

# THE HUMAN ORGANISM

## BASIC FUNCTIONS (6C)

**L**ike other organisms, human beings are composed of specialized cells grouped in organs that have special functions. The focus of this map is on the essential requirements for life—obtaining food and deriving energy from it, protecting against injury, providing internal coordination, and reproduction—rather than on the body systems as structural entities. Moreover, human body systems and their subsystems illustrate important aspects of systems in general.

The map is organized around four strands, each emphasizing a different survival requirement—*deriving energy from food, defense, coordination, and reproduction*. In the elementary grades, the focus is on the needs of the human organism and on body parts that help the body meet its needs. In middle school, the focus is on the role of body systems, cells, and a few simple molecules in carrying out functions to serve survival needs of the organism. High-school benchmarks supply additional detail about the molecules involved in these functions and their role in integrating the work of the various body systems.

At each level of biological organization, a number of connections can be made to maps in *Atlas 1*: to **MAINTAINING GOOD HEALTH** for benchmarks at the elementary- and middle-school levels, to **CELL FUNCTIONS** and **ATOMS AND MOLECULES** for benchmarks at the middle-school level, and to **SYSTEMS** for benchmarks at the high-school level. The *deriving energy from food* strand is closely related to the *Atlas 1* maps on **FLOW OF MATTER IN ECOSYSTEMS** and **FLOW OF ENERGY IN ECOSYSTEMS**. Likewise, the *reproduction* strand has links to the **VARIATION IN INHERITED CHARACTERISTICS** map (also in *Atlas 1*).

### NOTES

The 6-8 benchmark “To burn food for the release of energy...” in the *deriving energy from food strand* describes contributions of the digestive, respiratory, and circulatory systems to this critical basic function. It draws on ideas about energy transformations, burning as a chemical reaction, organs providing cells with basic needs, and interactions and feedback in systems.

Many ideas about basic functions are synthesized in the 6-8 benchmark “Like other animals, human beings...” Students’ understanding of body systems at this level depends on their having familiarity with ideas about systems thinking. In turn, benchmarks about body systems and their subsystems illustrate important aspects of systems in general and contribute to a more sophisticated understanding of systems at the 9-12 level.

Starting at middle school, students can relate knowledge about organs and organ systems to their growing understanding of cells. The organs serve the needs of cells and the specialization of cells serves the operation of organs. The new 9-12 benchmark “The human body is a complex system...” builds on the preceding benchmark “Like other animals, human beings...” and introduces more sophisticated understandings about body systems and links ideas about special functions of different kinds of cells to basic functions of the human organism.

### RESEARCH IN BENCHMARKS

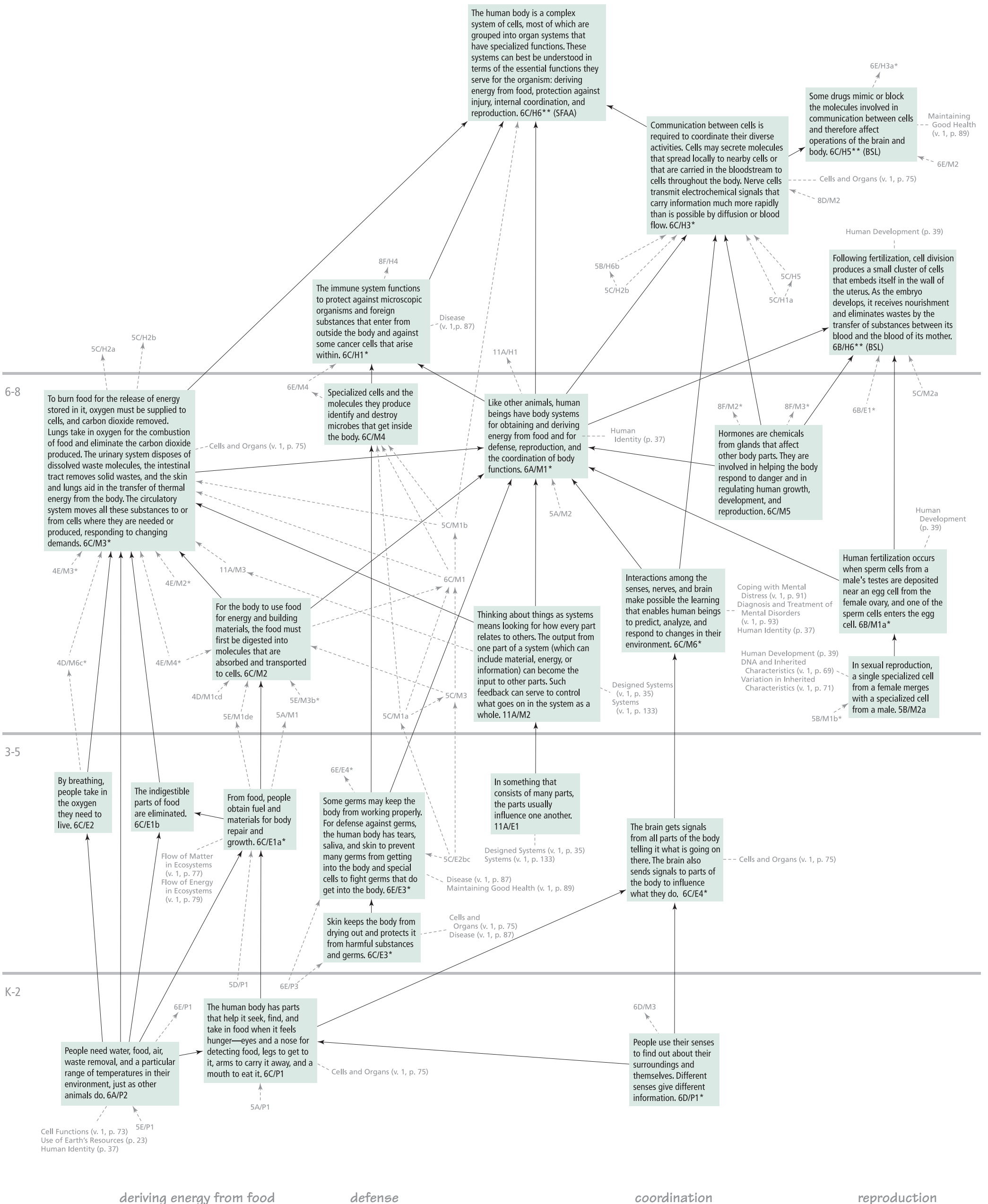
Lower elementary-school students may have little knowledge about internal bodily organs and think the contents of the body are what they have seen being put into or coming out of it (e.g., food, blood). Upper elementary students can list a large number of organs (Gellert, 1962); however, a sizeable proportion of adults has little knowledge of internal organs or their location (for example, few adults can draw the stomach and the liver in reasonable positions) (Blum, 1977).

By the end of 2<sup>nd</sup> grade, students know that thought is needed for different kinds of activities (e.g., motor acts) and as a result, know the brain is required for these activities (Carey, 1985). Fourth-graders know the brain helps the body parts but do not always realize that the body also helps the brain (Johnson & Wellman, 1982). Whether upper elementary-school students can achieve this understanding with adequate instruction needs further investigation. Upper elementary-school students attribute to nerves the functions of conducting messages, controlling activity, and stabilizing the body (Gellert, 1962), but even after traditional instruction about the brain and the nervous system, 5<sup>th</sup>-grade students appear not to understand yet the role of the brain in controlling involuntary behavior (Johnson & Wellman, 1982).

Lower elementary-school students know about circulation and something of the blood’s relation to breathing. Upper elementary-school students realize that the heart is a pump, but they are not aware that the blood returns to the heart (Carey, 1985). Students of all ages hold wrong ideas about the structure and function of blood, the structure and function of the heart, the circulatory pattern, the circulatory/respiratory relationships, and the closed system of circulation. Misconceptions concerning the circulatory pattern, the circulatory/respiratory relationships, and the closed system of circulation are difficult to change (Arnaudin & Mintzes, 1985, 1986).

Lower elementary-school students know food is related to growing and being strong and healthy, but they are not aware of the physiological mechanisms. By 5<sup>th</sup> grade, students know that food undergoes a process of transformation in the body (Contento, 1981; Wellman & Johnson, 1982).

Lower elementary-school students may not know what happens to air after it is inhaled. Upper elementary-school students associate the lungs’ activities with breathing and may understand something about the exchange of gases in the lungs and that the air goes to all parts of the body (Carey, 1985).



Cell Functions (v. 1, p. 73)  
Use of Earth's Resources (p. 23)  
Human Identity (p. 37)

deriving energy from food

defense

coordination

reproduction