correspondence

Conserving uranium

SIR,—We read with interest the recent article by John Davies on this topic (1 December, page 376). However, it does contain a number of scientific errors and misleading statements which we believe it is our duty to point out.

He is incorrect in stating that the difference between the $^{238}U \rightarrow ^{239}Pu$ and the $^{232}Th \rightarrow ^{233}U$ reactions is that the first needs fast neutrons while the second can use slow ones. In fact the cross-sections for the two reactions are almost identical at all energies and therefore they have very similar breeding characteristics. The reaction $^{238}U \rightarrow ^{239}Pu$ occurs to a very considerable extent in thermal reactors. In fact about one third of the energy output of a thermal reactor arises from the ^{239}Pu produced within it and then burned *in situ*. Thus in the UK we already get between 4 and 5% of our electricity from the fission of plutonium.

The control of both thermal and fast reactors is based on the delayed neutron contribution and this is on a time scale of seconds rather than micro-seconds. The only mechanisms for a sudden increase in reactivity are loss of coolant or fuel movement, neither of which could occur faster than the control rods could move.

Turning to the $^{233}U/^{232}Th$ fuel cycle we would first challenge the statement that ^{233}U is automatically safeguarded against illegal diversion by the intense γ-rays coming from the simultaneously produced ^{232}U. This isotope does not emit γ-rays. It decays with a 70 year half-life by α-emission to ^{228}Th which does emit the γ-rays to which Dr Davies refers. Thus only after a considerable period does the γ-activity build up to a sufficient level to afford intrinsic protection.

With regard to the waste disposal problem the thorium cycle may give rise to fewer problems from the production of long lived higher activities but on the other hand much more Pu^{238} and ^{234}U is produced. The latter isotope decays to the very hazardous ^{226}Ra.

Accelerators are replacing reactors for some forms of neutron research because they can produce neutrons in short pulses and can give higher peak fluxes than a reactor. However, the mean flux from such systems up to present is lower by orders of magnitude than in research reactors.

The use of accelerators for breeding significant quantities of fuel demands machines giving outputs two or three orders of magnitude greater than the most powerful machines built so far. The breeder target is nothing less than a very major reactor in its own right. Studies of such a system at Brookhaven suggest a cost/gm of ^{239}Pu three to five times greater than that of equivalent enriched ^{235}U. The hazards of such a system could certainly not be less than that of a major reactor system.

We do not wish to give the impression that we are in any way antagonistic to the thorium cycle or to accelerator breeding. We wish merely to warn against the temptation of assuming, like the grass being greener on the other side of the fence, that problems of an alternative technology are necessarily less than those of a technology upon which one has embarked.

Yours faithfully,

A. T. G. FERGUSON
I. M. BLAIR

AERE Harwell

Transposed sentence

SIR,—It has been brought to the attention of the editors of volume 23 of *Biographical Memoirs of Fellows of the Royal Society* that certain sentences in the memoir on Professor C. H. Waddington may be read as derogatory of the work of Dr Ruth Clayton and her colleagues. This was in no way the intention of the author, but arose from an unfortunate transposition of sentences in an early draft. The author therefore wishes to amend the last six lines of page 583 to read:

". . . work that Waddington had originally envisaged. A notable exception which fitted into Waddington's original concept was the work on the development of the avian lens in the group led by Mrs Ruth Clayton. The laboratory became well known for the DNA–RNA investigations which earned a world reputation for at least two of the leading workers."

We must unreservedly withdraw all inferences to the effect that Mrs Clayton's work and that of her group is anything other than of the highest class and of a deserved worldwide reputation and we whole-heartedly apologise to Mrs Clayton for the embarrassment caused to her and her group by the unfortunate misplacing of the sentences in the article.

Yours faithfully

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The Royal Society, London

Anti-Müllerian hormone

SIR,—In a recent issue of *Nature* the authors D. Tran, N. Meusy-Dessolle and N. Josso report on a testicular factor distinct from testosterone which mediates regression of Müllerian ducts in male foetuses (*Nature* **269**, 411–412; 1977). Apart from the heading of their article which read "Anti-Müllerian hormone, etc." (and which caused underlining and exclamation marks by some of my merry colleagues) I do not consider it appropriate to use laboratory-born artificial words such as 'testicular anti-Müllerian activity', 'Müllerian regression' and others in a scientific communication. I wonder how this obvious jargon escaped your referee's attention*. Besides there is no 'Müllerian regression' but a regression of the outline, the diameter or so of the Müllerian duct; likewise there is neither a 'testicular anti-Müllerian activity' nor an 'anti-Müllerian hormone'. I am sure that Johannes Peter Müller (1800–1858) would agree.

Yours faithfully,

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**It didn't, but the authors claimed that since the name had been used in all their recent publications, a change now would cause confusion.*—ED.

Essential relativity

SIR,—In connection with Paul Davies' kind review of the second edition of my book *Essential Relativity* (*Nature* 22 September 1977) I wonder if you would allow me to correct one slight error. The coordinates of accelerated observers in Minkowski space, which have recently been used in the study of black holes, are elaborated on, albeit in a later section on Kruskal space. Indeed, this was one of the more significant additions to the second edition.

Yours faithfully,

WOLFGANG RINDLER

The University of Texas at Dallas