When does life begin?

SIR — The widespread notion "that human life begins at conception" is not based on scientific evidence as J.R. Ling (*Nature* 24 January, p. 262) implied. It results from misleading oversimplifications and misconceptions about the biological basis of human individuality.

That our personal individuality develops after conception is conclusively shown by the natural occurrence of identical twins, triplets and so on. A fertilized egg is not yet "a potential human being" as J.R. Baker (*Nature*, 14 February, p. 524) puts it; left undisturbed, it may instead develop into several human beings, or even more commonly spontaneously abort without producing any. Because the timing of the split of the cell mass that produces identical twins is quite variable, no exact time can be given for the "start" of their individual human bodies — but it is always many days after conception.

If what we are interested in is not the start of individual body form, but the personality of individual humans (surely more important), this develops much later — only after the formation of the nervous system. Consciousness and a sense of self seem to develop only after birth and growing experience of the outside world.

If the vague term "human life" refers not to any of these features of the life of the individual but to human life in general, then this had no clear starting point at all in our gradual evolution from apes.

The notion of giving protection to all potential humans is an argument against contraception that would condemn us to gross overpopulation and misery. What we should protect vigorously are actual individuals possessing human feelings. The consequent legal and ethical necessity to choose a sensible dividing line at which such protection should be given must inevitably be somewhat arbitrary because of the gradualness of development. It is a fallacy to suppose that biology provides an easy answer to the problem.

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SIR — The leading article of 21 February (p. 612) asks "... who can object to the proposition that there can be no such thing as a human being without implantation?"

Let us examine how such a conclusion can be reached, beginning with some default assumptions about the meanings of the words used. Human life begins at conception (conception = the beginning of life), commonly taken as occurring at the moment of fertilization, the adjective "human" denoting the fact that both sperm and ovum are of human origin. Human life, in order to proceed, requires

implantation; this also is not disputed. Having proceeded by means of this process, the life in question develops to a greater degree of complexity and, in due course, is (normally) born. At this point we are running into trouble because the same words ("human life") are used both before and after implantation. We must therefore define our terms carefully, as follows; the words "human being" must refer only to human life which has at some stage been carried in its "mother's" womb; from this your conclusion follows easily. But perhaps this is not good enough, for as is well known, a baby cannot become a living person unless cared for by adults (if we define our terms carefully), on whom he/she also depends for "emotional and physical security".

On the other hand, perhaps all this playing around with words is idle sophistry. One could as well say that human embryos are not persons because a person is a human being with full rights under law which a human embryo plainly does not possess. Obviously, it follows that not all human beings are persons.

What is to be gained by all this? The following; the public will become confused, Parliament will produce legislation riddled with loopholes, research will thereby go on and human embryos will continue to be subject to experiment and destruction.

Sir, you do science a disservice.

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Sequence data

SIR — A national service for the retrieval and analysis of nucleic acid and protein sequences is being supported by the Medical Research Council (MRC) and is available to academic workers in the United Kingdom. The service is based on 4 databases which are regularly updated: the EMBL Nucleic Acid Sequence Library (currently 2.1 million bases); the GenBank Nucleic Acid Sequence database (currently 3.3 million bases); the Protein Information Resource (0.5 million amino-acid residues) and the NEWAT Library of Doolittle¹. Computer programs are available for database searches² and for the analysis of individual nucleic acid and protein sequences^{3,4}. The Staden programs^{5,6} for the experimental determination of DNA sequence have also been implemented. The service provides documentation of the databases and programs, help-files and facilities for communication within the user community⁷. There are currently some 50 scientists located at 15 sites throughout the United Kingdom accessing the databases.

The service was established in collaboration with scientists from a

number of departments at the University of Cambridge, particularly Dr M. Ashburner and Dr M. Bishop, and with the MRC Laboratory for Molecular Biology. The databases and programs are mounted on the IBM 3081 computer, maintained by the University of Cambridge Computer Service, and there are plans to mount them also on a VAX computer. The databases can be readily accessed through the Joint Academic Network (JANET) or through PSS from any location in the United Kingdom. Those interested should contact me or Dr Geoff Kneale at the address below (telephone: 0223 66499) for further information.

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Rings of light

SIR — Readers of *Nature* who look for intriguing optical phenomena in the world around them will have enjoyed Professor Thomas Gold's observation of puzzling reflections in water¹. He will, I am sure, regard it as a shared enthusiasm, and not a criticism, if I point out that others have observed and recorded these twists and loops too.

Minnaert's book² contains at section 14 ("Irregular reflection on slightly rippling water") a general bibliography stretching back to 1840, and he says of his own Fig. 17 "Remarkable is the appearance of closed coils of light ..."

The most comprehensive discussion is perhaps in a book by Sir Montagu Pollock³ published in 1903. His chapter on "Reflections in rippled water" outlines the geometry, though more particularly of the reflection of horizontal spars rather than of vertical masts. His book is illustrated with many plates by the Yorkshire marine photographers F.M. Sutcliffe and C.E. Wanless, who were fascinated by just such reflections of ships seen in the waters of Whitby and Scarborough harbours: Sutcliffe's Plate XXV is remarkably similar to Professor Gold's, and his Plate XXXV is appropriately titled by the artist "Rings".

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2. Minnaert, M. *Light and Colour in the Open Air* (Bell, London, 1940; reprinted by Dover, London).
3. Pollock, M. *Light and Water, a Study of Reflexion and Colour in River, Lake and Sea*, (Bell, London, 1903).