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ADVENTURES IN BIOLOGICAL ENGINEERING¹

By Dr. HUDSON HOAGLAND

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MAN, together with other higher vertebrates, has developed some elegant automatic mechanisms for regulating the physical and chemical properties of his blood and body fluids. The relative constancy of one's internal environment in the face of external stress and change is characteristic of such factors as blood volume, blood sugar, hydrogen ion concentration and salt content of the body fluids. The thermostat regulation of internal body temperature is another case in point. These factors are beautifully controlled with little or no conscious thought on our part. As Claude Bernard pointed out nearly a century ago this regulation renders the higher vertebrates free of their external environment to a degree impossible for animals not possessing these automatic mechanisms. Homeostasis of the internal environment, as

Cannon, Barcroft and others have demonstrated, is one of the truly central problems of physiology.

When, for example, the environmental temperature falls a bird or mammal conserves more of its metabolic heat and maintains its internal temperature constant. A frog, on the other hand, must take on the temperature of its environment. In cold weather its metabolism and other dependent reactions are slowed until it becomes immobilized and a prisoner of the climate. Freedom thus is not just a matter of sociology and politics, but freedom of a sort has its substratum in biochemistry and physiology.

In recent years with the development of aviation man has desired to be free in an environment for which his evolutionary history could not possibly have fitted him. In high-speed airplanes he is assailed by new and formidable stresses. Living as he does at the bottom of a sea of air supplying a continuous and

¹ Sigma Xi initiation lecture given at Worcester Polytechnic Institute on June 14, 1944.

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