Foreword

Compared with the high-profile discoveries of molecular genetics concerning individual genes and their specific expression at the tissue and organ level, studies of general patterns of growth in living organisms often receive less public attention in the media. Yet an understanding of the processes of biological growth at the level of the individual and in populations of organisms is key to human survival. Uncontrolled growth is a feature of human cancer cells which prejudices survival at the level of the individual, while unchecked growth of global human population density has to be considered against a background of finite limitations of planetary living space and natural resources. Indeed, this book begins with the premise that the basis of all biological growth is exponential, with an inherent tendency for constant doubling with time. A priori, therefore, it is argued that there would be evolutionary adaptive advantage to be gained by the acquisition of mechanisms which induce self-limitation of growth processes and therefore enhance the chances of survival of individuals and populations of organisms, including humans.

The author's interest in these phenomena started when he was studying the biological effects of toxic chemicals discharged into the sea. In laboratory experiments, the growth of simple marine organisms such as hydroid coelenterates was tested in response to the application of various toxins. As expected, growth of the test organisms was inhibited following exposure to high concentrations of chemical toxins such as copper. However, at low concentrations of some normally toxic agents it was found that growth rate was in fact enhanced. This phenomenon, called 'hormesis', was presumed to occur when a naturally occurring growth inhibitory mechanism, which normally modulates a growth promoter, was partially disinhibited. In a practical sense the phenomenon of hormesis demonstrates that the test organisms, and therefore naturally occurring species, may acquire some tolerance to

toxic agents. However, in a theoretical sense it permits the development of ideas throughout this book concerning a wide range of biological growth processes which can be analysed from a cybernetic point of view and which are shown to be self-regulatory. Experimental evidence for self-limiting growth, generated by interacting promoter and inhibitory processes, is provided for unicellular and multicellular organisms, leading to the notion of the 'Maia hypothesis', deriving analogously from James Lovelock's grand-scale Gaia hypothesis but named after the Roman goddess of growth, who gave her name to the month of May.

The basic hypothesis is then extended from the physiological level in individual organisms to animal populations which, by analogy, show reduced rates of reproduction induced by negative feedback mechanisms when an animal population threatens to overburden the carrying capacity of its habitat. Finally, developing the concept of population-density control achieved by animal populations in nature, the book turns to the implications for humankind on Earth. It is argued that human overpopulation has been recognised for over a hundred years and is set to continue to increase, notwithstanding a fall in the rate of increase in recent decades. In a naturally occurring situation it is inferred that self-regulatory population density mechanisms would have come into play by now, but it is argued that the extent to which humans have manipulated their environment in recent centuries has overridden the onset of inhibitory population control. Political recognition of the Earth's carrying capacity for the human race is not possible at the present time, but scientific estimates suggest that sustainable population density had already been exceeded by the end of the twentieth century, as evidenced by the critical manifestation of anthropogenic global climate change. On this basis the book raises the challenge for humanity to move towards a stable global population and a steady-state world economy. The challenge is immense and provocative. However, it is argued that on a planet with a seemingly continuously increasing human population and finite global resources, the challenge for human ingenuity is to devise feedback mechanisms which would bring the world population into something like a steady state, or to live with the consequences of uncontrolled growth.

The book has much to offer as a rational exposition in current debates concerning human population density on Earth and the 'belief' that anthropogenic global climate change is a myth.

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