

13.4 If It Is So Bad for You, Why Farm?

This question brings us back to some points about evolution raised in earlier chapters. Namely, the key components of evolution are survival to the reproductive years and production of offspring. One documented fact about the Holocene is that human fertility greatly increased during this time. That women gave birth to more babies was likely made possible by the reduced spacing between births in agricultural groups. Simply, because women were settled and not spending time moving about the landscape, they could bear children more frequently. Therefore, a population with a reduced quality of life might still have very high fertility. This combination, of course, is present through much of the developing world, such as in Peru, Bangladesh, Mexico, Thailand, and many African countries.

CONCEPT CHECK

Health Costs of Agriculture

Chapter 13: Our Past 10,000 Years: Agriculture, Population, Biology

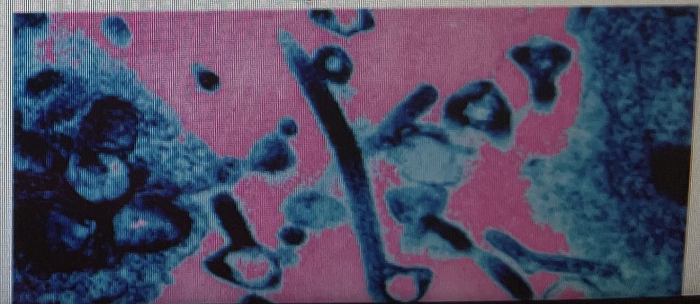
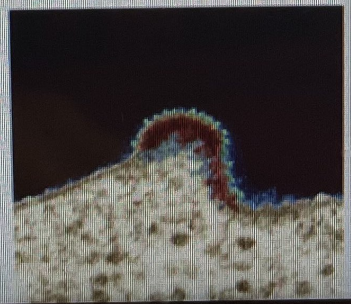
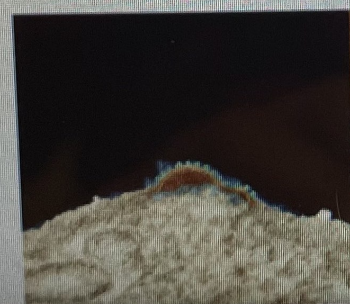
CONCEPT CHECK

Health Costs of Agriculture

Because of population increase, crowding, and poor nutrition, human populations' health declined in many settings globally.

Health Indicator	Hunter-Gatherers	Agriculturalists
Infection (periosteal reactions)	Low	High
Dental caries	Low	High
Child growth and development	Normal	Reduced
Enamel defects (hypoplasias, microdefects)	Low	High
Iron deficiency (porotic hyperostosis, cribra orbitalia)	Low	High
Adult height	Normal	Reduced

We have seen the evidence—a huge record—showing that the adoption of agriculture resulted in the development and spread of infectious disease and a reduction in health generally (Figure 13.23). Agriculture's positive side is that it provides both more calories per unit of land and the resources for population increase. And evolution dictates that organisms, including humans, engage in behaviors that increase the potential for and outcome of reproduction. Human health might have been adversely affected by the adoption of agriculture, but more and more individuals survive to reproductive age and reproduce: that is the central element of success in an evolutionary framework. Agriculture is one of a number of adaptive trade-offs in human evolution. Many of you likely regard production of crops, and agriculture generally, as an entirely beneficial experience. But, as an adaptation, agriculture is part of a culture that represents our unique human adaptation to our environment and is a product of natural selection.



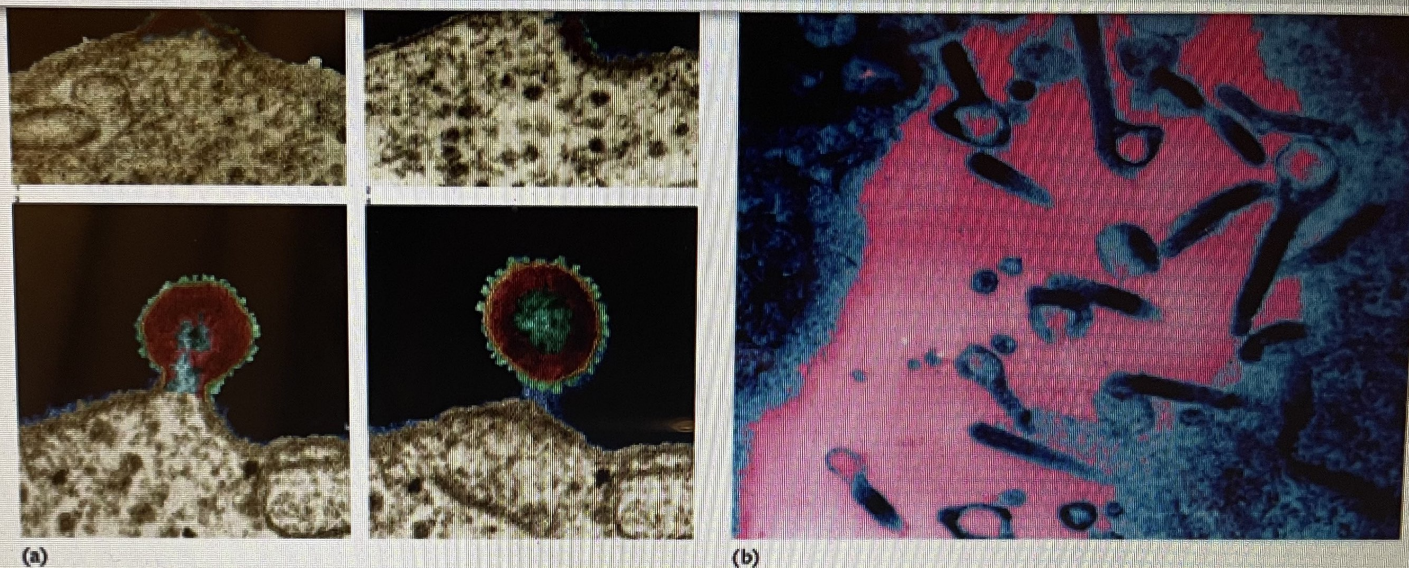


FIGURE 13.23

New Pathogens The pattern of population concentration and increase that started in the Holocene, during the agricultural revolution, established the conditions for the appearance and evolution of old and new infectious diseases. In addition, the conditions have become ripe for the evolution of new pathogens, such as the viruses that cause Ebola and acquired immune deficiency syndrome (AIDS), and prions that cause mad cow disease. **(a)** The AIDS virus, known as *human immunodeficiency virus (HIV)*, infiltrates human white blood cells, an essential part of the immune system. The virus forces the white blood cells to produce more virus particles (red). **(b)** The Ebola virus causes a hemorrhagic fever that can be life-threatening. The virus has a long, filamentous appearance, as shown in this electron micrograph.

The challenges facing humans beginning in the Holocene had their roots long before the agricultural revolution. As discussed in chapter 12, later Pleistocene people had begun to exploit less desirable foods, such as wild plants and aquatic foods. Domestication and especially agriculture were an adaptive response to these challenges and laid the foundation for rapid population expansion and the rise of cities and complex societies. The resulting focus on a limited number of foods

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CHAPTER 13

REVIEW

ANSWERING THE BIG QUESTIONS

1. When, where, and why did agriculture first develop?

- During the Holocene epoch (the most recent 10,000 years), *Homo sapiens* included domesticated plants and animals in their diets for the first time.
- The earliest agriculture occurred in the eastern Mediterranean (the Levant). It arose in 11 other centers independently around the world.

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- Plant and animal domestication may have arisen to feed the ever-increasing human population.

2. How did agriculture affect human living circumstances?

- Agriculture (and associated population increase) resulted in population sedentism and crowding. This provided the conditions conducive to the spread and maintenance of infectious disease.
- Nutrition shifted from a generalized diet to one focused on carbohydrates and poorer-quality protein.
- In most settings, agriculture caused a decline in workload and activity.

3. How did agriculture affect human biological change?

- Poorer-quality diets led to a decline in health as foragers became farmers.
- The shift from hard foods to soft ones resulted in facial bones reducing in size faster than the teeth. As a result, humans now have many more orthodontic issues requiring the artificial straightening of teeth.
- Decreased workload and activity resulted in a general tendency toward increased gracilization of the skeleton.

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- Decreased workload and activity resulted in a general tendency toward increased gracilization of the skeleton.
- The decline in health did not affect human reproductive performance. Human population grew from well under 1 million to perhaps several million by the close of the Pleistocene. Today, the human population exceeds *7 billion*.
- The adoption of agriculture was an evolutionary trade-off: human health was adversely affected, but more individuals survived to reproductive age and produced offspring. The population explosion that resulted from the increased food

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- The adoption of agriculture was an evolutionary trade-off: human health was adversely affected, but more individuals survived to reproductive age and produced offspring. The population explosion that resulted from the increased food supply represents the core of adaptive success.

KEY TERMS

ameloblasts

cribra orbitalia

dental caries

domestication

heme iron

iron deficiency anemia

masticatory-functional

hypothesis

Neolithic

nonheme iron

osteoarthritis

periosteal reaction

porotic hyperostosis

superfoods

treponematoses