RÉSUMÉ

Lunar reflections

IN the quest for ever-higher resolution in astronomy, there is a fundamental practical problem: a restricted aperture size on a telescope limits the resolution achievable. That is why radio-astronomers resort to very-long-baseline interferometry, with multiple-component telescopes such as the Very Large Array in New Mexico and MERLIN in the UK. But even these devices are restricted to the space available on our planet. So, for good measure, why not use the Moon as the radio mirror, ask T. Hagfors and colleagues (*Astrophys. J.* **362**, 308–317; 1990)? The Moon's surface is neither smooth nor very reflective. But incorporated into an interferometer array, it might just help resolve details of bright radio bursts on Jupiter or maser emission from Orion.

Aged introns

A CLASS of introns that interrupt certain genes of eukaryotes may have been present in the common ancestor of two major groups of bacteria, according to D. Shub and colleagues (*Cell* **63**, 417–424; 1990). Until now, the only known examples of introns in genes of eubacteria were three found in different genes of bacteriophage T4, a virus that infects gram-negative bacteria. These three were classed as 'group I' introns, because of the presence of characteristic conserved sequences. The question has been whether these introns are present in bacteria and eukaryotes as a result of their ancient origin or horizontal gene transfer. Shub *et al.* have discovered a group I intron in a gene of bacteriophage SP01 which can infect only gram-positive bacteria, adding force to the idea that the introns have an ancient origin and have existed for at least 1,500 million years (the estimated time since gram-negative and gram-positive bacteria diverged from their common ancestor). A further twist is that in all cases the eubacterial introns interrupt genes involved in DNA synthesis: the authors speculate that introns have been conserved because they are part of a system for regulating synthesis of viral DNA.

Pelvic parameters

DETERMINING gender from skeletal parameters is one of the preoccupations of anatomists and palaeontologists. A refinement from N. Milne is a set of handy discriminant functions (*J. Anat.* **172**, 221–226; 1990) based on principal components analysis of eight dimensions of the human pelvis, derived from 62 unsexed skeletons in a medical collection. The analysis separated the pelves into two clear groups based on gender, as confirmed by the answers to a separate, subjective questionnaire from a panel of anatomists.

tions like those in physics can only be solved in space–times where every history leading into the past from a given event hits the initial surface; time machines (and naked singularities) violate this condition; so time machines are incompatible with physics, and we ought to forget about them. It appears that this argument is wrong. Although 'in general' time machines may prevent prediction, there can still be particular cases such as the wormhole space–times where this is not the case.

While this may get the wormholes off the hook, there remains a worry about the other more realistic cases, different space–times and nonlinear fields. Computer simulations of collapsing stars are progressing fast. Suppose we found an initial configuration that does collapse to produce a time machine, of the sort where some initial field conditions do not have solutions. Should we be content at this stage to wheel in a Principle to solve our problems? Most theoreticians would want to go further and ask, what goes wrong with an attempted solution? The most likely outcome, which is suggested by this work, would seem to be that these cases are unstable, and that the back-reaction of the physical fields on the space–time would destroy the time machine. If this proved to be the generic case, then we would be able to forget about time machines, not because they were embarrassing, but because there were good physical mechanisms for preventing them. □

C. J. S. Clarke is in the Department of Mathematics, University of Southampton, Southampton SO9 5NH, UK.

1. Friedman, J.L. *et al. Phys. Rev.* D**42**, 1915–1930 (1990).
2. Friedman, J.L. *Nature* **336**, 305–306 (1988).
3. Morris, M.S., Thorne, K. & Yurtsever, U. *Phys. Rev. Lett.* **61**, 1446–1449 (1988).
4. Lee, C.W. *Gen. Relativity Gravitation* **15**, 21–30 (1983).
5. Wheeler, J.A. & Feynman, R.P. *Rev. mod. Phys.* **21**, 425–434 (1949).

EVOLUTION

Living fast and dying young

J. S. Jones

BIOLOGY used to be all about lists: lists of cranial nerves, lists of species and — soon to come — the biggest list of all, the DNA sequence of the human genome. Animal behaviour in particular was until recently just a vast catalogue of anecdotes on sex, life and death. A recent meeting* might have been (but was not) called 'Explaining David Attenborough': just why do animals do all the cute or disgusting things we see on television? It turns out that some simple rules govern the lives of creatures as different as flowers and apes — and might even help to make sense of some of the eccentric behaviour of DNA.

Life-history theory can be summed up as 'nobody gets a free lunch'; no creature can simultaneously be good at growth, survival and reproduction. There is always a trade-off, and success in one walk of life is paid for by failure in another. What lifestyle to adopt is determined by where an organism lives and by what its competitors are doing. Compromise is everywhere. In *Drosophila,* stocks selected for long adult life have low juvenile survival as larvae and grow for longer than normal (L. Partridge, University of Edinburgh). In plants, too, there is a trade-off of the resources allocated to flowers and to fruit (D. Charlesworth, University of Chicago). The conflict between components of fitness extends over generations: parents must bargain their investment in progeny against the loss of future reproductive success due to the expense of raising their first-born. The divergence in the interests of parents and children reduces optimal family size, and explains why birds are willing to let their youngest chicks starve if conditions are less than ideal (C. Godfray, Imperial College London).

Sex itself involves trade-offs. It is expensive, and males may die during the risky business of attracting and retaining a mate. Sometimes the expense makes it worth cheating; to mate and flee in the hope that, by cuckolding a more responsible father, reproductive success will emerge on the cheap. In blue-gill sunfish up to 90 per cent of adult breeding males behave in this way, but the costs of cuckoldry are high as such males are often exposed to predators. The two strategies — a safe and faithful life versus a seductive but dangerous one — are alternative solutions to the problem of trading sex against survival; and the proportion of each is stable within a population (M.L. Gross, University of Toronto).

There is a deeper conflict in sex, that between somatic tissue (a source of metabolites) and the gametes (a metabolic sink). This may help to explain aspects of the shift from unicellular to multicellular animals. In *Volvox* and its relatives, somatic cells do not appear until the plants reach a size of about 100 cells. As colonies get larger, relatively more somatic cells are needed to maintain the germ cells. Mutants which reduce the number of somatic cells in a colony have a disproportionate effect on the number of germ cells which can be supported; sex is a costly habit (G. Bell, McGill University). In other creatures, too, reproduction eats

**The Evolution of Reproductive Strategies.* Royal Society, London, 17–18 October 1990.