

Marian Diamond: The “Mitochondrial Eve” of Successful Aging

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Video: *My Love Affair with the Brain: The Life and Science of Dr. Marian Diamond* (Six Episodes, 60 Total Min)

Produced and Directed by Catherine Ryan

Advance Release Currently Available at: <http://lunaproductions.com/marian-diamond/>

Distributed by Luna Productions: <http://lunaproductions.com/>

Move back historically to the formal birth and popularization of Rowe and Kahn’s paradigm for successful aging (Rowe & Kahn, 1998). Move back still farther to the 1970 and 1980 decades where gestational studies show how environmental experiences and lifestyle account for physical and psychological changes once thought due solely to primary aging (e.g., Rodin & Langer, 1977; Schaie & Willis, 1986). Clearly, “successful aging” and its sibs—productive aging, positive aging, and optimal aging—have a rich vertical lineage spanning several generations of researchers. But who were the progenitors of this outlook? Who spawned this type of thinking? I believe a strong argument can be made that the original intellectual “Mitochondrial Eve” of our current positive paradigm is 88-year-old Dr. Marian Cleaves Diamond, professor of neuroanatomy at the University of California, Berkeley.

My Love Affair with the Brain: The Life and Science of Dr. Marian Diamond is a six-episode production that can be accessed currently at no cost on the Luna Productions website (<http://lunaproductions.com/marian-diamond/>). The episodes vary in length from 6 to 15 min. Award-winning videographers Catherine Ryan and Gary Weimberg succeed marvelously in their goal “to explore the achievements of Dr. Marian Diamond’s life and her science.” Though not explicitly intended to focus on the successful aging paradigm, the production shares her contributions to the brain science that informed it. In addition, it reveals her remarkable *personal* qualities—qualities that distinguish her as a passionate scientist, colleague, educator, mentor, and—foremost—as an open, authentic human being who now personally models successful aging.

The first two episodes (Episode 1: “Introduction” and Episode 2: “How She Changed the World”) provide insight into Marian Diamond’s remarkable brain science. Her path began as a small girl, where she saw her first human brain at the Los Angeles City hospital. “It was embedded in my mind; I wanted to study the human brain.” Inspired by research articles in the 1950s and 1960s showing links between brain chemistry and behavior, she joined a team of two psychologists and a biochemist at Berkeley, adding her expertise in brain anatomy. Keenly interested in how environmental experience changes brain anatomy, Marian and her colleagues placed rats in enriched and impoverished environments—with or without cage mates and toys. This now-classic study (Diamond, Krech, & Rosenzweig, 1964) showed that cortical neurons became *larger* in the brains of animals in the enriched environments; the cerebral cortex *decreased* in thickness for the impoverished ones. These differences were found in young, middle-aged, *as well as very old* rats (Diamond, 1993). As she explains in Episode 2: “Many scientists didn’t believe it.” This demonstration of brain *plasticity* violated assumptions of “fixed, genetically set limits” of brain functioning throughout the life cycle that held that the brain cannot change. Scientific doubters were fiercely resistant. She explains that “it took two generations of researchers for the ‘enrichment paradigm’ to be validated.” She offers some general implications for *human* brain structure and function: “This means you have some degree of *control* over your own brain tissue. It is a positive message that the best may still be yet to come.” (See Diamond, 1993, for more specific applications to elderly humans.)



Eighty-eight-year-old Dr. Marian Diamond in the classroom: "This 3-pound mass and these cells can conceive of a universe over a billion light years across."

Other episodes reveal Marian in her various professional and personal pursuits. Innovative thinking produced by her own brain is shown in her classroom teaching as well as in a festschrift devoted to her impact as an educator (Episode 5: "What Makes a Great Teacher"). Marian eschews power point technology; she teaches brain anatomy with colored chalk and a blackboard, purposely challenging students to draw her illustrations. She infuses humor into her lectures. She takes a human brain out of a hatbox, and holding it high in the air, says, "When you see an old lady with a hatbox, you never know what's going to come out!" Throughout her lectures, she continuously poses questions to students about their own brains: "What are *you* imagining now that *you* can think about with these cells?"

In Episode 3 ("The Woman with Einstein's Brain"), Marian discusses her research on Einstein's brain—"the brain that discovered the 'theory of relativity'." She tracked down Einstein's brain in Western Missouri, where it was kept in a mayonnaise jar filled with formaldehyde. Obtaining slices from two areas of the association cortex of Einstein's brain, she found that these samples of Einstein's

brain had smaller neuron-to-glial cell ratios (i.e., more glial cells) than those from 11 men (aged 47–80) in a comparison group. The publication of this finding spawned "tremendous criticism" from colleagues skeptical of raising the status of glial cells based only on one case. Marian remains content with the attention it brought to the possible functions of these cells, heretofore assumed to play only a 'supporting' role to nerve cells. Marian: "It put glial cells on the map."

Episode 6 ("Someone's in the Kitchen with Diamond") visits Marian in her kitchen. It is a quiet segment. She is baking a pie and sharing what her own brain does to relax and to experience the pleasure of the moment. It provides an appreciation of the woman behind the science and celebrity. I recommend that educators use it to open or close discussions surrounding her professional accomplishments.

As gerontologists, we owe a debt of gratitude to Marian Diamond for the *productive discomfort* and *revolutionary change* she created within the prevailing paradigm of her day regarding "constricted aging." Thanks to Marian—arguably the original birth-mother of successful aging—we began to conduct science on an *aging of the possible*.

References

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