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12/8/10
Atikkan
BI106

DNA Use in Species Identification-Barcoding: *Item Scanning Technology Applied to Organisms*

**By** Ronnie Stepanik

**Abstract** – In my research I explore what DNA Barcoding is. I then review a study regarding duckweeds that assesses whether proposed DNA markers for the species are efficient in their identification.

**Introduction**

The concept of DNA Barcoding is a topic that I previously knew little about. Through my research I sought to understand the underlying reason for why Barcoding studies have been developed and examine a specific application for Barcoding data or how this data is interpreted and reviewed in the scientific community.

**Background information**

The most valuable piece of information to consider is to define what Barcoding actually is. Invented by Canadian geneticist Paul Hebert, as Cristian Samper writes, DNA Barcoding can be best conceptualized as how "11-digit UPC barcodes are able to distinguish millions of items [in a store]; he posited that a short stretch of DNA code could likewise be able to distinguish species of flora and fauna" (Samper). The potential in being able to identify species based on DNA rather than solely morphological characteristics could have many applications. One such application, as Kevin McCann writes, could be to better understand both the "network topology and energy flux" within the ongoing debate regarding the consequences of declining biodiversity. As Samper shows, barcoding could be used in monitoring water quality and reduce bird airplane collisions. The objective of the Consortium for the Barcode of Life (CBOL), based at the Smithsonian's National Museum of Natural History, wants to "compile a global reference library of DNA barcodes" (Samper) to support these applications.

**Discussion**

**Findings:**

My research led me to look into the DNA Barcoding process of the Lemnaceae. As the report summarizing this study explains, Lemnaceae known as duckweeds are "all aquatic plants that grow on or below the surface of the water all over the world" (Ermakova). As is further explained in the report, the duckweeds are "ideal material for physiological, biochemical, and genomic studies" due to their rapid growth and size. Furthermore, due to their growth rate being "sensitive to a wide range of environmental contaminants such as metals, nitrates, and phosphates" (Ermakova), the Environmental Protection Agency uses duckweeds to measure water quality. This aquatic plant, therefore, has valuable applications. However, due to "few and somewhat variable morphological characters and

rarely emerging flowers or fruits make identification of duckweeds extremely difficult even for professional taxonomists" (Ermakova).

The goal of the completed study was to "determine whether one or more of the markers proposed by the CBOL Plant Working Group would serve as an optimal marker for species-level identification within the family Leminaceae" (Ermakova). It was then shown that the atpF –atpH noncoding spacer could serve as a universal DNA barcoding maker for the species-level identification of duckweeds" (Ermakova).

**Significance of the findings**

As it was concluded in the referenced report, combining these DNA markers with "traditional classification methods…would permit these species to be classified in a highly reproducible and cost effective manner" (Ermakova). This would allow the industries that utilize duckweed plants to distinguish necessary stocks in order to meet their respective outcomes much more efficiently.

Aside from the use of DNA markers in identifying materials needed in human industry, as it is explained by Ermakova and the team, barcoding can be used to identify species in specific conservation efforts, focusing in on the species needing of most assistance.

**Bibliography –**

Ermakova, Marina, et al. "DNA barcoding of the Lemnaceae , a family of aquatic monocots." *BMC Plant Biology* 10 (2010): 205. *Gale Science In Context*. Web. 8 Dec. 2010.

McCann, Kevin. "Protecting Biostructure". NATURE. Web. http://www.nature.com/nature/journal/v446/n7131/full/446029a.html. 8 Dec 2010.

Samper, Cristian. "Barcoding 101." *Smithsonian* Feb. 2008: 26. *Gale Science In Context*. Web. 8 Dec. 2010.

**BI1060909 FINAL EXAM – Due no later than Thursday, 9 Dec 10, 23:59:59 EST**

**Your individual 'general' topics are indicated below. You may not change or trade any of your topics – please do not ask.**
**Work must be submitted electronically. Late work will not be accepted – there are no exceptions.**

**'I sent it, but ……' is not an acceptable excuse. No your dog cannot eat your computer. Back it up so that if your dog eats your thumb drive you have another copy.**

**Joking aside: You are responsible for assuring that I receive it.**

**EXAM FORMAT**

Follow the format given below. If you fail to follow the format, it is an automatic 25% deduction. To avoid the format penalty, cut and paste the following outline and fill in the blanks

I. General topic assigned
II. (5%) Title of your article
III. (5%) Author [your name]
IV. (10%) Abstract – summary of what you researched and found
V. (20%) Introduction
    1. Why you chose the particular area/topic/organism/ecosystem to study
    2. What are some of the background information on the topic
VI. (40%) Your discussion
    1. What are your findings
    2. What is the significance of those findings
    3. Why is the overall topic and the findings important from the standpoint of the marine environment
VII. (20%) Bibliography – minimum 3 citations, with due justifications for any citation that is an URL.

Each of the papers is to be no less than a page, but no longer than 2 pages. Narrow down the topic so that it is manageable within those limits.

As always – citations are essential. **Minimum 3 per topic**; again, when using an URL as a source, justification is needed. Let's see if we can tighten up the justifications – just because it was authored by a Ph.D. is not sufficient grounds for believing it.

In your papers, the more you "connect the dots", the more points you will score. That is just giving me facts is OK, but won't earn that 90% + grade. Show me you understand concepts.

**Example**: If your topic is ocean salinity, telling me about the psu, o/oo, etc., and the various salts & their significance is OK, but that will get about a C+.
Now, if, after you cover the above ocean salinity related material in a paragraph or two, you write an expose on how salinity changes with sea ice formation, what impact that has on thermohaline circulation, polar bear ecology and/or seal survival, you are marching towards an A.

Most of what you present should come from literature research based on material covered in the lectures.

**Bottom line – teach me!**

I suggest that you consult me on your exact topic choices to assure that it meets the criteria