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Q & A

Mark Blumberg

Mark Blumberg is the F. Wendell Miller Distinguished Professor and Chair of the Department of Psychological and Brain Sciences at the University of Iowa. As an undergraduate at Brandeis University (1979–1983), he studied Physics and Philosophy. He did his doctoral work in Biopsychology at the University of Chicago (1983–1988) and focused on developmental psychobiology for his postdoctoral training at Indiana University (1988–1992). He has been at Iowa ever since, where he studies the development, neurobiology, and functions of sleep. Blumberg was a recipient of an Early Career Award from the American Psychological Association and a MERIT Award from the National Institutes of Health. He has served as Editor-in-Chief of Behavioral Neuroscience *and President of the International Society for Developmental Psychobiology. In addition to co-editing the* Oxford Handbook of Developmental Behavioral Neuroscience*, Blumberg is the author of several books of general science, including* Freaks of Nature: What Anomalies Tell Us About Development and Evolution*.*

What path led you to science? I trace my origins as a scientist back to my childhood dinner table where my father loved to argue (he called it debate) with my sisters and me. He was relentless — no matter the subject. And he never admitted defeat. Nonetheless, from these early experiences, I began to learn the rudiments of argumentation. Years later, I came to appreciate the larger lesson: that we benefit from pushing our arguments to their limits as a means of revealing flawed assumptions. In other words, an argument should not only be about persuasion but also about self-discovery.

As a child, I was fed a daily diet of religion in school. My childhood vision of centuries of rabbis arguing about the same set of books initially impressed me but ultimately repelled me. That repulsion opened a door for me to a different life. As I came to realize, the bible is a closed dataset. I prefer open datasets. I prefer science.

These early experiences made more sense to me after I began to study formal logic and philosophy of science as an undergraduate at Brandeis University. I also studied physics, and this reinforced the value of thinking about limiting cases to test the soundness of an argument. Along a parallel path, I was inspired by Frank Manuel — a towering figure at Brandeis at the time — whose seminars on intellectual history nicely complemented my two majors. Manuel introduced me to David Hume's *Dialogues Concerning Natural Religion*, a provocative little book with an exposition on the argument from design that influenced my thinking for decades. Manuel was imposing and intense, admonishing his students to 'get into the guts' of whichever philosopher or scientist we were reading that week.

The yin and yang of physics and philosophy was intellectually satisfying but did not propel me toward a career: the impetus for that was provided by another Brandeis professor, Art Wingfield. Despite my lack of preparation, Art graciously accepted me into his cognitive science laboratory. My senior year in his lab convinced me that a life in science was possible.

With a background such as yours, how did you fare in graduate school? I was not a stellar student at Brandeis, but I was nonetheless accepted into the Biopsychology doctoral program at the University of Chicago. In graduate school, with Howard Moltz as my mentor, everything finally clicked. Howard introduced me to the ideas of T.C. Schneirla, Gilbert Gottlieb, and Danny Lehrman, the intellectual forebears of developmental systems theory. He also taught me the craft of scientific writing; his edits were densely scribbled pencil notes with a hint of pipe smoke that wafted from each page.

During my first year of graduate school, Allan Rechtschaffen — a pioneering sleep researcher — published his experiment on the fatal effects on rats of prolonged sleep deprivation. It was an exciting time. I took Rechtschaffen's graduate course

on sleep and devoured every anecdote. By the end of that term, I knew that someday I would study sleep.

In the end, Howard proved to be quite a challenge for me, as he was for many of his other students. When I presented him with the final version of my dissertation, he wrote a note that I still keep inside my bound copy: "it will most likely 'play in Peoria,' so just submit it." Not long after, he voted 'no' at my dissertation defense. Eventually, I secured Howard's approval and graduated. But I walked away from that experience with a deep respect for the immense power that mentors can wield over the lives of young people.

Martha McClintock, another Chicago professor, provided invaluable guidance to me throughout my graduate career. Among other things, she taught me how our ways of observing and interpreting behavior are shaped by who we are and how we have been enculturated. As graduation approached, Martha introduced me to Jeff Alberts, who became my postdoctoral mentor and then lifelong friend. Jeff is one of the most lyrical and elegant science writers I know and one of the most creative thinkers as well. While working with Jeff at Indiana University, I was fully committed to studying development and never looked back.

Do you have a scientific hero? The incomparable comparative physiologist Knut Schmidt-Nielsen is kind of a hero to me. I have read and reread his

seminal textbook *Animal Physiology: Adaptation and Environment* and his classic book on body size *Scaling: Why Is Animal Size So Important?* Schmidt-Nielsen's work and writings informed much of my own research on thermoregulation and my first book, *Body Heat: Temperature and Life on Earth*.

Why did you decide to write books of popular science? There came a time, midway through my career, when I wanted to express myself beyond the constraints of technical science writing. As an avid consumer of popular science, I wanted to give it a try. The writing culture at the University of Iowa also inspired me. In quick succession, I wrote books on temperature regulation, the developmental origins of species-typical behavior, and the links between developmental anomalies and evolutionary change. Although the time devoted to writing these books slowed progress in my lab, the writing process was invigorating and helped to clarify my thinking on topics that lie at the heart of my research.

Do you have a favorite paper or science book? My favorite paper is Daniel Lehrman's 'A critique of Konrad Lorenz's theory of instinctive behavior', written in 1953 when the author was just 34 years old. In that paper, Lehrman pulled apart the nativist arguments of the older and more powerful Lorenz with passion and fearlessness. His paper projects a singular voice and I am still seduced by his quixotic assault on instinct theory. It's a thrill to introduce Lehrman's paper to my students, who benefit from his ideas and powerful rhetoric.

One of my favorite books is Edward Tufte's *The Visual Display of Quantitative Information*. This beautifully crafted book lays out many simple but essential guidelines for how to effectively communicate scientific ideas in visual form, with the aim of minimizing clutter and confusion. Tufte's approach influences every graph and figure in my research papers. Inspired by Tufte and borrowing from moviemaking, I encourage my students to begin the process of writing a paper by creating a series of figures — a 'storyboard' — through which the logic and narrative of a study can be told in visual form.

Why have you studied so many different topics over the years? My publication record may give the impression that I shifted research topics several times over my career — reproductive behavior, ultrasonic vocalizations, cardiorespiratory function, temperature regulation, sleep, sensorimotor processing. In fact, these topics reflect my singular interest in the factors that shape infant behavior and physiology; moreover, each topic flowed logically to the next. Still, with each transition, I had to develop new methods, become familiar with a new literature, and establish a reputation within a new community. There are good reasons why most scientists stick with one topic for much of their careers: moving into unfamiliar territory can be scary and lead to rookie mistakes. I've made my share of those. But I never regretted my choice to study development from diverse perspectives.

When I enter a new domain, I often start by reading several seminal papers and seeing if I can identify weasel words and unsupported assumptions that point the way to new questions. When I began to study ultrasonic vocalizations in infant rats, for instance, I saw value in questioning the assumption that these vocalizations were signals of emotional distress and cries for help. When I entered the sleep field, I was intrigued by the possibility that myoclonic twitches contribute to the self-organization of the developing sensorimotor system — contrary to the long-held assumption that they are by-products of a dreaming brain.

Do you have a favorite experiment? I am partial to a little experiment that Greta Sokoloff and I published in an obscure journal over 20 years ago. We showed that rat pups can effectively regulate their heat production if tested under conditions appropriate for their small body size. Previous researchers compared the thermoregulatory abilities of rat pups to 'cold-blooded' reptiles, even though pups produce heat internally. This perspective arose because pups were routinely tested in conditions far too cold for their small size. When we tested pups using more moderate temperature challenges, we unmasked their capacity to increase or decrease heat production as needed. Hardly anyone knows or cares about this experiment, but I retain a deep sense of satisfaction about this simple test of an important idea.

Every now and then I have the opportunity to do an experiment that feels like a major step forward. But I derive just as much pleasure — perhaps more — from carefully building a story over many studies and years to create a single, rich narrative.

Is there a theme that runs through your research? One overarching theme in my work — and in the work of many other developmental scientists — is an appreciation that infants are not simply small adults: they must be considered on their own terms. I already mentioned how the thermoregulatory abilities of infant rats were revealed by testing them under conditions appropriate for their small body size. Similarly, when I moved into the sleep field, it seemed to me that infant sleep was misunderstood because it is so different from what researchers are used to seeing in adults. Again, when infant animals are studied on their own terms, free of adult-centric expectations, new insights present themselves.

What is the best advice you've been given? It was from my mother: find work that makes you happy, something that makes you want to get up each morning and go to work. I routinely pass this advice along to my students and take great pleasure in seeing the relief on their faces as they realize, perhaps for the first time, that such a goal is both desirable and attainable. Doing science that makes you happy might sound selfish or self-indulgent, but it is the surest path to scientific progress. History bears this out: important discoveries are often made by people who happily and eagerly struggle to answer questions that they (and perhaps no one else) find fascinating.

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