

rearrangements (for example, of the *Oenothera* kind) but also out-of-step fast replication (or amplification) of some parts of it is one which natural selection would help to evolve and fix in a population. Such a property may not be ascribed to quirks of DNA replication as suggested by Dover⁴ but to selection favouring it. Natural selection is concerned not only with the existing variability but even more so with mechanisms which ensure its continued availability. If there is intragenomic selection leading to rapid build-up of some of the DNA sequences (the selfish DNA of Doolittle and Sapienza⁵ and Orgel and Crick⁶) we must treat this part of DNA as *incidental* to the fundamental process of mutability so vital for ensuring continued supply of raw material for the production of new genes. It does not follow that all of the DNA produced in this manner will, in fact, acquire a function. A large part of it (or even all of it) may not do so and may be eliminated only on an evolutionary time scale. Meanwhile, new DNA of the same and similar kind may continue to be produced so that at a given point of time there will always be large amounts of non-specific DNA. This fraction is best described as 'incidental' rather than 'selfish' DNA. We may call it incidental because it is a byproduct of the inherent property of mutability of the genome, a characteristic to which natural selection attaches great importance even if it leads to the production of repeated sequences and a wasteful deployment of energy. Viewed in

this light, non-functional DNA is very much a product of natural selection — a selection operating for mutability *per se*. Its relative abundance is probably a function of its nonfunctional nature for any other DNA which carries information of one kind or another would create genetic imbalance and would be quickly rejected.

It is important to recognise that economy has not been a major consideration in the process of evolution. Overproduction and rejection (both quick and prolonged) are not uncommon features of evolution; the excessive amount of DNA should be considered in the same context. Nature places considerable premium on playing safe so that it will not run short of raw material even if this means indiscriminate production leading to sequences which are destined to remain functionless. With our present understanding of the origin of life (far from complete) and its evolution through

several billion years, we must be prepared by now to accept some degree of confusion. After all, the evolutionary process is without any kind of central management, planning and coordination. It is totally dependent on variability arising through errors in the replication of DNA and its subsequent multiplication through recombination, which at times may involve genome fusion⁷. Whatever control mechanisms do exist are themselves a product of these errors which have been seized upon by natural selection to bring about some amount of order. A large number of mutant genes are now known which affect the meiotic process in various ways including chromosome pairing^{8,9}, chromosome condensation¹⁰, preferential segregation¹¹, amount of recombination^{12,13} and there are also, of course, the mutator genes^{14,15}, some of which could possibly be involved in the production of non-specific DNA.

The use of the term 'selfish' may be quite harmless if one does not try to see too much meaning in it. With our recollection of the reactions to Darwin's theory, it is too much to expect that attempts of this kind will not be made. We do not have to be squeamish when science demolishes some of our cherished beliefs. The truth pointed out by Darwin has, in the end, given a more meaningful direction to our social and cultural evolution. By the same token, we do not have to create unnecessary despair if the interesting concept of selfish DNA is misunderstood, as is likely to happen. □

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100 years ago

NEW GUINEA
from L.M. D'Alberis

"The most perfect harmony seems to reign in families of the Papuan Mahoris, and rare indeed are cases of quarrel among members of one household. They live in communities, sometimes of more than a thousand inhabitants, in well-built villages, worthy to be called small towns, both for their order and cleanliness. They are under the rule of the chiefs or landowners. The chief is looked upon as father of the family. He is called Pacao, and his servant or subject is called Irene. From all I could learn, slavery does not exist, and the sale of human beings is unknown." After describing their daily avocations, amusements, dress, implements, and ornaments (a group of which are figured), he goes on: "Their natural disposition is gentle and placid. They like to spend their time in talking and games, in which men and women take an equal share. Playful and free of speech,



Durabi, a native of Kiwai Island, at the mouth of the Fly River

they nevertheless do not transgress the bounds of modesty, either in word or deed. Women and children are included in every conversation, and often take part in public discussions, which are usually held in the evening. Women are always respected, and in some villages they enjoy a certain supremacy, although the government of the house belongs to the husband. Labour may

be said to be fairly divided between the two sexes, and they are accustomed to work from their earliest childhood. . . . Will they be the happier for civilization? This is a difficult problem, and one which cannot be solved until the experiment has been made. For my part I do not doubt that these, more readily than any other savages whom I know, would answer to the call of a civilised nation which, stretching out a paternal hand, would lead them towards our civilisation! To insure success, however, they should be treated as friends, not as slaves; they should be cherished, not destroyed."

Unfortunately our attempts at civilising savages have as yet in every case failed. Are we still, notwithstanding all our wretched failures, to go on in the old way, and allow these interesting and now happy people to be first ruined morally by the teaching of the dregs of our Australian and Pacific traders, and then physically deteriorated by the forced introduction of a form of civilisation utterly unsuited to them? Cannot either philanthropy, or religion, or Government protect these people from all such external influences as have been proved to be unsuited to their condition and stage of development, while aiding them to work out for themselves an indigenous civilisation? Here is perhaps the last chance we have to preserve one remnant of the better class of savages from being crushed under the juggernaut car of our high-pressure civilisation and mad struggle for wealth.

From *Nature* **23**, 23 December, 175, 1880.