DNA Barcoding of Life

Traditionally, taxonomists relied on anatomical traits to tell species apart. Although useful, physical features have several limitations when used as the only means to define a species. The identification of anatomical traits often requires the assistance of taxonomic experts that specialize on a specific group of organisms. In recent time, the number of species has far exceeded the number of available experts. This puts the cataloging of the world’s biodiversity on a slow path—much slower than the rate at which our natural areas are disappearing. So far, scientists have identified only about 1.5 million species out of a potential 30 million.

The Consortium for the Barcode of Life (CBOL) proposes that any scientist, not just taxonomists, could use a sample of DNA to identify any organism on Earth. Just like a barcode, or UPC code, is a unique identifier of products on a store’s shelf, the CBOL suggests it would be possible to use the base sequence in DNA to develop a barcode for each living thing (Fig. 19A). The order of DNA nucleotides—A, T, C, and G—with a particular gene common to the organisms in each kingdom would allow researchers to track the role taken by numbers in the barcode used in warehouses and stores.

Speedy DNA barcoding would not only be a boon to efforts to catalog a rapidly disappearing biodiversity, but it would also have practical applications. For example, farmers could readily identify a pest attacking their crops, doctors could rapidly identify the correct antibiotic for snakebite victims, and college students could identify the plants, animals, and plants against an ecological field trip. Already, the CBOL has accumulated hundreds of thousands of DNA barcodes representing species across the diversity of life.

Identification of fishes sold in markets and sushi restaurants in Manhattan, New York. They collected 60 fish samples from 4 restaurants and 10 grocery stores in Manhattan, which they sent off to have the DNA segment, the barcode, sequenced and compared to a global library of fish barcodes representing nearly 5,500 fish species. Their results sent a wave of controversy throughout Manhattan and beyond:

2 of the 4 restaurants, and 6 of the 10 grocery stores, sold fish that were mislabeled. Most of the mislabeled fish were being sold as more expensive species. For example, Mozambique tilapia, a commonly farmed fish selling for $1.70 per pound wholesale, was being sold as blackmore tuna at $8.50 per pound (Fig. 19C). In one case they found an endangered fish, the Acadian redfish, being sold as red snapper.

Questions to Consider

1. How might DNA barcoding be used by systematic biologists to speed up the classification of biodiversity?

2. Propose additional ways that DNA barcoding could aid in managing modern societal problems, such as the conservation of biodiversity, global warming, crime, and disease.