leic acid populations as though the very existence of such reactions were not the primary theoretical issue. With highly-skilled organic syntheses, the beginnings of something like non-enzymatic DNA or RNA replication are observed. But now, as Schwartz and Orgel have said (*Science* 228, 585–587; 1985), we need to “design reactions that proceed efficiently with more plausibly prebiotic substrate mixtures”. Sooner or later, organic polymers, able to replicate in the laboratory and having simpler backbones than DNA or RNA, will be synthesized. Then the idea of “takeover”, as Cairns-Smith has called it, will become inevitable.

Cairns-Smith, however, is far more radical than this, in that he rejects the concept of any primitive organic gene. Instead, he thinks in terms of clay particles, made of successive layers, each new layer added on top reproducing the defect structure of the previous layer; or of clays made of a succession of various kinds of uniform layers, that grow sideways. If such particles break across the layers, then the one-dimensional information contained in the particular succession of layers is conserved. Ways in which clays might influence organic reactions and use them for their growth are discussed in this book. Thus clay particles are suitable substrates for natural selection. Will field studies be conducted on the population structure of clay particles in given ecological niches? Or will some courageous young scientist design a clay-chemostat where the growth of clay crystals will be studied under various selective pressures?

Cairns-Smith's ideas deserve to be

assimilated and discussed. In *Seven Clues to the Origins of Life*, a layman's version of his earlier book *Genetic Takeover*, all his essential theses are presented in a clear, precise and condensed manner. The choice of a deductive form of presentation for his arguments (clays are introduced only three chapters from the end), buttressed by references to Sherlock Holmes, lends much rigour to the plot, and leaves no escape exit. How can low-technology life be designed, and how can it evolve towards the high-technology form? I know of no other book that succeeds as well as this one in maintaining this central question in focus throughout. It is a summary of the best evolutionary thinking as applied to the origins of life in which the important issues are addressed pertinently, economically and with a happy recourse to creative analogies.

The concept of “takeover” is an important evolutionary one, and may apply to a wide variety of situations. I regret in this respect that the author did not attempt to analyse concrete biological examples (such as the origin of split genes, RNA catalysts and ribosomes, or the design of the immune system) in the light of this idea. Inevitably, I think, schemes in which things acquire complexity of detail without a change in their organization will have to compete with “takeover” schemes. The time has now come for those scientists working on the subject of the origin of life to cease dealing with such ideas obliquely. □

Jacques Ninio is at the Institut Jacques Monod, Tour 43, 2 Place Jussieu, 75251 Paris Cedex 05, France.

that may occur in any population of individuals”. He transferred this anti-essentialism from entomology to human behaviour. Human sexual behaviour cannot be pigeon-holed; just as the world of wasps was a continuum in each and every one of its aspects, so too the male population cannot be divided into two discrete groups, heterosexual and homosexual.

The enigmatic smile of a swan — or an upside-down flamingo?

Gould teases out the wider implications of a particular scientific enquiry, from the taxonomy of wasps to a more accurate — and tolerant — understanding of what is regarded as sexual deviation. The scientific, moral and political (Kinsey had the misfortune to coincide with Senator McCarthy) implications are shown to interact.

The essays range widely from speculation about the reason for the extinction of the dinosaurs to the bizarre and unhappy cases of the Hottentot Venus and of Ritta-Christina, the celebrated siamese twin sisters. The style is relaxed but not flip; the content all the better for being disciplined by the limits of the monthly column. If there is a weakness it is Gould's rather too obvious wish to hook his reader with a startling opening paragraph. An essay on continuity and quirkiness in evolution leads off with Michelangelo and one on the flamingo's eating habits with Buffalo Bill. It is good journalism but unnecessary: in all these essays the subject matter is compelling enough in itself.

Scientists who communicate their enthusiasm to a wider audience are regarded by some of their professional colleagues as vulgar; if it can be explained to a layman it cannot be serious. Gould brushes aside that mixture of arrogance and insecurity. His essays popularize science in the same sense that Macaulay popularized history — by making it interesting and entertaining to read. Roll on volume five. Meanwhile I shall be looking for copies of volumes one to three. □

John Rae, 17 Dean's Yard, London SW1P 3BP, UK, is Head Master of Westminster School.

Appeal to the laity

John Rae

The Flamingo's Smile: Reflections in Natural History. By Stephen Jay Gould. W.W. Norton: 1985. Pp. 476. \$17.95. To be published in Britain in February 1986, £12.95.

It is 20 years since C.P. Snow described the gulf fixed between scientists and non-scientists in academia. Not much has changed. The two communities continue to go about their business like a couple of Englishmen travelling in a foreign land: they are on the same journey but have nothing to say to one another because they have never been introduced. The non-scientist complains that the scientist cannot communicate what he is doing in a language that the layman can understand. The scientist complains that the non-scientist defines language in narrowly non-scientific terms — why should a biologist have to explain what he means by morphology any more than a grammarian has to explain what he means by tautology? No doubt it is the education systems

that are to blame; meanwhile the dialogue of the deaf continues.

Stephen Jay Gould overcomes this problem, not by laicizing the language, but by using it in the context of intellectual enquiries that any intelligent person can understand and by a technique of cross-referencing that relates the scientific enquiry to comparable problems in other disciplines. It might be argued that as a palaeontologist and evolutionary biologist he has an easier task than say, the nuclear physicist. But easy or not he succeeds brilliantly. This collection of essays, the fourth to be based on his monthly column in the *Natural History Magazine*, communicates both the fascination and the universality of scientific study in a way that can hardly fail to intrigue scientist and non-scientist alike.

Take, for example, Kinsey and the wasps. Kinsey's reports on sexual behaviour were not the product of his desire to promote sexual enlightenment. He drifted into sex research by accident and applied to the question his experience as America's leading taxonomist of wasps. His study of wasps persuaded him — in his own words — “of the uniqueness of individuals and of the wide range of variation