

## THE RIDDLE OF THE UNIVERSE

ure of this "divine engineer" and his artistic work in the great workshop of creation. This was not so easy when the idea of God became refined, and man saw in his "invisible God" a creator without organs—a gaseous being. Still more unintelligible did these anthropomorphic ideas become when physiology substituted for the conscious, divine architect an unconscious, creative "vital force"—a mysterious, purposive, natural force, which differed from the familiar forces of physics and chemistry, and only took these in part, during life, into its service. This vitalism prevailed until about the middle of the nineteenth century. Johannes Müller, the great Berlin physiologist, was the first to menace it with a destructive dose of facts. It is true that the distinguished biologist had himself (like all others in the first half of the century) been educated in a belief in this vital force, and deemed it indispensable for an elucidation of the ultimate sources of life; nevertheless, in his classical and still unrivalled *Manual of Physiology* (1833) he gave a demonstrative proof that there is really nothing to be said for this vital force. Müller himself, in a long series of remarkable observations and experiments, showed that most of the vital processes in the human organism (and in the other animals) take place according to physical and chemical laws, and that many of them are capable of mathematical determination. That was no less true of the animal functions of the muscles and nerves, and of both the higher and the lower sense-organs, than of the vegetal functions of digestion, assimilation, and circulation. Only two branches of the life of the organism, mental action and reproduction, retained any element of mystery, and seemed inexplicable without assuming a vital force.