

# Living and Dying

Curricular Materials Prepared by  
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## Scientific Summary:

Each living cell on Earth contains DNA. Composed of varying configurations of molecules such as sugars, proteins, and nucleotides, the patterns found in DNA are the coding that gives cells instructions for digesting food, for growth and repair, and for the myriad other functions necessary for an individual organism to live and reproduce. Although relatively stable, DNA often undergoes random changes – which are frequently referred to as mutations. It is through these changes in DNA, as well as through the passing down of successful genes, that life is able to evolve and adapt to its environment at the subcellular level.

Organisms flourish and adapt by being aware of, and responsive to, their surroundings. The ability to see and to sense light is a trait with a long evolutionary path. Even simple forms of life, such as some kinds of bacteria developed sensitivity to light that allowed them to react to their surroundings and increase their chances of survival. The eye, one of the many ways in which living things are able to sense light, is part of a complex and ongoing evolutionary process. Ernst Mayr, the reknowned evolutionary biologist, estimates that the complex water-based eyes found in mammals, fish, and birds have been independently constructed at least forty times since life began. Other types of eyes, such as those of ancient trilobites, are formed from the mineral calcite. These bundled, rod-like eyes were passed down to creatures such as the lobster and the common housefly. Although different from the water-based eyes used by humans, they are not necessarily inferior. Calcite based eyes supply unique advantages such as the ability to see in the violet and ultraviolet range.

Death and violence, although troubling to contemplate, are aspects of life that we must work to understand. Throughout the grandeur and complexity of the universe, death and destruction are present. Stars explode in massive supernovas, elementary particles clash in bursts of devastating energy, and billions of sentient beings reach the end of their lives with each passing day. However, as we have seen, death and destruction can also be moments of unparalleled creativity. The death of ancient stars, for instance, is the source of all of the elements found in life on Earth. Even amongst living beings, predator-prey relationships can be creative moments of reciprocity and coevolution.

### **Discussion Questions:**

1. In the *Journey of the Universe* book, Brian Thomas Swimme and Mary Evelyn Tucker state that “[w]e have such difficulty absorbing the magnitude of the vast amount of adaptive information that life employs because our human life span amounts to a tiny fraction of cosmic time, approximately a millionth of 1 percent” (61). Does thinking about human existence within a broad time scale change the way you think about the role and place of the human in the evolution of the universe? How does thinking about the coevolution of the human with other species within this broad time scale change the way that you understand what it means to be human?
2. “With conscious self-awareness,” state Swimme and Tucker, “we have developed a new kind of sight – insight into deep evolutionary time” (63). What do they mean by this? How is seeing into deep evolutionary time a new kind of sight and what does it show us?
3. In the *Conversations*, Terry Deacon and Mary Evelyn Tucker speak of sentience, consciousness, collective sentience and the ability to be “reflexive.” Imagine that you had to explain these terms to a family member or a close friend. How would you describe the way that you understand these terms to them? How are these terms different from one another?

### **Online Resources:**

- For more information on evolution and the adaptation of life, go to the [National Academy of Science’s Evolution Resources](#) website. Their [section for educators](#) offers an extensive list of educational resources such as links to articles, journals, websites, and more.
- The Berkeley University website entitled [Understanding Evolution](#) has a wide array of useful links and resources for educators. Teachers interested in issues related to evolution might find the [Evolution 101](#) and the [Teaching Materials](#) sections of their website to be particularly helpful.
- Go to the Yale Forum on Religion and Ecology’s website for a [comprehensive list](#) of links to scientific organizations and educational resources. Highlights from this extensive list include: [NASA’s Earth Science](#) website, the [National Science Foundation](#) website, the [Union of Concerned Scientists](#), the [Ecological Society of America](#) website, and the [National Oceanic and Atmospheric Administration](#) website.
- Visit the [National Science Foundation’s website](#) for an exploration of Darwin’s *The Origin of Species* and the ways in which his ideas have changed and been studied over time.
- Visit the [American Museum of Natural History’s website](#) for a wide variety of useful links.

- For information on biodiversity and species preservation, visit the World Wildlife Fund's (WWF) [biodiversity](#) page and the [United Nations Environment Programme \(UNEP\) World Conservation Monitoring Centre \(WCMC\)](#).
- The TED series can be an excellent source of information from top scientists. [This talk by evolutionary biologist, E.O. Wilson](#), for example, brings a deep knowledge of life's diversity into conversation with religion.
- The [Journal of Evolutionary Biology](#) and [Evolution](#) are two of the many peer-reviewed journals that publish academic articles and scientific studies on evolutionary biology. [Nature](#), an international journal of science, is another useful online resource.
- The PBS website has an extensive [education page](#) on evolution.

### **Print Resources:**

- [Journey of the Universe Bibliography](#).
- [Science Bibliography from the Yale Forum on Religion and Ecology](#).

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