Table 1. JOINT TRANSDUCTION IN *P. aeruginosa* STRAIN 2 BY PHAGE F116

Marker	Phenotype requirement	Percentage joint transduction with try-3A	try-3B	met-1	met-2	met-3	leu-1	str*
try-1	tryptophan	0	0	0	0	0	0	0
try-3A	tryptophan or indole, accumulates anthranilic acid		0†	0	0	0	0	11
try-3B	as for try-3A			0	40	0	70	0
met-1	methionine or homocysteine				0†	0	0	0
met-2	methionine or homocysteine					0	44	0
met-3	methionine, homocysteine or cystine						0	0
leu-1	leucine							0

* Marker for streptomycin resistance or sensitivity.
† Linkage relationships determined only by method 2.

ment. Similar results have been obtained with groups of mutants affecting other pathways, including mutants having requirements for histidine, leucine, arginine and isoleucine plus valine, in these cases our conclusions being based largely on data obtained by method 2.

It seems reasonable to conclude that in contrast to the Enterobacteria, this lack of grouping of related loci on the chromosome is of general occurrence in *Pseudomonas*. This finding may have interesting implications in relation to the mechanism of genetic control of enzymatic reactions in this organism[5].

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Polysaccharide Fractions and Transformations in *Rhizobium*

OUR interest in the composition of rhizobial gums[1,2] led us to attempt transformations using, first a preparation based on that of Ljunggren[3] and later the cruder, and therefore deoxyribonucleic acid-rich, fraction used by Lange and Alexander[4]. In the first case we aimed at restoring virulence to avirulent strains of clover *Rhizobia*, including two used by Ljunggren, but with *R. trifolii*, *SU*297/31 as the source of 'polysaccharide'. In the second we attempted a wider transformation, similar to those reported by Lange and Alexander, between clover and lucerne. In the latter we included a specially prepared deoxyribonucleic acid fraction as an additional treatment.

In no case have we been successful in obtaining transformation, and an experience we had in our attempt to repeat Lange and Alexander's method points to what we believe to be a possible weakness in their evidence. In that case an aliquot of the crude clover polysaccharide, when plated directly on yeast mannitol agar, yielded a number of *Rhizobia*-like colonies. These were able to nodulate the clover host and were serologically indistinguishable from the donor strain. A puzzling feature was that there were no nodules formed when parallel aliquots of the same polysaccharide solution were added to the clover host. We believe, however, that we have demonstrated that a few rhizobial cells were able to survive what appears to have been a drastic chemical treatment.

The element of doubt which this possibility introduces into work of this nature recalls the need to demonstrate a mixed genome in 'transformed' cells, partly derived from donor and partly from recipient (c.f. ref. 5). Evidence as to the persistence of genetic markers of the recipient strain in a culture, transformed in respect of its symbiotic capacity, is strangely lacking with *Rhizobium*. It is possible that the workers concerned already have direct evidence that will permit distinctive characteristics of the recipient to be identified in the symbiotically 'transformed' culture, or that they are in a position to investigate further the transformed cultures they already hold. Certainly such a demonstration can be regarded as a prime requirement for the validation of claims of this nature.

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ENTOMOLOGY

Penetration of Pyrethrin I labelled with Carbon-14 into Susceptible and Pyrethroid Resistant Houseflies

As part of a wider investigation into the causes of insecticide resistance in a strain of house flies (*Musca domestica*), which show resistance to both DDT and the pyrethroids[1], specifically labelled (^{14}C)-pyrethrin I has been used to examine penetration of this insecticide into these insects.

(^{14}C)-pyrethrin I, labelled in the *cyclo*propane ring adjacent to the ester linkage, was prepared by the esterification of (^{14}C)-(±)-*trans*-chrysanthemum monocarboxylic acid with (+)-pyrethrolone. The alcohol was isolated from natural sources by Elliott's method[2]. The (^{14}C)-acid was prepared from (2-^{14}C)-glycine by the general route of Harper[3] with suitable modifications to the semi-micro scale; in particular, the separation of the mixture of *cis* and *trans*-chrysanthemum acids was carried out by fractional precipitation (infra-red control). Because of the small quantity of material available the (±)-*trans*-acid could not be resolved and so the final product was a mixture of natural pyrethrin I and one of its diastereoisomers, henceforth referred to as (^{14}C)-'pyrethrin I'.

Sub-lethal quantities of (^{14}C)-'pyrethrin I' in acetone were then applied by topical application to batches of flies of three strains: first, a susceptible strain (Fig. 1 *A*), secondly, a Swedish resistant strain[1] (Fig. 1 *B*), and thirdly, a colony of the Swedish resistant strain which had been allowed to revert to 'almost susceptible' by removing the pyrethroid selection pressure (Fig. 1 *C*). At increasing increments of time, batches of the flies were killed and the unabsorbed insecticide was washed from the flies and the containers with light petroleum, b.p. 40°–60°, and the combined washings were concentrated to dryness *in vacuo* and the weight of (^{14}C)-'pyrethrin I' was determined by a scintillation counting technique. A control experiment showed that the washings did not remove (^{14}C)-'pyrethrin I' already absorbed.

The results from these experiments are shown in Fig. 1, curves *A*, *B* and *C*. It would appear from these results that penetration into the resistant strain is significantly slower than into the other strains. No attempt was made to measure directly the loss of 'pyrethrin I' by excretion. Radioactivity recovered from the containers alone prob-