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*Faculty Center for Learning and Teaching
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**GENETIC MEMORY AND
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GENETIC MEMORY AND HERMAPHRODITISM:
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Part I: Genetic Memory

"...what humans forget, cells remember" (Eugenides 99)

In his article on "Genetic Immortality as a Multidisciplinary Problem," Professor Andrzej Szyszko-Bohusz poses the question whether individual consciousness, both reflective and nonreflective, is inherited. His research is based on the biogenetic law formulated by Ernst Haeckel and F. Muller, which states that ontogeny recapitulates phylogeny in the stages of embryonic gestation. That is, life experience of individuals repeats the biogenetic evolution of the species. With his research (since 1961), he attempts to prove that not only the brain but the entire organism reflects the physiological process of passing on events from the genetic history of the species from generation to generation. He considers genetic memory a vehicle for the continuity of life and consciousness, a vehicle for immortality, absolutely reliable and immune to destruction, surpassing memory encoded in the brain ("Discussion").

The Quest Institute in the UK characterizes the idea of genetic memory as recent and controversial. The concept has gained some acceptance since the experiments of Wilder Penfield in the fifties, who mapped the cerebral cortex and claimed that deep within every individual is a permanent record of our past:

"His research concerning epilepsy led him to study the cerebral cortex, that part of the brain in which are centred all motor, sensory functions and impulses that give rise to our variety of thoughts and feelings. As he carefully probed the brain, he found that careful administration of a mild electric shock to one of the temporal lobes could, miraculously it seemed, cause the patient to recall precise personal experiences that had long been forgotten. By this means he was able to locate the accumulated store of memory of past events and the emotions, sensations, and thoughts to which the events had given rise. Penfield's research into the structure and function of the brain, it might be added, was guided by his desire to discover a physical basis for the philosophical belief in the human soul" (PBS Online par. 13).

While neuroscientists believe that long-term memories are built into our brain by creating and strengthening a complex network of synapses -- connections between neighboring neurons -- which can recreate patterns of brain activity called memories, they have been perplexed by the question of long term memory storage in the brain. Since neuron connections are neither permanent nor stable, neuroscience has been confounded by the problem of how permanent memories can be stored in an impermanent medium. Neurobiologist Sandra Peña de Ortiz suggests that permanent memories are stored in altered genes ("Abstract" and Quest Institute, "Genetic Memory" par. 5). With her colleagues, she believes that there must be an archival blueprint for each neural network in our DNA, capable of producing a replacement neuron in the brain, a structural and functional clone of its predecessor. Unlike brain molecules, DNA is rather stable over time and has the ability to repair itself. New proteins for memory molecules could be created "from a unique blueprint that could be formed by neurons rearranging their DNA

in response to each new experience” (Quest Institute par. 6) and attaching themselves in a specific position on the synapses, helping to make memory stable. This is a radically new concept, because it suggests a dynamic alterable model for our genetic code, which until now has been considered fixed at birth, stable, and immutable, not subject to rewriting on a continuous basis (par. 8).

The recent decoding of the human genome supports C. G. Jung’s theory of collective memory as the repository of racial memories and universal archetypes. For Jung, “everyone’s personality has the same structural elements, which are inborn, and phylogenetic inheritance of the experience of the human race determines, at least in part, both structure and content of the personality” (Levin 116). Scientists involved in genome research of DNA fossils report that all of the earth’s inhabitants are descended from about 10,000 common ancestors (Sharon Schmickle, “Decoded genome is rich in surprises,” Star Tribune 13 Feb. 2001, A9). Dr. Francis Collins, director of the National Human Genome Research Institute, considers the findings by 1,000 scientists working at 20 institutions worldwide “a narrative of the journey of our species through time” (A9) and the genetic book of life “a shop manual with detailed operating instructions for every cell in the body” (A9). If it is true that memory is processed and stored in our DNA, the question may then follow if it is possible to locate ancestral memory and past life consciousness in our genome blueprint (Quest Institute, par. 10 – 11). What if our cells contain not only the inherited biological and physical characteristics encoded in the instructions for the sequences of the four chemical bases contained in our DNA (named A, C, T and G), but also information about experience going back many generations? Jeffrey Eugenides’ novel *Middlesex* revolves around this premise, though he reverses Haeckel’s dictum, in the interview with Foer claiming that “phylogeny recapitulates ontogeny” (par. 10). Reproductive processes and biological inheritance are mythicized throughout the narrative, because the sperm creating the hermaphrodite and central character of the novel “carry not only instructions about eye color, height, nose shape, enzyme production, microphage resistance, but a story, too” (Eugenides 210). Science and fiction merge in the life story of Calliope, who calls herself Callie into her teenage years while she is living as a female, Cal as an adult male. Together, they constitute the hermaphroditic narrator.

Part II: Hermaphroditism

“...the roller coaster ride of a single gene through time” (Eugenides 4)

Hermaphroditism is both real and fantastic, a phenomenon in nature and a product of the human imagination. It is the subject of both science and myth, at once physical and metaphysical. In Greek mythology, *Hermaphroditos* was the child of Hermes and Aphrodite, the messenger and herald of the Gods on Mt. Olympus and Venus, the Goddess of Love, born from the foam (Gr. *aphros*) of the sea. At the age of fifteen, Hermaphroditus traveled from Mt. Ida to Caria in southwestern Asia Minor. There he rejected the love of the nymph Salmacis while bathing in her fountain. Salmacis embraced the youth, praying to the gods to be forever united with him. As a result, they were joined into one being, half male and half female, the way the Greek sculptor Polyclitus represents them in the 5th century B.C.E. (The Universal Standard Encyclopedia 4302).

Hermaphroditism occurs biologically in animals and plants (Webster 566), as well as human beings when both male and female reproductive organs are present in one individual. A great majority of flowering plants are hermaphroditic, possessing “perfect flowers” having both male and female elements (stamens and carpels) on the same stem. Most hermaphroditic plants reproduce through dichogamy, which operates by cross-pollination, but some, like the violet and the evening primrose, are self-pollinating. Certain fishes, frogs, toads, sponges, mollusks, and earthworms exhibit hermaphroditism, but it is rare in higher forms of animal life. Human hermaphrodites are intersexual individuals whose gender is ambiguous. They generally are sterile and never produce fertile eggs and fertile sperm at the same time. (The Universal Standard Encyclopedia 4302). In German, the biological term for a hermaphrodite is *Zwitter: Zwitterbildung, Zwitterigkeit*. The *Zwitter*, implying sexual ambiguity, is androgynous, both male and female: a hybrid, a cross (Cassell's German Dictionary 1100).

In the novel, *Middlesex*, in which hermaphroditism is central, Cal Stephanides claims not to be androgynous, since he lives as an intersexual, female and male successively: “5-alpha reductase deficiency syndrome allows for normal biosynthesis and peripheral action of testosterone, in utero, neonatally, and at puberty. In other words, I operate in society as a man” (41). As an adult, he has lived half his life as a male, and Calliope surfaces only occasionally “like a childhood speech impediment” (41). Eugenides relies on medical research to explain the pseudo-hermaphrodite, also intertwining insights from recent sexology and gender studies with the ancestral history of his protagonist. The novel's female narrator, Calliope, whose name refers to the Greek muse of heroic poetry, aims to trace the “roller coaster ride of a single gene through time” (Eugenides 4), believing that “the ancient Greek notion of fate has today been carried into our very genes” (Foer interview with Eugenides, Part V, par. 4). For the author, however, Cal's condition represents the third gender with new possibilities, flexibility for the human being and freedom for the individual. The Eugenides novel, which spans three generations, traces the origin of Cal's hermaphroditic gene back to Smyrna during the collapse of the Ottoman Empire and his grandparent's incestuous love affair. One of the main themes of the book is the omniscience of genetic memory embodied in Calliope: “...what humans forget, cells remember” (99).

In the opening lines of the book, Calliope gives a précis of her life and her condition: She was born as a baby girl in Detroit in 1960 and became a teenage boy in a clinic in Michigan in August 1974. S/he was “ridiculed by classmates, guinea-pigged by doctors, palpated by specialists, and researched by the March of Dimes” (Eugenides 3). S/he became the subject of scientific investigations, including a study on “Gender Identity in 5-Alpha-Reductase Pseudohermaphrodites” in 1975. Like Tiresias, s/he was both male and female, though in reverse order. Cal confides: “A redheaded girl from Grosse Pointe fell in love with me, not knowing what I was. (Her brother liked me, too.) An army tank led me into urban battle once; a swimming pool turned me into myth....” (3) In a mock Homeric mood, s/he offers an incantation:

Sing now, O Muse, of the recessive mutation on my fifth chromosome! Sing how it bloomed two and a half centuries ago on the slopes of Mount Olympus, while the goats bleated and the olives dropped. Sing how it passed down through nine generations, gathering invisibly within the polluted pool of the Stephanides

family. And sing how Providence, in the guise of a massacre, sent the gene flying again; how it blew like a seed across the sea to America, where it drifted through our industrial rains until it fell to earth in the fertile soil of my mother's own midwestern womb (4).

As prefetal omniscient and self-conscious narrator, Calliope has clairvoyant knowledge of the past, though s/he claims uncertainty about the true facts of her conception (9), relating things which happened while s/he was waiting "in the greenroom of the world" (11). Fully conscious while still in the womb, s/he describes the process of her own gestation and the circumstances responsible for her hermaphroditism:

By six weeks, I have eyes and ears. By seven, nostrils, even lips. My genitals begin to form. Fetal hormones, taking chromosomal cues, inhibit Müllerian structures, promote Wolffian ducts. My twenty-three paired chromosomes have linked up and crossed over, spinning their roulette wheel.... Arrayed in their regiments, my genes carry out their orders. All except two, a pair of miscreants – or revolutionaries, depending on your view – hiding out on chromosome number 5. Together, they siphon off an enzyme, which stops the production of a certain hormone, which complicates my life (16).

According to Cal, genetic history is circular, a story in which beginning and end meet (20), perhaps implying that in the formation of the embryo, teleology and anamnesis unfold simultaneously, genetic memory reaching back in time and space to reconstruct past events which shape the human being in present and future time. At birth, baby Cal reverses the mental flow of images representing both private and public events, Sputnik rocketing back to earth, polio stalking the country once more, his clarinetist father growing young again and reverting to boyhood, his grandfather untaping a dollar bill over his cash register in 1931. Rewinding the film of life, he achieves regression in time and space, conjuring up the continent of his origin and his progenitors Desdemona and Eleutherios (Lefty) Stephanides, brother and sister, in the village of Bithynios on the slopes of Mt. Olympos in Asia Minor. Toward the end of his narrative, Cal remarks that "living sends a person not into the future but back into the past, to childhood and before birth, finally, to commune with the dead. You get older..., you enter the body of your father. From there it's only a quick jump to your grandparents, and then before you know it you're time traveling. In this life we grow backwards" (425). The novel is a hybrid of science and myth, of magical realism and social realism, an epic and a fairy tale, in the words of the author, "a novelistic genome" (Foer interview). The narrative strands of the book interlock like the braid of a double helix (from the Greek verb *eilyein*, to roll, wrap: Webster 562), connecting northwestern Asia Minor and stations on the Silk Road with Berlin before reunification and Detroit during the race riots.

Part III: Transrealism
"realism with a twist of the fantastic"

Archetypal mythic patterns create a transreal dimension superimposed on Cal(lie)'s family history: the figure of Teiresias, both male and female, links with the story of

genetic hermaphroditism. The myth of the Minotaur, the hybrid monster, relates to Cal's journey of self-discovery, which is likened to the wanderings in a maze (107). Classical allusions abound in the family tree: Cal(lie)'s great grandmother was called Euphrosyne after one of the three graces, originally goddesses of fertility, the eternal feminine principle of creation. Her name denotes joy (of life). Eleutherios, whose name in its Greek feminine form means "freedom," supplies another *leitmotif* in the novel. The cosmic egg from which Zeus liberated all things is linked with the egg game during Greek Easter, the time when Cal(lie) was conceived.

Ovid's *Metamorphoses* with its idea of "Ex Ovum Omnia" (198 - 211) occasions Cal's recollection of the Theory of Preformation from the seventeenth century, which proposed "that all of humankind had existed in miniature form since Creation, in either the semen of Adam or the ovary of Eve, each person tucked inside the next like a Russian nesting doll" (199). The insect used by Jan Swammerdam to prove this hypothesis was the silk worm, *Bombyx mori*, which revealed a tiny model of the future moth when its outer layers were cut away. The story of Lefty and Desdemona is linked with the Chinese silk worm legend of Princess Si Ling-chi (63), and silk worms become the *leitmotif* for Desdemona, who has a cocoonery on Mt. Olympus a thousand feet above Smyrna, now Izmir, then as now important for its silk trade. In the novel, silk worms connect continents, the Old World and the New World: Bithynios and Detroit, where Calliope is conceived on Greek Easter. The tails of the billions of sperms inside Tessie's belly "spin a long white silken thread" (210) linking her impregnation with the origins of Cal's sexual anomaly two hundred fifty years ago in the mountain village in Bithynios, "where cousins sometimes married third cousins and everyone was somehow related. Following this thread from her end, pre-natal Callie follows it to its beginning, reversing time and channeling Desdemona: "...when I speak, Desdemona speaks, too. She is writing these words now..." (38) At the same time, with pre-embryonic prescience, traveling forward in time at the moment of her conception in the ovum, s/he sees her grandfather Lefty collapse from an aneurysm on the night of her birth (211). The reversal of time in following the strands of DNA back to their origin unravels the chronology of events and connects beginning and end of Cal's genetic history. The inventive construct of this particular embryo, the hermaphrodite resulting from the mutation of a gene over time, functions as a structural device in the novel, a new technique for story-telling, the voice which gives the historical and biological realism of the novel that "twist of the fantastic" Rudy Rucker demands of avant-garde literature in his "Transrealist Manifesto" (1 [sic] and 3)]. Eugenides makes it clear that Cal(lie) Stephanides, is a real living pseudo-hermaphrodite, not simply a mythical creature or theoretical construct. S/he represents "the new human experience" (Foer, par. 12), transcending the limits of sexual stereotypes and "breaking down consensus reality" (as Rucker would say, par. 7), blending multiple gender perspectives in an attempt to unify them. For Eugenides, gender ambivalence with its inherent hybridity is the source for new possibilities, opening new dimensions of perception and cognition, whether regarded as a biological, psychological, or spiritual phenomenon. The hermaphrodite, as Cal says, has "the ability to communicate between genders, to see not with the monovision of one sex but the stereoscopy of both" (269).

In his interview with Safran Foer, Eugenides reverses the famous dictum by Ernst Haeckel, remarking that in his novel, "phylogeny recapitulates ontogeny," which would imply that the biogenetic evolution of the species repeats the life experience of

individuals. In his own words, “The traits of our ancestors show up in us today” (Foer, par. 10). As current neurobiological research suggests, every cell of our body may include a genetic blueprint of past memories. Cal(lie)’s embryonic time travel is directed toward inner space in a fantastic odyssey along the spirals of her DNA, leading to a conscious channeling of ancestral memories resembling time regression in hypnotic states or dreams. Eugenides’ fictional account of DNA-travel constitutes Calliope’s quest for her origin and identity leading to the discovery of the interconnectedness among distant cultures and layers of time. The new world discovered by the embryonic cell imploding into fullblown consciousness and spiraling back in time while anticipating ejection from the womb of her mother Tessie living in Detroit is the old world of her ancestors. The story of love and illicit passion between Desdemona and Eleutherios unfolds chronologically in northwestern Anatolia before the First World War, its fulfillment inscribed in the genetic code of their offspring, haunting the lovers and future generations. Superimposed on this linear progression of events is time bent backwards, recapturing the past in memory refracted through the immediate present of the not-yet-born female narrator (Callie) anticipating her birth. The various dimensions of time looping through the nodule of embryonic consciousness inscribe an infinite world, which transcends the fictional reality of the novel. Teleological time becomes transparent to circular time: the repetitiveness of hereditary experience inherent in the DNA of genetic structure.

In the Eugenides novel, the higher reality Rucker finds imperative in transreal fiction consists of invisible worlds embedded deep within our genetic structure, containing the stories of our ancestors. Time travel, as he suggests in his “Transrealist Manifesto,” is memory (par. 2), which creates another dimension and intensifies the realism of fiction. The transreal novel, shattering the limits of reality and notions of “normalcy” (par. 6), is a “revolutionary art form” (par. 6), breaking down consensus reality (par. 7), which Eugenides accomplishes with his hermaphrodite protagonist. In reference to *Middlesex*, Rucker’s dictum, “Each mind is a reality unto itself” (par. 7) may be rendered as “Each gene is a reality unto itself,” a minute world opening toward the beginning of time and approaching infinite consciousness.

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