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Opening Convocation remarks, Aug. 24, 2016

All of us come to Sweet Briar from somewhere else. Some of us seem to have settled here permanently but **you guys**, you students, are seasonal migrants. This week, you migrated to campus from Mongolia and China, from California and Florida, from Lovington and Lynchburg.

In the animal behavior textbook I use, **migration is defined as a regular movement back and forth between two relatively distant locations by animals using resources concentrated in these sites.**

What are the resources concentrated here, attracting young women regularly each year between August and May? Faculty mentors, coaches, horses, trails, books, computers, and peers.

I'd like to propose to you that migrating animals, and more specifically migrating monarch butterflies, can give us an interesting perspective on you, on Sweet Briar students. Let's see if I can persuade you that this is so.

Monarch butterflies migrate in the fall from all over the eastern United States to Mexico, where they spend the winter, and then they migrate in the spring back to the United States.

For decades, people curious about this migration have been putting tags with identification numbers on monarch butterflies' wings. When someone finds a tagged butterfly and reports the finding, we have data on the distance and direction that butterfly flew. This is an **extrinsic** tag, something a person added to the animal.

Extrinsic tags of your origins include driver's licenses and license plates, T-shirts naming your high school band mates, and caps decorated with high school mascots. When you leave Sweet Briar, your class ring will be an instantly recognizable extrinsic tag.

More interesting, I think, is the fact that monarch butterflies have **intrinsic tags** of their geographic histories. And so do we.

At the beginning of my talk I referred to you collectively as "**you guys**" rather than "y'all" or "you all" or "you people" or "all of you." Other clues of my origins are that I say soda rather than pop, sneakers rather than tennis shoes, and I call a light rainstorm when the sun is out a sunshower. [I thought almost everyone said this, but apparently I'm wrong.]

These and other decisions of word choice and pronunciation allowed an online dialect survey to correctly pin my origin as near NYC. (In fact, I grew up primarily on Long Island just east of NYC.)

While many birds have dialects, monarch butterflies do not. But monarchs have at least two chemical markers that reveal information about their geographic histories. One of these systems is shared with all living things, including ourselves.

As Guionites know, the major chemical building blocks of living organisms are carbon, oxygen, hydrogen, nitrogen and sulfur. These are also the primary elements in aquatic systems and in the atmosphere.

Each of these chemical elements occurs in nature in multiple stable forms, called **stable isotopes**, which are atoms with the same number of protons, but a different number of neutrons.

The commonest isotope of hydrogen, for example, has one proton and zero neutrons. A less common “heavy” isotope of hydrogen, called deuterium, has one proton and one neutron.

What matters for us are the following:

1. Isotope ratios (heavy:light isotopes) vary geographically, and over time, and ecologically. For example, hydrogen isotope ratios in rainfall vary across North America in a well-documented pattern, and carbon isotope ratios vary in marine systems.
2. Organisms’ tissues reflect (sort of) the isotope ratios of the organisms’ inputs at the time the tissue is formed. For plants, these are the isotope ratios in rainfall, soil and atmosphere; for animals, the isotope ratios in our food. That is, isotopically, you are what you eat.

These facts have made stable isotope analysis a major tool in a lot of disciplines, including archaeology, climatology, plant physiology, geology and ecology.

OK, let’s get back to migrating monarchs and migrating students. Metabolically inactive body parts, such as our hair, and butterfly wings, lock in isotopes indefinitely. These reflect where the animal was, or what it was eating, during the short period when that tissue was growing.

Isotope ratios in a monarch’s wings, constructed while the monarch was a pupa, reflect where it lived as a caterpillar and pupa.

In tissues that are metabolically active, however, profiles of some isotopes can change over days, weeks, months.

What this means is that as monarchs migrate and then settle into their winter home in Mexico, they both retain the geographic history of their earlier life, and pick up indicators of their second home. They integrate their past and their present.

You've been drinking Sweet Briar's water for several days, and the cells lining your stomach are already showing changes in their hydrogen isotope ratios. Your muscle cells will change more slowly. Four years at Sweet Briar will not affect the isotopic makeup of your dental enamel.

What is my takeaway message to you?

You will change at Sweet Briar. Some of your slang, food preferences and dress habits will change easily and quickly. Habits of mind, intellectual passions and life goals will change more slowly. You, like the monarch butterfly, will retain evidence of where you were before, and also accumulate evidence that you migrated **here**.

When you are as old as your professors and your grandparents, you will still retain some of Sweet Briar's influences on your interests, belief systems, and loves.

Your life journey is much longer and much more complicated than the monarch butterfly's, allowing you to soak up experiences and blend influences across the planet and across time. Getting to know you during your years here, and watching your life journeys afterwards, is one of your professors' greatest joys.