1273 DB

bncdoc.id	ANX
bncdoc.year	1991
bncdoc.title	New Scientist.
bncdoc.info	New Scientist. Sample containing about 54457 words from a periodical (domain: applied science)
Text availability	Worldwide rights cleared
Publication date	1985-1993
Text type	Written books and periodicals
David Lee's classification	W_non_ac_nat_science

<1273/c>	as well as plasmids coding for drug resistance. Some pseudomonads carry fertility genes which enable them to mate among themselves and pass plasmids to unrelated, or distantly related, bacteria. Armed with transposons and other genes, these 'promiscuous' plasmids are not sensed as alien by other bacteria. Quite the opposite: they are willingly accepted by a diverse range of microbes, from Proteus and Azotobacter to E. coli. And any of these recipients can usually pass the plasmids on again. In fact, many of the plasmids used in research on E. coli were first found in pseudomonads or salmonella; it can be difficult to tell in which species a plasmid first originated. How important are these gene transfer processes in the natural environment? Transduction seems to be too drastic and to involve fragments of DNA too small to be of serious ecological importance. But transformation may well be common in environments with a high microbial turnover, such as decomposing organic matter. Examples of plasmid transfer in the external world are well established; for instance, it is the mechanism by which drug resistance spreads in hospitals or intensive farming units. It is likely, too, that the chromosomes of all eubacteria are as mutable as that of E. coli. Although some yield mutants less readily in the laboratory than does E. coli, this is because they are better equipped to repair mutations. So, in principle, the calculation in Box 3 applies to all eubacteria. A slow-growing soil bacterium, good at DNA repair, might require weeks, even a couple of months, for its global gene pool to undergo as many mutations as afflict the world's E. coli; but even so, the potential of eubacteria for rapid mutation is phenomenal. The late Bob Hedges, of the Royal Postgraduate Medical School at Hammersmith, a pioneer of plasmid research, suggested almost 20 years ago that bacterial evolution has not been linear, as in higher organisms, but rather a patchwork, with organisms drawing from a communal gene pool. Advances in molecular genetics have reinforced that view. Restriction enzymes and DNA repair systems confer a certain degree of integrity on bacterial genomes, but these systems mutate too. The speed at which bacteria can mutate and their readiness to pass around packages of genetic information means that bacteria are poised to react to selection pressure with rapid and substantial genetic changes. It is safe to conclude that at any stage of this planet's history the world of bacteria has been overwhelmingly conditioned by the state of the biosphere. Anxiety over global environmental change has perhaps made us more aware of the converse idea: that the activities of microbes largely determine the state of the biosphere, and in particular
 Key: **Footprint ConEn1** **Footprint ConEn2** **Footprint ConEn3**	**the evolution of the Earth's atmosphere**
	. But both propositions are equally true. Just as laboratory bacteria are artefacts of the culture media, so the bacterial world can be viewed as an artefact of the rest of the biosphere. Yet in the face of environmental stress, a malleable genome has given the microbe the edge on the elephant. Finally, reflect, if you will, on how drastically

	humanity has changed the biosphere during its brief strut on the terrestrial stage; one wonders how much of today's microbial world we have ourselves created. 1: How Escherichiacoli pass their genes around TRANSDUCTION: Some bacterial viruses (bacteriophages), after they have infected an E. coli cell, combine with some of their host's DNA and make it part of themselves. As the virus DNA multiplies, the piece of host DNA multiplies along with it. In due course the host dies and releases into the environment virus carrying fragments of its DNA (see diagram below). When the hybrid virus attacks and enters a new cell, it carries in that DNA. Most of the cells attacked will succumb to the infection, but a few will be resistant, and these will integrate the alien DNA into their own genomes. If the new DNA includes DNA sequences which the resistant host can use, the host will do so, and its genotype will thus have been changed. The pieces of DNA transduced by bacteriophages may carry one or two whole genes, but they are often smaller fragments which may nevertheless modify genes already present in the recipient. Transformation: E. coli at a certain stage of their growth cycle can, after treatment with chemicals such as calcium chloride or rubidium chloride, take up raw DNA (for example, DNA purified in the laboratory) and, if it contains appropriate sequences, will incorporate them into their own genomes. Transformation can involve pieces of DNA comprising dozens of genes, such as purified plasmids (see Box 2). Conjugation: E. coli only conjugate when one of the cells possesses fertility genes and the other does not. The two organisms come together, a tube grows between them, pulling them close, and the fertile strain donates fertility genes to the recipient, which then becomes fertile itself. Conjugation may involve the transfer of anything from about 30 to over 100 genes. 2: Plasmids THESE ARE mini-chromosomes found in bacteria. They are distinct from the cell's main store of DNA, the bacterial chromosome, yet still multiply during cell growth. In E. coli plasmids range from about 3 to 20 per cent of the size of the chromosome. Most often there is one copy of a given plasmid per chromosome, but with the small ones