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1) How did my career get started?

Both of my parents were educated in botany, my father in paleobotany and my mother in plant biology. In 1961, as a second-year college student, I listened intently as my paleontology professor, Larry DeMott, explained to the class that the pre-Cambrian (pre-~550 million-year) fossil record was completely unknown, that this missing fossil record posed the “greatest unsolved problem in all of Natural Science,” and that it had remained unsolved since Darwin first highlighted the problem in his 1859 *Origin of Species*. I was skeptical, to say the least. How could this possibly be true? After all, 100 years, a full century had passed since Darwin’s days! Someone somewhere simply *must* have found evidence of pre-Cambrian life!

After checking Darwin’s opus (in which he states that this missing record was “inexplicable,” thus confirming Professor DeMott’s judicious assertions) I journeyed over to the college library and found that only two scientific papers had been written about the problem in the preceding 20 years. Because to me – a fledgling know-nothing college Sophomore – both the lack of evidence and the lack of interest in the problem made no sense, I set out to solve the problem. Many of my father’s friends, virtually all professional paleobotanists, tried to dissuade me – “others have tried, all have failed” – but I was not deterred.

Over the years I have had quite a lot of success (luck?) discovering the first cellularly preserved Precambrian



fossils in Australia, India, Russia, and South Africa, “spreading the word” across the globe, introducing five novel analytical techniques now used by scientists worldwide, and helping to establish a new international, interdisciplinary field of science, Precambrian paleobiology. **In 1993 this work led to my report of the oldest cellular fossils now known in the geological record (~3.5 billion-year-old photosynthetic bacteria, methanogens and methanotrophs), and, thus, extension of the known fossil record seven-fold from that known in Darwin’s time.**

The “take-home lesson”: if you as a college student think the prof is mistaken or that the proclaimed assertions make no sense, check out what the prof said – you just might be correct! And, after you have established the facts, don’t be dissuaded by naysayers. There are only two ways that you can make a mistake: either you don’t understand the problem, or you are asking the wrong questions, and, with a bit of effort, both of these errors can be corrected!

2) What do I consider my most important contributions to plant science research?

As noted above, **probably my most notable contributions have been** my work discovering the first cellularly preserved Precambrian fossils on multiple continents, introducing several new highly useful analytical techniques, helping establish the new international, interdisciplinary scientific field of Precambrian paleobiology, discovering and describing the oldest cellular fossils now known in the geological record, and, thus, *extending the known fossil record by a notable seven-fold.*

In my latest book (*A History of Earth’s Biota – The Blooming of Life*, 2022, Cambridge Scholars Publ.), I highlight and explain another overlooked major factor in life’s evolution, namely the *sequential co-evolution of plants and animals*, with plants leading the charge by colonizing new previously unoccupied habitats (e.g., marshy lowlands then, later, upland areas) and, after some 50 to 60 million years, each such advance being followed by animals invading the new locale in search of food. First **among these** were amphibians, with their alternating water-land life cycle invading the marshlands and, later, reptiles with their hard-shelled eggs (the animal equivalent of plants’ hard-shelled seeds) moving into the uplands. In other words, the “eaters” following the pioneering “eatees.”

Why has this obvious interrelationship been so commonly overlooked? In part, of course, it is because the plants-first, animals-second sequential evolutionary events are separated in both the marshlands and highlands by tens of millions of years,

a factor that has no doubt led some to assume that they are not related. But, I think, the primary reason is the markedly separate emphases of paleobotanists and paleozoologists – as a whole, neither group having much knowledge of, or even interest in the findings of the other. This bifurcation is fostered by the structure of our academic institutions, with paleobotanists housed in the Life Sciences and paleozoologists largely in the Physical Sciences, and it is detrimental to our understanding of the natural world. After all, *Nature is not compartmentalized!*

3) What impact has ASPB had on my career?

I much enjoy the annual meetings (when I am able to attend) and look forward to the various botanical publications which I search through to keep up with the literature in my areas of interest and search assiduously for articles dealing with *Nelumbo nucifera* (Buddhism's Sacred Lotus), the primary research interest of my wife, ASPB member Jane Shen-Miller.

4) What advice would I offer a young person considering a career in plant biology?

As suggested above, if you as a college student think the prof is mistaken, check out what the prof has said – you just might be correct! There are only two ways that you can make a mistake: either you don't understand the problem or you are not asking the right questions, errors that with a bit of effort you can easily rectify. **Most importantly, be creative, think "out of the box," and believe in yourself!** Science, and plant biology in particular, is truly **GREAT FUN!**