

# ScienceNews

## Activity Guide for Students: Create a Recipe for Life

### Directions:

In this activity, you will research the components and conditions thought to be necessary for life to originate in an environment where life did not previously exist. You will work in groups to develop a recipe for life based on principles from one of several scientific disciplines. Then, you will discuss as a class how evidence from these disciplines contribute to human understanding of the origin of life on Earth and possibly elsewhere in the universe. If this activity is done virtually, your teacher will provide you with online resources and instructions for the components of the activity that will take place online in breakout rooms.

### The setup

After reading the article *Science News* article "[Life on Earth may have begun in hostile hot springs](#)," answer the following question as part of your homework.

1. What did you want to learn more about after reading this article? List at least three questions you have about the origins of life on Earth.

### Class discussion

Discuss the answers to the following questions as a class.

1. What conditions do the scientists mentioned in the *Science News* article propose are required for the formation of organic or biological materials? How do those conditions differ based on the scientist's core science discipline, such as biology, chemistry, physics, geology or astronomy?

2. Are the scientists mentioned in the *Science News* article creating new life in their experiments? Support your claim with evidence and scientific reasoning.

### Research conditions necessary for life

Your teacher will divide you into groups for this part of the activity. As a group, use the *Science News* archives and other internet resources to identify the basic requirements for life. You will use the information to construct a "recipe" for life based on a specific scientific discipline. Search for articles that describe discoveries, experiments or explanations of the origins of life on Earth from the perspective of scientists from your selected discipline.

To keep track of what you find and to share information with your group, use Google docs or another format. As a group, answer the questions that relate to your scientific discipline.

1. Identify the scientific discipline on which you will base your recipe.
2. List some search terms you will use to research articles and resources about the building blocks for life.

### **Biology focus**

1. What are the basic characteristics of life? How do scientists determine whether an entity is living or nonliving?
2. What “ingredients” are necessary for known living things to survive? List as many ingredients as you can, including both complex components and their constituents. Then, mark each ingredient on your list as essential or optional.
3. What environmental conditions are necessary for most living things to survive on Earth? Have any known organisms survived outside of those conditions?
4. What are the prevailing hypotheses in biology that describe how organic compounds might have gotten to Earth or formed on Earth?

### **Chemistry focus**

1. What chemical “ingredients” are essential for life as we know it? List as many substances as you can.
2. How do we determine whether a chemical substance is essential for life? How about whether it is produced by living things?
3. What processes must the ingredients you identified go through to change from their separate identities into a functioning living unit? Describe the steps, in chronological order, that must occur to change the nonliving substances into a living organism.
4. What conditions are necessary for the processes to occur? For example, do the steps require certain concentrations of ingredients or proportions of substances? Do the processes take a certain amount of time or require a certain type or amount of energy?

5. What are the prevailing hypotheses in chemistry that describe how organic compounds might have gotten to Earth or formed on Earth?

### **Physics focus**

1. Physics and chemistry are sometimes grouped together in a discipline called “physical sciences.” How does the focus of physics differ from that of chemistry? How does that affect how physicists view the origins of life on Earth?

2. What sources of matter and energy were likely available on Earth 4 billion years ago? How do living things acquire and use energy today?

3. What processes or conditions required for the origin of living things can be explained by transfers and transformations of energy?

4. What are the prevailing hypotheses in physics that describe how organic compounds might have gotten to Earth or formed on Earth?

### **Earth science focus**

1. What are the conditions on Earth that make it able to support living things?

2. What were the conditions on Earth when it first formed? How are those conditions similar to and different from the conditions on Earth where living things can be found now? At what point in Earth’s history would conditions that could support life have arisen?

3. How do living things on Earth acquire the materials and energy they need to sustain life processes?

4. What are the prevailing hypotheses in geology or earth science that describe how organic compounds might have gotten to Earth or formed on Earth?

## **Astronomy focus**

1. What chemical combinations do astronomers think could signal the presence of life on other bodies throughout the universe?
2. What environmental conditions on other planets, moons or other celestial bodies are scientists studying for clues about the origins of life on Earth?
3. Where else might conditions for life exist elsewhere in our solar system and the universe? Describe why scientists have identified those locations as potentially hospitable to life.
4. What are the prevailing hypotheses in astronomy that describe how organic compounds might have gotten to Earth or formed on Earth?

## **Construct a recipe**

Organize the information you gathered during your research into the format of a recipe, including your “ingredients,” conditions and instructions. Be sure to include as much detail as possible to ensure that someone following your recipe would have the highest likelihood of succeeding.

## **Synthesize a model**

Present your recipe for life to your teacher and to the class. Listen carefully as other groups present their recipes. Then, as a class, discuss the different recipes and construct a final, interdisciplinary recipe for life using the questions below.

1. As a class, choose one recipe to modify to make a final multidisciplinary recipe for originating life. Make changes to the recipe until the class agrees that this is the most complete and likely recipe the class can create.
2. How did the sharing of scientific knowledge and peer review of your work help improve your final recipe? How do these habits enhance the development of scientific theories and the advancement of science?

