

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Weekly Reading HW

HW Wk \_\_\_\_\_

*Directions: Read and annotate the passage below. Then answer the questions.*

### At the Printer, Living Tissue

Someday, perhaps, printers will revolutionize the world of medicine, churning out hearts and livers. For now, though, Darryl D’Lima would settle for a little bit of knee cartilage. Dr. D’Lima has modified an old inkjet printer to put down layer after layer of a gel containing living cells to print cartilage in tissue removed from patients. Although there is still much work to do, his eventual goal sounds like something from science fiction: to have a printer in the operating room that could custom-print new cartilage directly in the body to replace tissue.

Instead of the plastics or powders used in conventional 3-D printers to build an object layer by layer, so-called bioprinters print cells, usually in a liquid or gel. The goal isn’t to create a toy, but to assemble living tissue. In theory, at least, a bioprinter has advantages in that it can control the placement of cells and other components to mimic natural structures.

However, the field of bioprinting has seen its share of hype. News reports often imply that 3-D printed organs are just around the corner. The reality is that there are many formidable obstacles to overcome. For now, researchers have set their sights lower. Organovo, for instance, a San Diego company, is making strips of liver tissue, about 20 cells thick, that it says could be used to test drugs. A lab in Germany is one of several experimenting with 3-D printing of skin cells; another German lab has printed sheets of heart cells that might some day be used to repair damage from heart attacks.

Dr. D’Lima acknowledges that his dream of a cartilage printer is years away. But he thinks the project has more chance of becoming reality than some others. “Printing a whole heart is glamorous and exciting,” he said. “But cartilage might be the first 3-D printed tissue to get into a real person.” One reason, he said, is that cartilage is simpler than other tissues. Cartilage is made of cells called chondrocytes that are relatively low maintenance — they do not need much nourishment. Keeping printed tissue nourished, and thus alive, is one of the most difficult challenges facing researchers.

But cartilage also has its own unique challenges. With cartilage, “we are changing the shape, the composition, the type of cells, even the orientation of the cells,” said Dr. D’Lima. Another challenge is figuring out how to get enough cells for the printer.

1. (RST.9-10.2) The main idea of the passage is that:
  - a. 3-D printers are now printing whole organs like human hearts.
  - b. 3-D printers are now being used to make living tissue.
  - c. Cartilage is a simpler kind of tissue than heart or liver tissue.
  - d. Whole organs are too complicated to print on a 3-D printer.
  
2. (RST.9-10.1) What is the difference between a bioprinter and a conventional 3-D printer?
  - a. 3-D printers print 3-D objects but bioprinters print a 2-D sheet of living cells.
  - b. Bioprinters print a gel or liquid containing living cells instead of plastics or powders.
  - c. Conventional 3-D printers print toys but bioprinters print small organisms.
  - d. Conventional 3-D printers can control the placement of cells unlike bioprinters.

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3. (RST.9-10.4) As it is used in the passage, the word *formidable* means:
- a. Proficient
  - b. Accomplished
  - c. Difficult
  - d. Comforting
4. (RST.9-10.1) Which of the following is NOT one of the 3-D printing projects that researchers are currently working on?
- a. Strips of liver tissue
  - b. Skin cells
  - c. Bone marrow
  - d. Cartilage
5. (RST.9-10.1) Explain how 3-D bioprinters function.

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6. (RST.9-10.1) Why does Dr. D’Lima think that “cartilage might be the first 3-D printed tissue to get into a real person”?

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*Adapted from the article, “At the Printer, Living Tissue” by Henry Fountain for The New York Times, on August 18, 2013.*

