Air & Water Borne Diseases

Lannoo. Air Water Borne Diseases 2012, 1:1
http://dx.doi.org/10.4172/2167-7719.1000e102

Editorial Open Access

"Funeral by Funeral, Theory Advances"

Michael J. Lannoo*

Department of Anatomy and Cell Biology, Indiana University, School of Medicine–TH, USA

In 2003, the economist Paul Samuelson famously wrote, "funeral by funeral, theory advances." It was, in fact, a more terse and therefore better adaptation of the physicist Max Planck's 1940s quip "science progresses funeral by funeral." The primary thought conveyed here is both cynical and humorous—cynical because theory does not always advance through a release from constraints; funny because it so frequently does, and we often find humor in a warped view of the truth. In biology, single theories are rarely universal. But theories can be beautiful, and no one wants to destroy beauty, especially when they are our own creation. Beautiful theories, well defended, can influence lines of thought for generations. Too bad, because despite such resistance, a fuller version of the truth always, eventually, emerges; Salieri could hold back Mozart for only so long. And while the Planck/Samuelson quotes focus on less than admirable human behavior, the purpose here is to twist the thought to focus on amphibian declines, disease, epidemics, and stemming the effects of human impacts, while we still can.

Amphibian declines are iconically signaling the Anthropocene, the geologic period identified by human domination of the environment. While most amphibian declines likely are caused by habitat loss (including fragmentation, shredding, and successional processes), there can be no doubt that amphibian populations have been lost or compromised by exposure to pesticides, metals, other xenobiotic chemicals, and UV-B radiation; not to mention acidification of wetlands and introduced invasive species. There can also be no doubt that disease—especially exposure to the chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*)—has been decimating amphibian populations and species. In fact, it is now clear that chytridiomycosis was the "mysterious" cause of amphibian declines that generated the first concerns about global amphibian declines. Linking these thoughts, *Bd* infections manifested through the disease chytridiomycosis are signaling the Anthropocene.

The early panic that ensued as amphibian species in Central America and Australia were wiped out and chytridiomycosis was viewed not just as an epidemic but as a amphibian pandemic, has been replaced (although the threat of *Bd*-driven extinctions remains very real in many parts of the world) with a fuller, richer, more nuanced perspective on this pathogen and its disease. As bodies were collected and necropsies done, *Bd* was described, factors of its life history were worked out, strains were identified, and it was discovered to have been in North America for decades. Tolerance was documented through genetic, immunologic, and microbiological processes, and certain species were identified as carriers. More recently, seasonal and ecological factors have been shown to be important in the spread and intensity of *Bd* infections. Among species that live in seasonal climates, *Bd* infections appear most intense during breeding, in the cool, wet springtime. Chytridiomycosis-related deaths occur following breeding, survivors may clear the infection in upland habitats. Funeral by funeral, theory advances.

Theoretical advances have led to practical advances. Animals in harm's way have been collected and housed in sterile facilities. Standardized biosecurity protocols to treat and prevent infection have been established. For some species, the last of their kind are being held in these facilities. This is the penultimate limit to the idea that "funeral by funeral, theory advances." Theory has gotten us to the point where, for animals in captivity, species funerals have more or less stopped.

Now comes the hard part—making that last leap from survival in captivity to survival in the wild. That is, we must now develop in vulnerable species the one or more forms of *Bd* tolerance (either to infection outright or its intensification into disease) now enjoyed by surviving species, so that tolerant members of extirpated species may be released back into their natural, native habitats. Some of the brightest minds of our generation are working on this issue. And let us now hope now for this one more—final—theoretical advance, so we can stop the funerals.

Acknowledgements

Special thanks to Joe Mendelson, Priya Nanjappa, and Susie Lannoo for reading and commenting on earlier drafts of this ms.

***Corresponding author:** Michael J. Lannoo, Professor, Department of Anatomy and Cell Biology, Indiana University, Terre Haute, Indiana, USA, Tel: 001-812-237-2059; E-mail: mlannoo@iupui.edu

Received December 15, 2011; **Accepted** December 27, 2011; **Published** January 05, 2012

Citation: Lannoo MJ (2012) "Funeral by Funeral, Theory Advances". Air Water Borne Diseases 1:e102. doi:10.4172/2167-7719.1000e102