preparations of IgG globulins and this alone is sufficient reason to question the current belief[11] that the absorption of protein in this species is by a process which is entirely non-selective[12].

Resumen. El intestino delgado del cerdo recién nacido, usado in vitro, transporta immunoglobulina G (IgG) de bovino más rápido que IgG de porcino. El transporte intestinal tanto de sodio como de fluido aumenta en presencia de IgG de bovino. Preparaciones de IgG de ovino, equino y humano son transportadas a igual velocidad que IgG de porcino. Estas proteínas no estimulan la transferencia de sodio o fluido. Esta diferencia en la velocidad de transporte entre IgG de bovino y porcino pone en duda la opinion general que sostiene que la absorción de proteína en el intestino de cerdo es enteramente no selectiva.

R. Witty[13], Pat Brown[14] and M. W. Smith

A.R.C. Institute of Animal Physiology, Babraham, Cambridge (England), 14 October 1968.

[11] I. G. Morris, in *Handbook of Physiology-Alimentary Canal* (American Physiological Society, Washington DC 1968), vol. 3, p. 1491.

[12] We would like to thank Dr. A. Feinstein and M. J. Hobart for providing antisera to human and ovine IgG light chains; N. Buttress for his ultracentrifugal analysis of proteins and K. Burton and T. Archer for their technical assistance in this work.

[13] P.I.E.R. Fellow, N.R.C. Canada.

[14] Unilever Fellow.

Transformation of Phage-Resistance in *Bacillus subtilis*

The occurrence of transformation has now been confirmed in different bacterial species. A wide range of bacterial characters are transformable[1].

There are as yet no reports of transformation of phage-resistance, but the present investigations show how transformation of phage-resistance can occur.

For transformation the recipient strain *Bacillus subtilis* 168 M try$^-$ phs (SPO-1 phage sensitive) was used. Phage-resistant spontaneous mutant was isolated from the host bacteria and designated 168 M try$^-$ phr. The mutation rates was 8.32×10^{-6} calculated to Luria and Delbrück[2]. Three bacterial strains were used as donors of transforming DNA. One of them was *B. subtilis* Marburg. The other 2 prototrophic bacterial strains 168 M try$^+$ phs and 168 M try$^+$ phr were obtained by transformation of 168 M try$^-$ phs and 168 M try$^-$ phr spontaneous mutant using DNA of *B. subtilis* Marburg.

The preparation of optimal competent cells and the transformation procedure were previously described in detail[3].

To show that the phage-resistance transformation is connected with the DNA isolated from phage-resistant strain, the following experiment was made. Competent 168 M try$^-$ phs cells were used in the transformation experiment. Three kinds of DNAs were used with a final concentration of about 2 µg/ml. The bacterial-DNA mixtures were shaken for 30 min in the water-bath at 37 °C; and 0.2 ml were then measured into 3 100 ml Erlenmeyer flasks fitted with side arms in which were 10 ml MG liquid media[3] containing 0.1% casein hydrolysate. The incubation was continued till the suspensions reached 0.3 optical density values (9–10 h). The try$^+$ phs transformants were selected on MG agar[3]. The phage-resistant transformants were selected as try$^+$ phr cells using SPO-1 phage as a selective agent permitting the detection of the phage-resistant transformants present in the population. The results are seen in the Table.

The number of try$^+$ phs and try$^+$ phr transformants/ml and the frequency of try$^+$ phr cells after transformation, using different kinds of DNA

	DNA from 168 M try$^+$ phr	168 M try$^+$ phs	*B. subtilis* Marburg
try$^+$ phs	1.23×10^8	8.03×10^7	1.03×10^8
try$^+$ phr	9.20×10^5	2.38×10^3	1.27×10^3
Frequency of try$^+$ phr	7.50×10^{-3}	2.96×10^{-5}	1.23×10^{-5}

It is seen that the frequency of the phage-resistant cells is 7.5×10^{-3} in the case of the bacterial-DNA mixture containing DNA isolated from the phage-resistant strain. In the other 2 cases, where the donor strains were sensitive, the frequencies of the phage-resistant cells are very low. The number of phage-resistant cells in these cases was nearly the same as the number of spontaneous phage-resistant mutants among the 168 M try$^-$ phs cells.

The curve of competence was determined by the number of try$^+$ phs and try$^+$ phr transformants. In both cases the beginnings and the peaks of competence occur nearly at the same time, but do not run parallel with each other.

Transformation procedure was carried out using different concentrations of DNA prepared from 168 M try$^+$ phr bacterial strain. The number of try$^+$ phs transformants gave a straight line in the coordinate, but the curve of the number of try$^+$ phr transformants did not run parallel with it. It seems that the try$^+$ and phr markers are not linked.

The number of try$^+$ phs transformants rose quickly to a high level during transformation and the phenotypic lag was about 5 h. The try$^+$ phr transformants appeared only after 6 h 30 min incubation.

The frequency of transformation for try$^+$ phr marker compared to try$^+$ phs marker was about 0.12–0.032%[4].

Zusammenfassung. Mit Hilfe von extrahierter DNS wurde der genetische «Marker» der Phagenresistenz auf phagensensible Bakterien übertragen.

S. Horváth

Institute of Genetics, Hungarian Academy of Sciences, Budapest (Hungary), 14 October 1968.

[1] A. W. Ravin, Adv. Genet. *10*, 61 (1961).

[2] S. E. Luria and M. Delbrück, Genetics *28*, 491 (1943).

[3] S. Horváth, J. gen. Microbiol. *48*, 215 (1967).

[4] I wish to thank Dir. Dr. B. Györffy for his criticism and Irene Kállay for her assistance.