CORRESPONDENCE

Cashing in

SIR — In *Nature* of 28 May (p.260), De Witt Stetten Jr writes concerning the release of the gene of Veniality and the epidemic produced thereby. Enjoying as he does a healthy income as an author of one of the best biochemical textbooks around, but being precluded from participating in the gene technology largesse by virtue of his employment as a civil servant, Dr Stetten makes a witty but not inaccurate statement as to the consequences of the new commercial value to gene technology in terms of suppressing the totally free exchange of information which was, for many years, characteristic of biomedical research. However, in order to establish a risk/benefit ratio, someplace along the line the benefit must also be mentioned; it is not just that the socioeconomic status of the upwardly mobile scientist in gene technology is improved (important though that may be!), but there is reason to expect a profound acceleration of scientific development for human use to occur.

A number of foundations have been predicated on the clear and demonstrable proposition that the rate of transformation and transport of information from the laboratory bench to the clinical bedside is extremely slow and tends to fall outside the purview of the grant support system developed over the years by the National Institutes of Health. Venture-capital supported gene technology is certainly one example (together with hybridoma technology and other forms of research and development partnerships) wherein a much more rapid translation of laboratory discoveries to the benefit of human consumers can be accomplished. It is in the context of this benefit that the risk to scientific communication should be evaluated. I, for one, would rather see the scientist "make a buck" than be excluded from that process by non-scientific entrepreneurs!

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Known quantity

SIR — Semi-log notation, as advocated by J.A. Nicoll (*Nature* 10 June, p.450), is already known, see Danloux-Dumesnils, M., *The Metric System,* 152 (Athlone, London, 1969).

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Earth science in Ovid

SIR — Two passages in Ovid's *Metamorphoses* should be of interest to geologists for the way they illustrate some early ideas that without too much exaggeration could be epeirogenic, geomorphic and vulcanologic. The first passage occurs in a long philosophical peroration delivered by Euphorbus of Samos; the second in a song by one of the Aonian sisters, all of whom were too vainglorious for their own good.

Euphorbus declaims[1]:

> Nothing, I feel sure, lasts long under the same appearance . . . thus often has the condition of places changed. I myself have seen what once was solid land changed into sea; and again I have seen land made from the sea. Sea shells have been seen lying far from the ocean, and an ancient anchor has been found on a mountain top. What was once a level plain, down-flowing waters have made into a valley; and hills by the force of floods have been washed into the sea . . . Zancle also is said to have been a part of Italy until the sea washed away their common boundary and thrust back the land by the intervening waters. If you seek for Helice and Buris, once cities of Achaia, you will find them beneath the waves; and the sailors still show you the sloping cities with their buried walls.

Calliope, the Aonian — with harp and song to Ceres[2]:

> The huge island of Sicily had been heaped upon the body of the giant, and with its vast weight was resting on Typhoeus . . . He struggles indeed, and strives often to rise again . . . and Aetna's weight is on his head. Flung on his back beneath this mountain, the fierce Typhoeus spouts forth ashes and vomits flames from his mouth. Often he puts forth all his strength to push off the weight of the Earth and to roll the cities and the great mountains from his body: then the Earth quakes, and even the king of the silent land is afraid lest the crust of the Earth split open in wide seams . . .

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1. Miller, F.J. (transl.) *Ovid in six volumes, III Metamorphoses* 3rd edn, I, 263 (Harvard University Press, 1977).
2. *ibid.* II, 383; 385.

Vietnam now

SIR — Large numbers of individuals in Indo-China, both military and civilian, were inadvertently exposed to dioxin (TCDD; 2,3,7,8-tetrachlorodibenzo-para-dioxin) as a result of US actions during the Second Indo-China War. This continues to be a matter of grave concern owing to the toxic, teratogenic, carcinogenic, and mutagenic properties of this substance. I provide the following information on dioxin levels in Vietnam owing to the widely divergent values that keep appearing especially in the popular and semi-popular literature, often incorrectly attributed to me.

Dioxin was disseminated as an impurity of the 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) component of the now notorious anti-plant chemical weapon code-named Agent Orange; and also of its much more modestly used close relatives (Agent Orange II, Pink, Purple, and Green), all subsumed here under Agent Orange. The Agent Orange was dispensed by the United States between 1962 and 1970 (primarily during 1966–70) in attacking inland and coastal forests and some crop lands. Although Kampuchea, Laos[3], and North Vietnam were all thus attacked, it was South Vietnam that was the major recipient[4].

Approximately 44,300 m^3 (57.0 million kg) of Agent Orange was expended by the United States during the war, containing about 24.1 million kg of 2,4,5-T *per se* (ref. 1 p.26). It is difficult to make a reliable estimate of the actual amounts of dioxin contained in the Agent Orange used in Indo-China owing to the untimely destruction by the US Air Force and the Dow Chemical Company of the reference samples of most of the lots used. An estimate based on Dow determinations released by the US Air Force in 1974 is that the Agent Orange had an average dioxin content of 2.5 g m^{-3}, or 1.9 mg kg^{-1} (ref. 1 pp.44-45). This suggests that a total of at least 110 kg of dioxin was disseminated. Some new information released by the US Air Force in 1980 indicates that the total was somewhat higher, perhaps 170 kg (ref. 5: p.368). As dubitable as these Dow/Air Force data are, I am aware of no others from which to make better estimates. It should also be noted that the total amount of dioxin in Vietnam, whatever it was, was probably augmented to a slight extent as a result of the burning of wood that had been sprayed with 2,4,5-T.

It appears that approximately half the amount of aerially applied dioxin decomposes within a few days, with the remainder becoming more permanently incorporated into the soil and biota. Here it can work its way up food chains, including those culminating in humans, becoming concentrated in the process. The dioxin thus incorporated into the ecosystem appears to disappear following first-order kinetics, having an environmental half life of perhaps 3.5 years (refs. 4,5). In the case of Vietnam, if one makes the simplifying assumptions that the amount of dioxin introduced was, indeed, 170 kg and that it had all been introduced in 1968, then perhaps 8 kg remained in 1980, 3 kg will be present in 1985, and 1 kg in 1990. Its legacy, on the other hand, could persist far longer.

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1. Westing, A. H. *Ecological Consequences of the Second IndoChina War.* (Almqvist and Wiksell, Stockholm,1976.)
2. Westing, A. H. in *Harvest of Death,* 177-205 (Macmillan Free Press, New York, 1982).
3. Westing, A. H. *Nature* **294**, 606 (1981).
4. Westing, A. H. *Ecol. Bull.* **27**, 285-294 (1978)
5. Westing, A. H. *SIPRI Yearbook* (1982).

Too many drugs?

SIR — In *Nature* of 1 April, M. Weatherall[1] reviews the reasons for the fall off in the number of newly introduced drugs using the now familiar arguments of restrictive legislation with its inappropriate toxicity screening procedures and the need to explain to the public the problems involved in solving the risk-to-benefit equation, recently widely discussed both nationally and multinationally[2-4].

The pharmaceutical industry accepts[5] that its future contribution to treating the generally recognized pattern of Western diseases will be minimal, a view substantiated by the US Senate report[6] linking six of the ten major diseases to dietary imbalance, epidemiological evidence[7] that repeatedly points to ways of preventing some important cancers, obesity and heart disease, and Hellman's assertion that there will be no magic bullet in the chemotherapy of cancers[8]. In spite of this last statement recent proposals have been placed before the Committee for the Safety of Medicines to introduce a special classification for new experimental molecules which may be potential anticancer drugs. These proposals, if accepted, will allow the clinical trial of molecules, designed using current biochemical knowledge and that possess, theoretically at least, the possibility of interfering with cancer

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