## Alignment of base sequences

SIR — Fitch (*Nature* **309**, 410, 1984) uses gaps in aligning two base sequences "to increase the number of base matches." He possibly "misleads the careless reader" by not mentioning that there is a 25 per cent chance of two bases being identical in two unrelated sequences, each containing equal quantities of A, C, G and T. The two sequences in his first diagram have more matches (7 in 27 bases aligned) when aligned one over the other *without* a gap:

```
CCTTCAGAATACAGAATAGGGACATAGAGA

ATCCCACCCAGCCCCGTGGACCTGTAT---
```

than with the gaps used (3 in 21 bases aligned). In Fitch's second diagram, he contrives 7 matches in 27 bases aligned by inserting a gap, which is the same amount of matching as without a gap, and the same as by random coincidence.

Any two random sequences of A, C, G and T may be made to give the appearance of matching if enough gaps are arbitrarily inserted. Each such gap quantitatively diminishes the probability of evolutionary homology[1]. Obviously, there is no point in inserting gaps that do not increase the number of matches, or in using algorithms to no purpose.

THOMAS H. JUKES
*Space Sciences Laboratory,*
*University of California,*
*Berkeley, California 94720, USA*

1. Jukes, T.H. & Cantor, C.R. *Mammalian Protein Metabolism* Vol.3, 21-132 (Academic, New York, 1969).

## Opiates and sexual function

SIR — We were interested to note that Weisenfeld-Hallin and Sodersten[1] were able to confirm (in rats) previous findings in man that spinal opiates interfere with male sexual function. In 1980, Torda *et al.*[2] reported failure to ejaculate in three out of four sexually experienced Australian anaesthetists who had been pretreated with lumbar extradural morphine. We feel stimulated to enlarge on this; although we do not have precise measurements of the number of intromissions or the duration of intercourse in the latter study, the incidence of ejaculatory failure was in fact 100 per cent, as the fourth volunteer was not introduced to a sexually receptive female within the expected duration of effect of the extradural injection.

It may be true[2] that spinal opiate research in laboratory animals has concentrated exclusively on pain perception, but this is not the case in man. There is now abundant evidence that spinal opiates interact with a far wider variety of neural pathways than originally thought. The endocrine responses to nociceptive stimuli[3,4], bladder function[2], psychogalvanic responses[5] and respiratory function[4,6] are all modified by spinal opiates.

Spinal opiates appear to affect sexual performance primarily by modifying sympathetic responses to sexual stimulation. Whereas the efferent pathways for penile erection in man are thought to be parasympathetic, ejaculation and termination of the erection are believed to be under the control of sympathetic efferents. One might predict, therefore, that sympathetic blockade by a spinal opiate would lead to sustained erection with ejaculation, as has been observed in man.

Nalaxone reversal of sexual dysfunction has not been investigated in man, but its occurrence in rats implies that the effect is specific to opiates. This may not be so, as we have observed delayed, but ultimately successful, ejaculation after the use of caudally administered extradural steroids. That the sexual effects of spinal opiates may be nonspecific is not altogether surprising; concentrations of morphine in spinal fluid after intrathecal injection may be over 100,000 nmol per litre[7], and a significant fraction of extraduaral morphine may cross the dura[8] to give very large spinal fluid drug concentrations. These are far in excess of concentrations required for saturation of spinal opiate receptors.

Whatever the mechanism, there is at least one important clinical implication for these findings. Spinal administration of opiates or other drugs may constitute an important new therapeutic tool in the treatment of premature ejaculation.

A. PYBUS
T. TORDA
*Department of Anaesthesia,*
*Prince Henry Hospital,*
*Sydney, Australia*

H.J. MCQUAY
*Nuffield Department of Anaesthetics,*
*Abingdon Hospital,*
*Abingdon, Oxford, UK*

R.A. MOORE
*Nuffield Departments of Clinical Biochemistry and Anaesthetics,*
*Radcliffe Infirmary, Oxford, UK*

1. Weisenfeld-Hallin, Z. & Sodersten, P. *Nature* **309**, 257-258 (1984).
2. Torda, T. *et al. Br. J. Anaesth.* **52**, 939-942 (1982).
3. Cowen, M. *et al. Anesth. Analg.* **61**, 15-18 (1982).
4. Moore, R.A. *et al. Br. J. Anaesth.* (in the press).
5. Leslie J. *et al. Lancet* i, 151 (1979).
6. Rawal, N. & Wattwil, N. *Anesth. Analg.* **63**, 8-14 (1984).
7. Moore, R.A. *et al. Clin. Pharm. Ther.* **35**, 40-46 (1984).
8. Moore, R.A. *et al. Br. J. Anaesth.* **54**, 1117-1128 (1982).

## Adiabatic boiling and ocean metal transport

SIR — R.N. Anderson[1], commenting on Delaney and Cosens[2], presents a misconception about adiabatic boiling, as well as an error about precious metal transport and deposition. Both articles assume that adiabatic ascent of heated seawater beneath thermally active ocean ridges[3] can result in a greatly concentrated residual liquid due to steam loss if the liquid intersects and follows the subcritical temperature–pressure two-phase curve. This is their explanation for fluid inclusions with salinities two to five times that of seawater in seafloor basalts[2].

The dissolved salts in seawater raise its critical point above that of pure water to about 405°C[4]. Using thermodynamic data for a seawater-equivalent NaCl solution[5], and enthalpy calculations by K.S. Pitzer (personal communication), one may calculate the maximum steam fraction that will result due to adiabatic boiling from 400°C and, say, 500 bars[3] to 200°C (the maximum temperature range over which boiling might occur before magmatically heated seawater is expelled from an ocean ridge). About 53 per cent of the original mass of the liquid would be converted to steam, thus concentrating the salinity of the original to the residual liquid by a factor of about 1.9.

I do not argue that boiling cannot occur beneath the ocean floor. It may, particularly beneath some of the shallower ridges, or where the gas contents are high. But the concentration factors cited[2] cannot be attributed solely to boiling, and the fluid inclusion data are not conclusive evidence of boiling. A possible mechanism for the creation of the brines in fluid inclusions may be supercritical phase separation of seawater[4-6].

Anderson also claims that Delaney and Cosens "predict the steam" generated by such boiling may carry gold and silver to shallower parts of a hydrothermal system, leaving lead, zinc and copper below the zone of boiling. However, Delaney and Cosens[2] do not suggest (nor does anyone else) that precious metals are transported by subcritical steam. Rather, it is simply observed in some ore deposits that precious metals are often stratified above base metals, with the point of separation being the zone of first boiling. Although vapour may be present above this zone, it is the residual liquid that continues to be the transporting medium of the non-volatile species. This is the situation in the geothermal systems of New Zealand, where ore-grade gold and silver precipitates are being formed[7].

Studies of active hydrothermal systems and their hot springs are very important to understanding how fossil hydrothermal systems formed ore deposits; they may assist in finding new deposits and even new environments of mineralization. But Anderson's speculations, particularly on finding a deep sea "steam vent where we might observe precious metal deposits forming *in situ* for the first time ever", are not justified.

JEFFREY W. HEDENQUIST
*DSIR Geothermal Research Centre,*
*Wairakei, Private Bag,*
*Taupo, New Zealand*

1. Anderson, R.N. *Nature* **303**, 283 (1983).
2. Delaney, J.R. & Cosens, B.A. *Mar. Technol. Soc. J.* **62**, 62-66 (1982).
3. Bischoff, J.L. *Science* **207**, 1465-1469 (1980).
4. Bischoff, J.L. & Rosenbauer, R.J. *Earth planet, Sci. Lett.* (in the press).
5. Pitzer, K.S. & Li, Y-G. *Proc. natn. Acad. Sci. U.S.A.* **80**, 7689-7693 (1983).
6. Delaney, J.R. *et al. EOS* **63**, 472 (1982).
7. Weissberg, B.G. *Econ Geol* **64**, 95-108 (1969).