Mailing address: Genetics Bldg.

*Anderson*

November 25, 1957

Dear Tom:

When I came back from Australia, I found your article with Mazé in the
Ann. Pasteur; this just coincided with the galley proof enclosed, which
I have just corrected and returned. I thought you'd be interested to see
it.

As you know, these data are quite antique by now, but I had hesitated to
publish them in such detail until I got on to the notation set out in the paper—
which in turn was a development from an analysis of Demerec' data on trans-
duction. I can imagine the same considerations may have discouraged you from
tabulating the full genotypes of the recombinants, clone by clone,— a datum
I'd be interested to look at if you have it handy.

I suppose we shouldn't be too startled at the coincidence of our conclusions:
it lends some confidence to their possible correctness.

Do you have a record of the frequency of viable Hfr and F⁻ exconjugants
respectively? In my J Bact note, this was (rather confusingly)given  as:

| | | | |
|---|---|---|---|
| Total pairs: | 279 | Pairs with recombinants from B- exconjugant | 66 |
| Hfr viable | 222 | | |
| F⁻ viable | 190 | Among these, Hfr also viable | 51 |
| [Both viable | 159] | | |

Does this accord with your results? Of course, a complete account should
take note of the fate of the subclones of the Hfr exconjugant, and this I
did not bother to do except in a few pedigrees. If there is a marked effect
on the viability of the Hfr mate, itwould be worth comparing this in F+ x F-
crosses also.

With best Regards,

Yours,

Joshua Lederberg

## TABLE 1

### Recovery of parental types and divisions at which segregation of various recombinants occurred in 11 pedigrees

| Types Recovered | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parental** | | | | | | | | | | | | | |
| Hfr | +++++++ | + | + | + | + | + | ⚥ | - | + | + | - | + | |
| F- | ------- | 1-9 | 1-5 | 2-3 | 1-5 | 1-6 | 2 | 4-7 | 1 | 1 | 1-7 | 1-8 | |
| **Recombinants** | | | | | | | | | | | | | |
| F-1 | -------+ | - | - | - | 4 | - | 4 | 5-11 | - | - | 4-8 | 5-7 / -* | 5 |
| A | +------ | - | - | - | - | - | - | - | - | - | - | 8* | 1 |
| B | ++----- | >9 | - | - | - | - | - | - | 6 | - | - | 5 | 3 |
| B' | ++----+ | - | - | - | - | - | - | - | - | >7 | - | - | 1 |
| C | +++---- | - | - | - | - | - | - | >8 | >6 | - | 3 | - | 3 |
| D | ++++--- | >9 | - | - | - | 7 | - | 8 | >6 | - | - | 4 | 5 |
| D' | ++++--+ | - | - | 4 | >4 | - | - | - | - | - | - | - | 2 |
| E | +++++-- | - | - | - | - | - | - | - | - | - | - | - | 0 |
| F' | +++++++ | - | - | - | - | 8 | - | - | - | - | - | - | 1 |
| G | --+----* | - | - | - | - | - | - | >8 | - | - | - | - | 1 |
| H | --++---* | 5 | - | 4 | - | - | - | - | - | - | - | - | 2 |
| I | --+++-- | - | - | - | >5 | - | - | - | - | - | - | - | 1 |
| J | ---+---* | - | -- | - | - | - | - | - | - | - | - | 6 | 1 |
| K | ------+- | - | - | - | - | - | 8 | - | 5 | - | - | - | 2 |
| K' | ------++ | - | - | - | - | - | 7,8 | - | - | - | - | - | 1 |
| L | ++-++-- | - | 5 | - | - | - | - | - | - | - | - | - | 1 |
| M | ++++-+- | - | - | - | - | 8 | 7 | - | - | - | 4-7 | - | 3 |
| M' | ++++-++ | - | - | - | - | - | 5,8 | - | - | - | 8 | - | 2 |
| N | --+--+- | - | - | - | - | - | >8 | - | - | - | - | - | 1 |
| **Totals** | | 3 | 1 | 2 | 2(3)+3 | | 3(6) | 3(4)+4 | | 1(2) | 2(4)+4 | | 28(36) |
| **Protoplasmic Dilution when segregation occurred** | | >90 | 100 | 16 | >60 | 100 | >200 | >40 | >50 | >180 | 24 | 200c | |

## DISCUSSION

LEDERBERG (1956) has recorded genetic analyses of bacterial families produced by the plump, nonmotile F⁻ strain W-2401 after conjugation with a slender motile Hfr strain W-3011. Only 66 F⁻ exconjugants out of 279 couples gave recombinants (involving 9 markers) which is a much smaller proportion than the 11 out of 18 pairs that we obtained. This may be explained by the fact that his Hfr strain transmitted a different set of characters and in an order that is the reverse of that transmitted by our strain HfrH. His results agree with ours in showing that a number of different recombinant types may be recovered from a single exconjugant. However, the average number of recombinants per exconjugant is much lower than ours. Of 75 F⁻ exconjugants reported in greater detail later (LEDERBERG, 1958), 52 gave only one type of recombinant, all for the most frequently observed set of three markers; 10 yielded two types; 3 gave three types; and only one gave four types. In none of these four latter pedigrees was a given Hfr marker observed in more than two recombinants. This suggested the possibility of reciprocal crossovers or, in agreement with our data on strains of higher "fertility", the alternative of successive redombinations or "meiotic recycling."

\* e could easily have missed recombinants of these classes if they were mixed with F- bacteria in a terminal clone.

\+ The numbers in parentheses indicate the total number of recombinant types including recombinants for motility.