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THE DISCOVERY OF BIOLOGICAL ICE NUCLEI: EARLY SUCCESSES, MISSTEPS AND SOME REMAINING QUESTIONS.

Schnell, Russ
NOAA

In the mid-1960s Gabor Vali refined the drop freezing method of detecting freezing nuclei that allowed for quick and unequivocal detection of active ice nuclei, and their activity spectrum, over a wide temperature range. His early work suggested that the more fertile a soil, the more ice nuclei active at -5 to -6 C it contained. But it took a year of research beyond that to realize the active ice nuclei were coming from the organic component of the soil, and another 6 months to determine that well decayed leaves were the probable source of the ice nuclei. These nuclei were named leaf derived nuclei (LDN). In an attempt to follow what was thought would be a slow chemical release of the ice nuclei from green leaves as they decayed, to our great surprise ice nuclei active at -1.5 C were produced in the moist leaf slurry. In an as yet unexplained action, the author put these samples into frozen storage and never thought to test them again for some living entity. It was one year later that a repeat of the earlier leaf decay experiment led to the identification of living P. syringae bacteria as producing active ice nuclei. These nuclei were named bacteria derived nuclei (BDN). In retrospect, what could have been a two year project, took four. That was 30+ years ago. Yet today, the process of how the BDN become LDN (assuming they do) is still unclear. Also unknown to this day is the true role of BDN and LDN in atmospheric ice nucleation processes even though it is believed they are important. How then to address some of these unknowns? It would seem that one could trace a genetic marker for the ice nucleus protein produced by BDN from its formation in the coat of the bacteria through to its appearance in LDN, and by extension look for that marker in the atmosphere and in ice nucleation sites in young ice crystals collected within clouds.