many strains produced the same change, the elapsed time necessary for complete decolorization varied considerably. When organisms, with the exception of the streptococcus, were suspended in a 2% aqueous solution of peptone instead of peptone-broth, there was a diminution in the speed and degree of decolorization.† A concentrated suspension of organisms yielded more complete decolorization than an unconcentrated suspension. Conversion was more rapid and complete in the presence of oxygen than under anaerobic conditions. Presumably, oxygen favored the growth of the organisms, which in turn produced a greater supply or greater activity of enzyme. Therefore, the optimum conditions for the *in vitro* conversion of prontosil-soluble depended upon a large inoculum of bacteria, the most favorable media for growth, and an available source of oxygen.

It is of interest that anaerobic conditions favored a more effective reduction of methylene blue. This difference in behavior between the 2 dyes may be partly explained on the basis that the decolorization of methylene blue is a reversible phenomenon, whereas it is irreversible for prontosil-soluble.

Completely decolorized prontosil-soluble solution yielded 10 mg per 100 cc of free sulfanilamide when determined by the method of Marshall and Litchfield.[6]

Summary. Different strains of bacteria vary in their ability to decolorize prontosil-soluble. It was shown that it was more difficult for microörganisms to decolorize prontosil-soluble than methylene blue.

11135

Functional Spinal Cord Regeneration in Adult Rainbow-Fish.

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Studies on the regenerative capacity of teleosts have given conflicting results. Koppanyi and Weiss[1] reported functional recovery and morphological reconstruction in the severed spinal cord of the adult goldfish. The return of function after spinal section in adults

† The difference in conversion-power of hemolytic streptococci, when compared to the other strains of microörganisms studied, may be due in part to the media used for the streptococcus, although brain-broth did not appear to affect the action of a strain of *Streptococcus viridans.*

1 Koppanyi, T., and Weiss, Paul, *Anz. d. Akad. d. Wissen, Wien.*, 1922, **7**, 206.

of this fish was further substantiated by Pearcy and Koppanyi.[2] However, Hooker[3] was unable to demonstrate either functional or morphological regeneration in adult goldfish after spinal section. Nicholas[4] failed to demonstrate morphological regeneration following section of the cord in Fundulus embryos, but Hooker[5] was able to show both functional and morphological restitution in the rainbow-fish when the cord had been severed during the first 4 days after "birth". Tuge and Hanzawa[6] proved both functional and morphological regeneration after spinal section in adult Japanese rice-minnows.

To further test regenerative capacity of the spinal cord in teleosts, the cord was transected in 132 adult rainbow-fish *(Lebistes reticulatus)*. Females were used because the males are too heavily pigmented for satisfactory translumination. The transluminated cord was cut with a narrow, thin-bladed knife under a binocular Greenough microscope, either just cephalic to the dorsal fin or at its caudal border.

Those which survived operation more than 24 hours (104 individuals) were observed and tested for reflexes at 24- to 48-hour intervals, for as long as 41 days in some cases.

The completeness of transection was evidenced by paralysis behind the lesion, drooping and loss of active motion in the caudal fin and appearance of the avoiding reaction described by Hooker.[5] To select fish with complete operations but to rule out extensive damage to structures other than the spinal cord, complete paralysis behind the lesion and a bilateral avoiding reflex were required. These conditions were fulfilled by 59 individuals, the others were considered to have incomplete operations (paralysis incomplete) or extensive damage to other structures (unilateral or absent avoiding reflex). The dorsal fin reflex, described by Tuge and Hanzawa[7] and considered by them to be pathognomic of spinal section in the Japanese rice-minnow, was discarded as a criterion because it can be evoked in normal rainbow-fish.

Of the 59 fish considered definitely spinal, 20 showed melanophoric expansion in the paralyzed area, 29 showed no color change, and in 10 there was a distinct loss in color.

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2 Pearcy, J. F., and Koppanyi, T., PROC. SOC. EXP. BIOL. AND MED., 1924, **22**, 17.

3 Hooker, Davenport, PROC. SOC. EXP. BIOL. AND MED., 1930, **28**, 89.

4 Nicholas, J. S., *Proc. Nat. Acad. Sci.*, 1927, **13**, 695.

5 Hooker, Davenport, *J. Comp. Neur.*, 1932, **56**, 277.

6 Tuge, H., and Hanzawa, S., *J. Comp. Neur.*, 1937, **67**, 343.

7 Tuge, H., and Hanzawa, S., *Sci. Repts. Tohoku, Imp. Univ., Biol.*, 1935, **10**, 589.

Return of function was evidenced by the appearance of an occasional flexion of the tail and either normal spreading of the caudal fin or its active motion (side to side fanning or its minute undulating motion constantly present in the normal fish). At first these signs were present only for short periods, following stimulation or when appearing spontaneously. These activities gradually became more constant, more forceful and better coördinated. In a few cases, the behavior ultimately closely approached that of the normal fish. The interval between operation and the first evidence of returning function varies greatly. In 3 fish such evidence appeared on the third day after operation; in 31 from the fourth to the sixth day; in 12 between the seventh and eleventh day. In addition, 13 others, observed for 7 days or less and which were among those sacrificed at intervals after operation for morphological study, showed no evidence of returning function before terminal anesthesia and fixation.

The evidence afforded by these observations indicates that the adult female of the rainbow-fish, *Lebistes reticulatus,* exhibits a high capacity for functional restoration following section of the spinal cord.

11136 P

Changes of Choline Esterase at End Plates of Voluntary Muscle Following Section of Sciatic Nerve.

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Choline esterase, present throughout the body, exists in especially high concentrations at the end plates of striated muscle, in the synapses both of the central nervous system and of the sympathetic ganglia.[1, 2] The concentration in these 3 foci is sufficiently high to satisfy the requirements of the theory that acetylcholine (ACh) may be involved in the transmission of nerve impulses from neurone to neurone or from neurone to striated muscle fibre. The alterations in enzymatic concentration which occur after the nerve endings disappear have been investigated.

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1 Marnay, A., and Nachmansohn, D., *J. Physiol.*, 1938, **92**, 37.

2 Nachmansohn, D., *Bull. Soc. Chim. Biol.*, 1939, **21**, 761.