Chapter 2

Examples of Complex Systems

This chapter surveys some of the most common examples of complex systems studied by complexity science. The first two sections consider examples from physics and chemistry that show that even nonliving systems without goals or functions have properties with a rich structure and can exhibit different kinds of self-organisation and generate order. The first section is particularly important for the rest of the book, because it explains concepts that originate in physical science but which have been applied throughout complexity science (for example, the ideas of equilibrium and phase transition are widely used outside of thermal physics, where they originated). The next section is about the universe and how it and its parts, like the solar system, display various features of complex systems. The final nonliving system considered is the Earth's climate, the physics and chemistry of which both support and are generated by life. The subsequent sections discuss living systems, which display adaptive behaviour of many different kinds and different degrees of sophistication, and two complex systems of human construction – namely, the economy and the World Wide Web. The chapter ends with the human brain, which is a supreme example of a complex system. The next chapter identifies the features of complex systems displayed by these examples.

2.1 Matter and Radiation

Physics is concerned with processes involving matter and radiation at all scales, from the interactions of subatomic particles and fields to the formation of galaxies and even the universe itself. At the beginning of modern physics, in the seventeenth century, some natural philosophers, such as René Descartes and Pierre Gassendi, revived the ancient idea that the natural world is based on matter moving around in space. They became known as the 'me-