PART 2
The Basics of Biology: An Engineer's Perspective

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An Overview of Biological Basics

2.1. ARE ALL CELLS THE SAME?

2.1.1. Microbial Diversity

Life is very tenacious and can exist in extreme environments. Living cells can be found almost anywhere that water is in the liquid state. The right temperature, pH, and moisture levels vary from one organism to another.

Some cells can grow at −20°C (in a brine to prevent freezing), while others can grow at 120°C (where water is under high enough pressure to prevent boiling). Cells that grow best at low temperatures (below 20°C) are usually called *psychrophiles*, while those with temperature optima in the range of 20° to 50°C are *mesophiles*. Organisms that grow best at temperatures greater than 50°C are *thermophiles*.

Many organisms have pH optima far from neutrality; some prefer pH values down to 1 or 2, while others may grow well at pH 9. Some organisms can grow at low pH values and high temperatures.

Although most organisms can grow only where water activity is high, others can grow on barely moist solid surfaces or in solutions with high salt concentrations.

Some cells require oxygen for growth and metabolism. Such organisms can be termed *aerobic*. Other organisms are inhibited by the presence of oxygen and grow only