in the same world and must interact synergistically to provide us all with "honorable future."

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I gather that the opinions expressed by Zack represent the most acceptable response by scientists and physicians to the current effort by Congress to define when life begins. However, I am not sure that Congress is as confused as Zack implies regarding the appropriate roles of science and jurisprudence. New medical and scientific developments such as amniocentesis and extrauterine fertilization and improved techniques of premature infant care and therapeutic abortions have all created ethical problems for the law. This fact, alone, seems to me to obligate science and medicine to do what we can to help the body politic reach wise solutions to these problems.

The answer to the question "When does life begin?" obviously depends upon one's definition of life. Since most good definitions are pragmatic, it should come as no surprise that those which serve science best work poorly when applied to politics. On the other hand, should Congress ask us, "Are there facts that might help us to establish when a child should be vested human rights?" a more useful dialogue might be established. Being made aware of the age when the fetus should be expected to survive outside the uterus seems to be germaine to the issue. . . .

I was taught to grow corn by planting five kernels to the hillock and then to pluck the two sprouts that appeared least likely to yield. Not until this recent debate had I ever considered that some might judge I had committed an immoral act.

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I appreciate the thoughtful comments of Stokes and of Grobstein, and I agree entirely with Stokes that the appropriate question to be asked of science is, "Are there facts that might help us to establish when a child should be vested with human rights?" Grobstein's letter, on the other hand, exemplifies the confusion between scientific and moral issues which I attempted to address in my editorial.

Of course science should "assist any public decision-making that involves substantive scientific content." My point is that, in the particular instance under consideration, substantive scientific content is being dangerously confused with moral judgment.

The question asked by some legislators was, "When does human life begin?" The answer given by some scientists was, "Human life begins at stage x in the development of the zygote-embryo-fetus." The pernicious aspect of this simple provision of "scientific" information lies in the conclusion drawn by many observers; namely, that if human life begins at stage x of development, and if destroying human life is murder, then destroying a zygote-embryo-fetus after stage x of development is murder. Thus, the arbitrary, utilitarian definition of human life provided by the scientist has been transformed into a definition of a morally reprehensible and legally punishable act.

It is important to realize how very arbitrary any scientific definition of human life is. I stated in my editorial that within one conceptual model "the fertilized egg of a human being is in itself a human life." I neglected to state the critical corollary that other, *equally valid* (and probably equally prevalent) conceptual models exist in which the fertilized egg of a human being would *not* be considered a human life. Grobstein states that "scientifically," zygotes and gametes are "alive and human." Others, just as scientifically (read "arbitrarily") would disagree.

Such definitions are chosen by the scientist on the basis of their usefulness in his work, not because any particular definition is any more "true" or "right" than another. Surely, then, what any individual scientist chooses to define as the beginning of human life can have no relevance to the moral issue of whether and when the zygote, embryo, or fetus should be vested with the rights and privileges of a human being. If a law defining the onset of human life for legal purposes is passed based in any measure on the scientific definition, instead of solely on the moral judgment of the people and of their representatives, then an intellectual and moral tragedy will indeed have occurred.

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Lead Chromate

Aronow (Letters, 17 July, p. 290) objects to the use of lead chromate in traffic paints on the grounds that lead chromate is "highly toxic" and that it is a wasteful use of a strategic material. No references are cited to support the inference of high toxicity. My search of the standard data bases (*1*) suggests that none exist.

I am, however, aware of studies conducted in the automotive industry which show that concentrations of lead in the blood of automotive spray painters working with lead chromate are not greater than those in the general population (*2*); also that rat and dog feeding studies showed that lead chromate (medium chrome yellow) was not toxic at a concentration of 2000 parts per million in the diet when fed for 90 days (*3*).

Lead chromate is a valued pigment because of its functional properties, which include high visibility against differing backgrounds, under a variety of lighting conditions; outstanding abrasion, weathering, and fade resistance; high obscuring power; compatibility with a broad range of paint vehicle systems; and low cost compared to the cost of alternative pigments of equivalent durability and obscuring power.

Although it is true that our chrome ore is imported, the consumption of chrome in traffic paints calculated at one-third of 11,000 tons is trivial—less than 1 percent compared to the 450,000 tons in metallurgical uses (including refractories). Ironically, the United States is also dependent on imports for high-grade titanium ores—the basic raw material for the white pigments.

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2. G. A. Sattelmeyer, in *Proceedings, Chromates Symposium—80* (Industrial Health Foundation for Organization Resources Counselors, Pittsburgh, Pa., 1981), pp. 165–177.
3. E. E. Christofano *et al.*, *Toxicol. Appl. Pharmacol.* **37**, 160 (1976); G. L. Kennedy *et al.*, *ibid.*, p. 161.