

Haworth<sup>12</sup> showed that inulin is a polymerized anhydro-fructo furanose, the linkages being at positions 1 and 2 of the fructose chain, while levan is formed by linkages at positions 2 and 6, as shown by Hibbert and co-workers. The structure of dextrans is unknown but is being actively investigated by the latter authors.

In view of the present results, is it to be assumed that pneumococci possess 2 different enzymes, one specific for inulin and another for levan, or that the same enzyme is capable of splitting both of these polysaccharides, which while polymerized fructo-furanoses yet differ markedly in structure? It seems possible, in the light of the suggestive and interesting researches of Quastel,<sup>13</sup> who assumes the possibility of one cell possessing at least 56 "hydrogen transportases" (Thunberg's terminology), that different enzymes are actually present.

Much further work is needed to settle this fundamental point regarding enzymic behavior of microorganisms on various chemical substances. The various enzymes apparently exert a very specific and selective action with respect to the chemical structure.

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### Seasonal Changes in Frog's Muscles and Their Bearing on the Clasping Reflex.

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Sommerkamp<sup>1</sup> showed that different striated muscles reacted differently to contracture producing substances such as acetyl choline, nicotine, etc., and explained his results by the assumption that certain muscle fibers (tonus fibers) reacting specifically to contracture producing substances are unequally distributed in different muscles. It is apparent that these investigations have great importance in the study of tonus. Therefore experiments were carried out in which the isometric tension of the flexors of the forelimb was determined in male and female frogs (*Rana esculenta*). Acetyl choline (1:10,000), KSCN (0.113M) and veratrin (1:1,000,000) were used during and after breeding season. The results are sum-

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<sup>12</sup> Haworth, W. N., and Learner, A., *J. Chem. Soc.*, 1928, 619.

<sup>13</sup> Quastel, J. H., *Trans. Faraday Soc.*, 1930, **26**, 115.

<sup>1</sup> Sommerkamp, H., *Archiv. Exp. Path. und Pharmacol.*, 1927, **128**, 99.

marized in Tables I and II. While the isometric tension set up by KSCN expressed in percentage of the tetanus tension produced by a just maximal current is practically identical in males and females the experiments with acetyl choline show that the muscles of male frogs react specifically. The tension in males averages 13% and in females 3.2%. It is interesting that several weeks after breeding season an intermediate value averaging 5.6% is obtained from males.

TABLE I.  
*Contracture tension in % of tetanic tension with maximal current.*

| No. of Exp. | KSCN<br>0.113M | Acetyl<br>choline<br>1:10,000 |                                             |
|-------------|----------------|-------------------------------|---------------------------------------------|
| 9           | 10             | —                             | Clasping males. During breeding season.     |
| 7           | —              | 13.8                          |                                             |
| 8           | 9.8            | —                             | Non-clasping males. During breeding season. |
| 8           | —              | 12.9                          |                                             |
| 10          | —              | 5.6                           | " " After breeding season.                  |
| 19          | —              | 3.2                           | Females. After breeding season.             |
| 13          | 8.2            | —                             |                                             |

The isometric curve of flexors of the forearm which were poisoned with veratrin sulphate revealed the specific reaction of the male muscles during breeding season in a still more striking manner. When stimulated with a just maximal faradic current the tension of the slow contracture beginning immediately after the twitch was regularly greater than the twitch tension in males during breeding season; in females the contracture tension was the lower. In these experiments again an intermediate reaction was observed in males several weeks after breeding season. The specific reactions are restricted to the flexors of the forearm since other muscles like *M. gastrocnemius* even in the breeding season react alike in males and females.

TABLE II.  
*Secondary veratrin tension expressed in % of that of the primary twitch tension with maximal current.*

| No. of Exp. | %   |                              |
|-------------|-----|------------------------------|
| 9           | 147 | Males during breeding season |
| 8           | 97  | Males after breeding season  |
| 15          | 78  | Females                      |

The mechanism of these reactions is the objective of further studies.