HEREDITY

INTRODUCTION

GENETICS, A NEW SCIENCE

THE theory of organic evolution has probably influenced more fields of human activity and influenced them more profoundly than has any other philosophic deduction of ancient or modern times. By this theory philosophy, religion, and science have been revolutionized, while in the practical arts of education and agriculture, twin foundation stones of the state, man has been forced to adopt new methods of procedure or to justify the old ones in the light of a new principle.

The evolutionary idea has forced man to consider the probable future of his own race on earth and to take measures to control that future, a matter he had previously left largely to fate. With a realization of the fact that or-

ganisms change from age to age and that he himself is one of these changing organisms man has attained not only a new ground for humility of spirit but also a new ground for optimism and for belief in his own supreme importance, since the forces which control his destiny have been placed largely in his own hands.

The existence of civilized man rests ultimately on his ability to produce from the earth in sufficient abundance cultivated plants and domesticated animals. City populations are apt to forget this fundamental fact and to regard with indifference bordering at times on scorn agricultural districts and their workers. But let the steady stream of supplies coming from the land to any large city be interrupted for only a few days by war, floods, a railroad strike, or any similar occurrence, and this sentiment vanishes instantly. Man to live must have food, and food comes chiefly from the land.

A knowledge of how to produce useful animals and plants is therefore of prime importance. Civilization had its beginning in the attainment of such knowledge and is limited by it at the present day. If, therefore, this knowledge can

be increased, civilization may be advanced in a very direct and practical way. Before Darwin the practices of animal and plant breeders were largely empirical, based on unreasoned past experience, just as was in antiquity the practice of metallurgy. Good plows and good swords were made long before a scientific knowledge of the metals was attained, but without that scientific knowledge the wonderful industrial development of this present age of steel would have been quite impossible. In a similar way, if not in like measure, we may reasonably hope for an advance in the productiveness of animal and plant breeding when the scientific principles which underlie these basic arts are better understood. Two practical problems present themselves to the breeder: (1) how to make best use of existing breeds, and (2) how to create new and improved breeds better adapted to the conditions of present-day agriculture. We shall concern ourselves with the second of these only.

The production of new and improved breeds of animals and plants is historically a matter about which we know scarcely more than about the production of new species in nature. Selec-

tion has been undoubtedly the efficient cause of change in both cases, but how and why applied and to what sort of material is as uncertain in one case as in the other. The few great men who have succeeded in producing by their individual efforts a new and more useful type of animal or plant have worked largely by empirical methods. They have produced a desired result but by methods which neither they nor any one else fully understood or could adequately explain. So there exists as yet no true science of breeding but only a highly developed art which was practiced as successfully by the ancient Egyptians, the Saracens, and the Romans as by us. The present, however, is an age of science; we are not satisfied with rule-of-thumb methods, we want to know the *why* as well as the *how* of our practical operations. Only such knowledge of the reasons for methods empirically successful can enable us to drop out of our practice all superfluous steps and roundabout methods and to proceed straight to the mark in the most direct way. The industrial history of the last century is full of instances in

which a knowledge of causes in relation to processes, i. e. a *scientific* knowledge, has shortened and improved practice in quite unexpected ways. So we may not doubt the ultimate value in practice of a science of breeding, if such a science can be created.

A beginning has been made during the last ten years, starting with the rediscovery of Mendel's law of heredity in 1900. This book will be concerned largely with the operations of that law.