The action of "bacitracin" on additional species has been ascertained through use of the blood agar plate-penicylinder method. When *C. novyi* was the test organism, the zone of inhibition obtained was comparable to that with *C. histolyticum*. Certain strains of anaerobic nonhemolytic streptococcus were inhibited to the same extent as beta hemolytic streptococcus. Other strains were more resistant. The anaerobic staphylococci were very susceptible to its inhibiting action. Gonococci and meningococci also showed a zone of inhibition of growth in chocolate agar-penicylinder plate tests under increased CO_2 tension. *E. coli, Ps. aeruginosa* and *B. proteus* were not inhibited in agar plate-penicylinder tests or in serial dilution in broth tests.

The *in vivo* protective action of "bacitracin" has been tested against hemolytic streptococcus C203 M. V. in mice. When mice were injected intraperitoneally with 10,000 M. L. D. of an overnight culture of this streptococcus in blood broth, followed immediately by an intraperitoneal injection of one to two units of "bacitracin" in a cell-free filtrate of the antibiotic as harvested, approximately 80 per cent. of the mice survived. When the mice were injected with 10,000 M. L. D. intraperitoneally, followed immediately by a subcutaneous injection of one to two units of "bacitracin," 30 to 40 per cent. of the mice survived. If mice so injected received additional doses of one to two units subcutaneously every three hours for 36 hours, 80 to 90 per cent. survived.

Guinea pigs have been protected against the development of gas gangrene when 1 cc and 0.5 cc of an overnight culture of *C. welchii* or *C. septicum* combined immediately before injection with 50 to 100 units of "bacitracin" in 1 cc of distilled water, was injected into the thigh muscle. These pigs received additional doses of 50 to 100 units of "bacitracin" subcutaneously every three hours for 36 hours. Some swelling and oedema developed at the site of injection of the gas gangrene organisms, but in 80 per cent. of the pigs, this gradually receded and the pigs were alive and well two weeks after the injection. The control pigs injected with a like inoculum of organisms all died within 12 hours. There was no sign of local toxicity from the subcutaneous injection of the "bacitracin," nor was there any toxic general reaction in the experimental pigs or the antibiotic controls.

"Bacitracin" has been used locally to treat a relatively small number of human infections due to hemolytic streptococcus and staphylococcus. The results have been comparable to the response of similar cases to local penicillin. Not enough material has been available as yet for systemic treatment. Attempts are now being made to produce this antibiotic by large-scale commercial methods.

SUMMARY

A new antibiotic "bacitracin" has been recovered from a strain of the *B. subtilis* group of organisms. It is neutral, water-soluble, non-toxic and relatively heat stable. *In vitro* it is active chiefly against Gram-positive organisms, but the gonococcus and meningococcus are susceptible to its action. It is also active *in vivo* against experimentally produced hemolytic streptococcal infections in mice and gas gangrene infections in guinea pigs. Clinical use in hemolytic streptococcal and staphylococcal infections in man have given encouraging results.

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SEROLOGIC EVIDENCE OF CYTOPLASMIC INTERCHANGE DURING CONJUGATION IN PARAMECIUM BURSARIA[1]

THE preliminary experiments reported by the authors[2] on antigenic changes in cultures of *Paramecium bursaria* have been expanded to include serologic examinations of conjugants at various intervals after the onset of the mating phenomenon and at various times following the conclusion of the event. The new work has been done very largely with two strains of the ciliate: one of these is colored brilliantly green by zoochorellae inclusions; the other is colorless. (The color difference is so striking that no difficulty whatever was experienced at any time in determining to which strain either representative belonged.) These two strains are antigenically distinct: each reacts quickly and extensively in homologous antiserum; neither reacts at all in antiserum for the other unless it has undergone conjugation with the other.

The development of a gelatinous precipitate in and about the ciliary zone and the occurrence of ciliary tangling (with eventual loss of action) was taken as positive evidence of antigen-antibody reaction when it appeared within two hours after the paramecia were placed in antiserum. The examinations were made in hanging drop preparations with the "high dry" (4 mm, 44X) objective and 10X ocular of the microscope.

The examination of a large number of paramecia has revealed that about 95 per cent. of all recent (within one hour) ex-conjugants contain some antigenic substance common to their mates which was not previously present within themselves. Moreover, a study of other ex-conjugants has revealed that the

[1] This work was aided by a grant from The Rockefeller Foundation.

[2] J. A. Harrison and E. H. Fowler, *Jour. Immunol.*, 50: 115, 1945.

new antigenic character conferred upon the individual at the time of conjugation persists in its progeny for at least one month of active growth. About 5 per cent. of all recent ex-conjugants seemed to be insensitive to sera which were effective on the cells with which they had mated.

Serologic tests done on pairs of animals while in conjugation have given variable results: in not a single instance have both members of pairs reacted in either antiserum after short periods of conjugation; in many instances both members of pairs have reacted in the antiserum in which they were tested after long periods (12 hours at 28° C. to 40 hours at 19° C.) of conjugation.

All conditions and observations of these experiments make it clear to the authors that the antigen involved in the reaction is very largely, if not exclusively, cytoplasmic in character. We therefore are of the opinion that during the course of conjugation in *Paramecium bursaria* there occurs an extensive interchange of cytoplasm, although it is admitted that the proper explanation of the reactions observed may relate to an alternative suggestion that the cytoplasm of paramecia undergoes a sudden and profound antigenic reorganization with reference to, and influenced by, the cytoplasm of the contiguous animal or the wandering pronucleus received from it. (The opinion that cytoplasmic interchange occurs was strengthened somewhat in finding, on more than one occasion in these experiments, zoochorellae in the conjugant which was previously free of these inclusions. However, this observation can not be taken as conclusive evidence, for it is a fact that under the influence of effective antiserum the conjugating animal is not normal externally, although it may be almost so in its internal organization.)

The position taken here with regard to cytoplasmic interchange during conjugation in paramecia apparently does not conform to the hypothesis held generally by zoologists since the work of Maupas[3] in 1889. An inextensive search through the literature in this field—an admittedly unfamiliar one to the authors—indicates that the only evidence against the occurrence of cytoplasmic interchange in conjugating paramecia is the fact that it has not been observed microscopically. At the turn of the present century Hickson[4] pointed out that this fact should be attributed to an inadequacy of the methods used and should not have been developed into the conclusion that interchange does not occur.

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[3] E. Maupas, *Arch. de Zool. Exp. et Gen.*, (2), 7: 149–517, 1889.

[4] Sidney J. Hickson, *Quart. Jour. Micros. Sci.*, 45: 346, 1902.

THE COAGULATION OF LATEX

THE mechanism of the coagulation of latex is a very brief chapter in most treatises on rubber. The theories are numerous and conflicting. The most widely accepted interpretation is one in which the destruction of the stabilization membrane is postulated. Recently, in Haiti, I made an electrophoretic study of latex involving the determination of mobility rates and isoelectric points. The timing of the migration of individual latex particles obviously necessitated the use of a microscope. This permitted constant observation of the globules, so that not only were their rate and direction of movement observed, but their aggregation as well.

When latex is put into a buffer mixture of a pH value at or near the isoelectric point of the latex, agglutination of the particles takes place. While observing this incipient coagulation of the latex, I was led to the conclusion that though pH values of isoelectric points indicate a protein covering on latex particles, electrophoretic behavior points to a surface which is, in part, non-protein. The very feeble charge on Cryptostegia latex globules in comparison with the greater charge on Castilloa and the still greater charge on Hevea suggests that there is least protein on the Cryptostegia particles, and most on the Hevea particles. This deduction receives even better support from the complete dissimilarity in the mobility curves of Cryptostegia latex particles and the isolated serum proteins. That there is a non-protein component of the particle surface is hardly to be doubted. I thought it very probable that this non-ionizable component is hydrocarbon, the same which constitutes the core of the latex globule.

Direct observation of incipient coagulation also revealed that there is no loss of identity of the globules and no destruction of the stabilization membrane on initial agglutination.

The foregoing experimental findings and the deductions based thereon met with some opposition. The surface of latex particles is generally assumed to be of pure protein, the hydrocarbon presumably not entering into the composition of the stabilization membrane at all.

The expression "stabilization membrane," as commonly used in the chemistry of emulsions, denotes all forms of coating on the surface of the globules, from monomolecular to multimolecular layers. Monolayers may occur in living systems, but multilayers cover cells and natural emulsions. The stabilization membranes of some artificial emulsions may actually be isolated as delicate pellicles. Monolayers receive emphasis because they are more amenable to physical-chemical laws.

When latex particles collide, one of two events could take place, the particle may coalesce, as when