Reports

Deoxyribonuleic Acid Mediates Sensitization of Penicillin-Resistant Staphylococcus

Abstract. An extract, which contained deoxyribonucleic acid, from a penicillin-sensitive hospital strain of *Staphylococcus aureus* conferred the property of sensitivity upon a penicillin-resistant strain of the same species, with the phage type of the sensitized *S. aureus* remaining unchanged after transformation.

In 1949 George and Pandalai (*1*) demonstrated the sensitization of *Escherichia coli* to penicillin in the presence of a nucleic-acid fraction isolated from a sensitive strain of *Staphylococcus aureus*. Evidence of DNA-mediated transfer of penicillin sensitivity between two bacteria of the same species has been lacking. The present study (*2*) reports the sensitization of a penicillin-resistant strain of *S. aureus* in the presence of a DNA-containing extract of a sensitive strain of the same species.

The two strains of *S. aureus* chosen were isolated from hospital patients. The resistant receptor strain was phage type 73/80/81, a particularly resistant staphylococcus (*3*), and the sensitive donor strain was phage type 55.

The preparation of the sensitive staphylococcus transforming principle was carried out essentially by the method applied by Alexander and Leidy (*4*) to type c *Hemophilus influenzae*. The sensitive strain was grown for 8 hours in 40 erlenmeyer flasks, each containing 100 ml of trypticase soy broth. The yield was centrifuged, the supernatant was discarded, and 45 ml of a solution containing 0.1*M* sodium chloride and 0.1*M* sodium citrate was added to the cells. After freezing with a mixture of carbon dioxide ice and 95-percent ethyl alcohol, the cells were thawed at 4°C, and the volume was increased to 500 ml by the addition of citrate saline solution and 5 ml of 10-percent sodium deoxycholate. After the solution cleared, protein was removed by three extractions with chloroform and amyl alcohol. A fibrous precipitate was obtained by adding two volumes of absolute ethyl alcohol to the partially deproteinized solution and allowing it to stand for 12 hours at 4°C. This precipitate was dissolved in 0.85-percent sodium chloride at *p*H 7.0, deproteinized twice more as described above, and again precipitated with two volumes of absolute alcohol. For use in the experiment, the final fibrous precipitate was washed in absolute alchohol and dissolved in 30 ml of physiologic saline at *p*H 7.0.

Antiserum reactive with resistant *Staphylococcus aureus* was prepared by injecting guinea pigs intraperitoneally with a gradually increased inoculum of the resistant strain, which contained approximately 1.5 to 2.0 billion cells per milliliter in 0.2 percent formalinized saline. The initial dosage of 0.1 ml was increased by 0.1 ml daily for the first 4 days of each week, until a final dosage of 1.0 ml daily was attained. Seventeen days after the initial injection, the animals were bled, and the serum obtained was heated to 60°C for 30 minutes.

Tubes containing a 2-mm loopful of a 6-hour culture of the resistant strain of *S. aureus*, 0.5 ml of the antiserum, 2 ml of trypticase soy broth, and 0.1 ml of the transforming extract were incubated at 35°C for 16 hours. Additional tubes were prepared by incubating resistant *S. aureus* culture and antiserum for 2, 4, and 6 hours, then adding the broth and transforming extract, and incubating for an additional 16 hours. The control consisted of a 2-mm loopful of the resistant *S. aureus* strain and 2 ml of broth, incubated at 35°C for 16 hours. After 16 hours of incubation, the differently treated cultures and controls were spread uniformly on nutrient agar plates with a 10-unit, 7-mm penicillin disk in the center of each dish. The plates were incubated for 24 hours at 35°C.

Zones of inhibition within 3 mm of the 13-mm size (measured from edge of disk) of the zone of inhibition of the original sensitive strain were obtained on all plates except those of the controls, which showed no inhibition zone. No colonies grew in any of the zones of inhibition. Colonial growth in all the plates containing the transforming extract was moderate. The growth of the controls and the original sensitive strain was abundant.

The same procedure described above, modified only by the addition of deoxyribonuclease (*5*) in the tubes with the transforming extract, resulted in no zones of inhibition. Subtransfers were not made.

Attempts to sensitize penicillin-resistant *S. aureus* in vivo are suggested by these results.

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References and Notes

1. M. George and K. M. Pandalai, *Lancet* **I**, 955 (1949).
2. The work described in this report was done largely in my home laboratory. I am grateful to Earle Borman, director, and Dr. Walter Karakawa, research microbiologist, of the State of Connecticut Health Laboratories, for making available those facilities which I lacked at home.
3. J. E. Blair and M. J. Carr, *J. Am. Med. Assoc.* **166**, 1192 (1958).
4. H. E. Alexander and G. Leidy, *Proc. Soc. Exptl. Biol. Med.* **73**, 485 (1950).
5. Furnished through the kindness of Worthington Biochemical Corp., Freehold, N.J.

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Instructions for preparing reports. Begin the report with an abstract of from 45 to 55 words. The abstract should *not* repeat phrases employed in the title. It should work with the title to give the reader a summary of the results presented in the report proper.

Type manuscripts double-spaced and submit one ribbon copy and one carbon copy.

Limit the report proper to the equivalent of 1200 words. This space includes that occupied by illustrative material as well as by the references and notes.

Limit illustrative material to *one* 2-column figure (that is, a figure whose width equals two columns of text) or to *one* 2-column table or to *two* 1-column illustrations, which may consist of two figures or two tables or one of each.

For further details see "Suggestions to contributors" [*Science* **125**, 16 (1957)].

Environmental Familiarity and Feeding in a Planarian

Abstract. Planarians, in common with higher animals, tend to delay feeding in environmental conditions to which they are not habituated.

If a higher animal, for example, the rat, is placed in a strange situation, its feeding behavior is suppressed until it becomes familiar with the novel environment. This has the experimental consequence that animals fasted a given