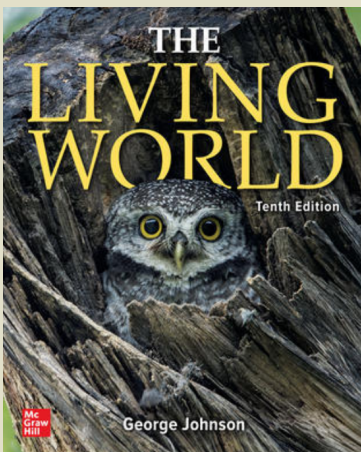


List of Changes



The Living World 10th Edition

George Johnson

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available in



connect®

We are all of us scientists. We live in a world where science impacts our lives daily. Atomic bombs are the product of science, and so are antibiotics and cancer treatments. This year human babies had their genes edited, and climate change was debated in the halls of congress. What are we to make of the science that is forming the world in which we will live our lives? How do we know what to fear and what to seek? The first step is to understand how science is done. How does a scientist "know" something? Understanding how to evaluate a scientific claim has become a necessary tool for every educated citizen and the changes in this edition further demonstrate that.

SEE LIST OF CHANGES ATTACHED.

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Editing Your Genes. The most exciting advances since this text's last edition have involved the wide-spread application of a new, easy-to-use tool called CRISPR that allows researchers to edit genes. As described in Chapter 13, CRISPR is being used to treat human diseases on many fronts, including developing a potential cure for AIDS, facilitating organ transplants from pigs (!), correcting disease-causing mutations such as cystic fibrosis and sickle-cell disease, and genetically modifying a patient's own blood cells to fight leukemia.

CRISPR-edited Human Babies. The invention of gene editing with CRISPR has led quickly to an ethical nightmare. As recounted in Chapter 13, a Chinese researcher In November of 2018 announced that he had used CRISPR to edit the genomes of human babies! Do you see the problem? In the CRISPR applications described in the paragraph above, DNA was edited in the somatic (body) tissues of adults, changes that could not be passed on to future generations. As described in the new edition, the Chinese researcher edited the DNA of a single-cell embryo. This alters all the tissues that derive from it, germ-line as well as somatic -- the changes he created with CRISPR will be passed on in the germ line to future human generations.

Metazoan Tree of Life. The classification of animals has until recently been based on close examination of their bodies, animals with similar traits being grouped together. Traits shared by many kinds of animals -- like having body segments --have been judged fundamental. With the advent of DNA sequencing, genomes can now be compared directly, which has led to the more detailed understanding of the animal family tree presented in Chapter 19.

The Opioid Crisis. Opioids have been used as pain killers since 1806, when a German chemist isolated the active chemical ingredient of opium, calling it morphine. In an attempt to lessen addiction, morphine was chemically modified in 1898, but the modified form, heroin, proved even more addictive. In 1924, a substitute opioid was invented called oxycodone. Marketed as less addictive than heroin, it became widely used in the 1950s. By 2010, a continuous-release form called OxyContin reached over \$3 billion in annual sales. Tragically, pharmaceutical marketing had downplayed the danger of their new painkiller: as detailed in Chapter 28 these next-generation opioids are actually quite addictive. And addicts often seek more powerful forms like fentanyl, increasing the danger of fatal overdoses. 47,600 Americans died of opioid overdoses in 2017, almost triple the number of fatal overdoses ten years earlier. On the day you read this, a hundred more will die.

A Sense of Where You Are. How is a basketball superstar like LeBron James able to sink a jump shot without looking at the basket? Seeking an answer to this question, explored in Chapter 28, has led to two recent Nobel prizes and a lot of rat races through mazes. Researchers were able to show that your brain keeps a "map" of where you are in three dimensions and constantly updates it as you move through space.

Human Sexual Orientation. Adult sexual behavior is determined by the activation, early in development, of fetal genes located on the Y chromosome that lead to secretion of the hormone testosterone. This testosterone acts on the brain of the fetus in a way that determines that individual's future sexual behavior. As a rough measure, the sexual orientation of the individual will be to persons of the opposite gender (heterosexual or "straight"), to the same gender (homosexual), or to both genders (bisexual). Non-heterosexual individuals commonly refer to themselves as LGBTQ (lesbian, gay, bisexual, transgender, queer). The CDC estimates the number of these individuals as 5% of the total U.S. population -- some 13 million LGBTQ individuals. As discussed in Chapter 30, their sexual orientation was determined before birth, and is not subject to later change.

Role of Volcanoes in Mass Extinctions. A large asteroid slammed into earth 66 million years ago, the same time dinosaurs went extinct. Recent excavations have revealed a site in North Dakota with clear evidence of the impact, a jumbled mess of fossils including fish that had choked to death on glassy particles raining down from the fireball. Did the dinosaurs die on this day? Perhaps. Perhaps not. Other mass extinctions are not correlated with similar impacts, while almost all ARE correlated with huge volcanic eruptions, as described in Chapter 18. This was even true. Perhaps, 66 million years ago, the asteroid impact triggered the volcanic eruptions, like setting off a bear trap with a nudge.

Vaping. Fearing the lung cancer caused by chemicals in tobacco, People are no longer smoking so much. While 40% of Americans smoked in 1965, only 16% did in 2017. The commercial answer to this lost market? Sell the addictive nicotine to consumers without the tobacco! As described in Chapter 24, e-cigarettes release nicotine as a vapor (hence the term *vaping*). An e-cigarette called a juul (pronounced “jewel”) vaporized a liquid that is 5% nicotine, a powerful amount. Juul users quickly become addicted to nicotine, just as cigarette smokers did, and a lot of teens are smoking juuls – nearly 21% of high school students vaped in 2018. There are serious efforts underway to regulate e-cigarette sales, driven by reports by the CDC that over the course of 2018, the number of high school students using tobacco products increased by 38% in a single year, almost entirely e-cigarette smoking.

Global Warming Revisited. Perhaps the greatest challenge facing the future is the increase in global temperature resulting from increases in the CO₂ content of earth’s atmosphere. While the world’s scientists are almost universal in blaming the increase on the burning of fossil fuels, there is considerable discussion among the general public about the reality of the problem and the need for action. Taking a closer look in Chapter 38 we address an array of questions about what is happening now, what scientist predict will happen soon, and what can be done.

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