Elizabeth Bishop's "Sestina" embodies ideas about heredity that circulated after the discovery of the DNA double helix, a scientific event that caused radical shifts in cultural conceptions of genetics, family, and identity. This reading synthesizes her poetics with cultural contexts, including biography, psychology, and the history of science.

Life Forms: Elizabeth Bishop's "Sestina" and DNA Structure

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In her poem "Sestina," Elizabeth Bishop constructs a haunting picture of the interactions between a grandmother and a granddaughter on a gloomy autumn evening. The poem epitomizes the way that family members share long-buried and unarticulated sorrows, simultaneously hiding and revealing what they know of themselves and of each other. The title, "Sestina," appears to simply identify the poetic form that Bishop chose for her story: the sestina is a complex, interwoven structure of six stanzas, wherein six end-words repeat themselves in a set pattern. Reading this poem, however, we do not experience it as a display of cold or abstract mechanics. Instead, it is raw and deeply emotional, for all that the empirical details of the underlying sorrow (what it is actually "about") are concealed from the reader. We "understand" the sadness without "knowing" its source.

This tension that the poem produces in readers between understanding (emotion) and knowing (the story) is intriguing; why does "Sestina" make us understand

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what we cannot know? Examining the form of this text reveals an exciting possibility: that Bishop used the sestina form itself to explore the powerful feelings that we have around the issue of heredity, especially regarding inherited diseases like mental illness. Her choice of form is significant not only because of the sestina's intrinsic references to repetition and circularity, important ideas in a discussion of heredity, but also because of the form's resemblances to the double helix structure of the DNA molecule, the mechanism of heredity, which had been discovered just a few years before Bishop composed this poem. In "Sestina," poetic form is consonant with the science of genome theory, a consonance that is reinforced through Bishop's images and end-words, revealing the emotional import of one of the key scientific and cultural "discoveries" of our time.

Because the effect of "Sestina" is cumulative, inhering in its repetitions, I will quote the poem in full.

Sestina
September rain falls on the house.
In the failing light, the old grandmother
sits in the kitchen with the child
beside the Little Marvel Stove,
reading the jokes from the almanac,
laughing and talking to hide her tears.

She thinks that her equinoctial tears
and the rain that beats on the roof of the house
were both foretold by the almanac,
but only known to a grandmother.
The iron kettle sings on the stove.
She cuts some bread and says to the child,

It's time for tea now; but the child
is watching the teakettle's small hard tears
dance like mad on the hot black stove,
the way the rain must dance on the house.
Tidying up, the old grandmother
hangs up the clever almanac

on its string. Birdlike, the almanac
hovers half open above the child,
hovers above the old grandmother
and her teacup full of dark brown tears.

She shivers and says she thinks the house
feels chilly, and puts more wood in the stove.

It was to be, says the Marvel Stove.
I know what I know, says the almanac.
With crayons the child draws a rigid house
and a winding pathway. Then the child
puts in a man with buttons like tears
and shows it proudly to the grandmother.

But secretly, while the grandmother
busies herself about the stove,
the little moons fall down like tears
from between the pages of the almanac
into the flower bed the child
has carefully placed in the front of the house.

Time to plant tears, says the almanac.
The grandmother sings to the marvellous stove
and the child draws another inscrutable house. (124-25)

The narrative of this poem is clear enough, but the sorrow that inflects it is obscure. Most readers who have some knowledge of Bishop's biography assume that the poem refers to the time in her childhood when she lived in Nova Scotia, after her mother had been committed to an asylum (Sanger 47). A fictionalized account of this event is given in the short story "In the Village," which shares with "Sestina" the characters of the grandmother and the little girl. As resonant as this poem is with the details of Bishop's biography, it also opens up far beyond the specifics of Bishop's own life. The poem's highly figurative quality resists any singular interpretation; after all, there are many children and many grandmothers, many houses, and much, much unspoken sadness.

Reading "Sestina," we feel this shared sorrow keenly, and it is my argument here that our empathetic response comes more from the structural repetition of words and concepts that are characteristic of the sestina form, than from the details of any specific life story. The form of the sestina has long been recognized as one that produces emotion in readers by its very structure. For example, in *Seven Types of Ambiguity,* William Empson reflects on the experience of reading Sir Philip Sidney's double sestina "Ye Goat-herd Gods":

> The poem beats, however rich its orchestration, with a wailing and immovable monotony, for ever [sic] upon the same doors in vain [. . .]. [The end-words] are the bones of [the] situation; [. . .] through thirteen repetitions, with something of the aimless multitudinousness of the sea on a rock, we seem to extract all the meaning possible from these notations; we are at last, therefore, in possession of all that might have been implied by them (if we had understood them) in a single sentence; of all, in fact, that is implied by them, in the last sentence of the poem. (36–37)

As Empson's imagery suggests, the repetitive form of the sestina often evokes a certain solemnity, and Bishop's text harnesses this. Furthermore, the repetition can itself become the subject of the sestina, both in its tendency to constantly call attention to the poem's structure, and, more abstractly, in its evocation of the repetitiveness and patterning of natural phenomena and of human lives. This, as Michael Wood explains, is what the form of a poem "knows"; the very structure of a literary form like the sestina (or in Wood's example, a villanelle) "may well know quite a lot about things like love, loss, repetition, design, language, memory, [and] longing" (136).

Our access to embodied knowledge in literary form is often oblique, especially in the case of the sestina. The end-word pattern is complex enough to appear random to the uninitiated eye; at the same time, we often sense a pattern, without being clear how it works. Having taught the form in undergraduate classes, I can attest that in their first encounter with a sestina, the students will often say, "The stanzas are changing in a pattern . . .?" in a tone that falls somewhere between a statement and a question. It usually takes them much longer to map the pattern they sense is there than to understand that there *is* a pattern in the first place. This experience of an intuited order is important to Bishop's meaning in "Sestina." As I have said, there is much in this poem that we "know" without being able to clearly explain. We know, for example, that there is some shared tragedy between the grandmother and the child. We know that some occulted piece of information is being transmitted between the generations. But the transmission is oblique. In effect, as readers, we are put in the same position as the child—as any child—in relation to her family history. There are things a child intuits about her family before she can know them. We are also put in the position of the grandmother who, although possessing more knowledge about the past than the child does, still fears an unknowable future.

If the poem's form underscores the reader's sense of an intuited order ("I know"), it also complicates any singular or directly biographical reading ("what I know"). As the individual end-words are repeated and recontextualized, they take on multiple meanings; the form *requires* us to recognize the multiplicity of interpretative contexts

and therefore of interpretive understandings of both poems and family histories. If biography is one important interpretative context for the poem itself, another important context—which allows us to (re)interpret issues of heredity in the poem—is the larger cultural experience of heredity in the 1950s: specifically, the discovery of the DNA double helix.

Sestinas in general, and Bishop's "Sestina" in particular, are often described as possessing a magical ability to co-opt our subconscious. In his manual of poetic technique, Alfred Corn describes the sestina as a "hypnotic verseform" that "casts a spell over the reader." He compares the effect of the sestina to the methods of subconscious control possessed by a shaman, noting that there is "something ritualistic" about the form (108). Seamus Heaney presents a similar idea in his discussion of Bishop's "Sestina." He suggests that the abstract subject matter of the poem—sadness—is hypnotized, or placed within a controlled state, by the form:

> The poem circles unspoken sorrows, and as it circles them, it manages to mesmerize them and make them obedient to creative will [. . .]. [It] confounds its elaborately articulated and indirectly stated grief in an art within its art [. . .]. In the poem, the short-circuited pain within the grandmother's house, a pain to which the almanac imparts a fatal inevitability, is shut up for the time being inside the inscrutable house which the child draws. In so far as it echoes old tales where the wicked spirit is imprisoned in some box or tree or rock, this conclusion represents a victory over the negative conditions. But viewed from another perspective, it simply returns the situation to its original configuration, where the entrapment is ongoing and the resolution is attainable only in imagination. (170–71)

The form of the poem, like the child's drawn house, is an "art within the art." It tells the story structurally *within* the narrative that tells the story descriptively; the form tells us directly (if subtextually and perhaps subconsciously) the nature of the sadness. Sadness is repeated, inevitable, and inherited. May Swenson described "Sestina" as having "that almost surrealistic feeling of some room way down deep in memory, or in a dream, that's been dark, and suddenly the light is turned on and every detail is seen, as on a far away stage, tiny, but very clear" (qtd. in Harrison 177). Each generation will suffer, and pass suffering on. The child is already producing her own house where such sadness will take place. Although narratively we may think she is describing a house of pain in the past, structurally we sense that this is also the future; because the poem is circular, form dictates that the poem will end where it began. Like the Marvel Stove, the sestina form tells us "*It was to be.*" The child's attempt to contain this sorrow in a rigid house mimics the poet's attempt to contain it in a rigid verse

form. Therefore, as Heaney suggests, the art within the art is the story within the story; a story of *mapping* some infinite and unarticulated sorrow, within the story of the sorrow itself.

In the fifties, when Bishop wrote "Sestina," the issues of heredity and inherited diseases, including mental illnesses, were both scientific and social fascinations. Family patterns of illness had been obvious for generations, but discerning the exact pattern of recurrence was a dubious science. James Watson and Francis Crick's mapping of the structure of the human genome was a scientific enactment of what families had been doing for generations—attempting to discern the shape of their past and future sorrows: who will inherit the pain, when, and why? Bishop finished "Sestina" in 1956, while she was living in Brazil. This was only a few years after the publication of Watson and Crick's discovery, and the poem possesses some uncanny similarities to the DNA strand as it was presented to the public in the mid-fifties. Bishop may have found structural similarities between the double helix and the sestina form, although that discovery may have been a happy coincidence as much as a deliberate plotting.

It seems reasonable to assume that when the announcements of the discovery of DNA structure began in 1953 Bishop would have followed them with interest, and that she would have been familiar with some of the details of DNA science as it was circulated in popular magazines and newspapers. Robert Olby has suggested that media attention to the discovery of the helical structure of DNA was "quiet." He points out that while the scientific serial *Nature* published seven articles on DNA in 1953, "only one national British newspaper—the *News Chronicle*—referred to the double helix" ("Quiet" 402). The announcements in the popular media may have been quiet by Olby's standards, but the discovery did receive its fair share of attention from some major publications both in Britain and the United States. In addition to Watson and Crick's original article, published 25 April 1953, and their follow-up article in *Nature* on 30 May of the same year, the information was circulated in high-profile sources like the *New York Times* ("Clue to Chemistry of Heredity Found," 13 June 1953), which also published several subsequent features on DNA, and *Scientific American,* whose October 1954 issue featured an article written by Crick himself. Crick's article included a "visually attractive" diagram of the double helix; this diagram went on to be republished in several other sources, so the image was familiar to the reading public early on (Winstanley 548).

It is difficult to be definitive about which periodicals Bishop had access to in Brazil, but she notes in a letter to Robert Lowell of 1953 that she got "quite a lot of things, down to the *Farmer's Digest*" (Bishop and Lowell 142). Her letters are peppered

with references to major newspapers and magazines from both the United States and Europe, including the *New York Times,* the *Atlantic, Time,* the *London Times,* the *New Republic,* the *New Yorker,* and the *Partisan Review,* as well as smaller publications and clippings from Boston newspapers sent by her aunt in Massachusetts (Bishop, *One* 236, 256; Bishop, *Poems* 789, 796; Bishop and Lowell 142, 145). Letters can only provide a partial window on what she may have read; most references to her periodical reading are related to her own work or that of her friends and colleagues. She may not have mentioned material if she felt her correspondent did not share her interest in a subject. Case in point is Darwin himself, whom although she claimed was one of her favourite authors, she mentions only a couple of times in letters, such as when she enthuses to Marianne Moore in a 1953 letter, "I thought [his *Beagle* diary] was wonderful. I think I'll begin right way on all his other books" (*One* 257). We know that she read naturalist writing; she recommends a book called *A Naturalist in Brazil* to Moore in another letter of 1953 (*Poems* 790). It is likely that she read more science-oriented material than is reflected in her letters. In her brilliant essay on literary form, "Dimensions for a Novel," she incorporates Julian Huxley's article "The Size of Living Things," which is a science essay written for the non-specialist reader that was originally published in the *Atlantic* in 1929 (although it is more likely that Bishop read it in *Man Stands Alone,* his collection of biology essays of 1941). Her analogy between Huxley's explanation of the limits of physical bodies according to the laws of physics and the formal limits of the novel demonstrates a facility with scientific ideas and language, as well as a tendency to imagine literary forms as physical bodies: "Before a genuine change in form takes place," she wrote, "maybe quite a while before, the actual substance, the protoplasmic make-up of the writing must be changed" (*Poems* 672).

Bishop may have read the reports on DNA in the *New York Times,* which she refers to frequently in her letters to Lowell, Moore, and Pearl Kazin (*Poems* 765, 786, 789), or in a science periodical like *Scientific American* or *Nature*. Even if her access to media did not extend to the latter two publications, they are still important indirect influences, as they set the standard methods of reporting on the double helix discovery; the descriptions of Crick's article in *Scientific American,* along with the visual diagrams, were replicated themselves in an almost genetic fashion through the reporting in other publications, such as the article "The Secret of Life," published by *Time* in 1958.

Crick's article in the widely read *Scientific American* is key to understanding how science related to the structure of DNA was circulated in the years after the double helix was discovered. The article includes large graphics on almost every page: illustrations of various structural aspects of DNA, including Lewis structures; pictures of three-dimensional structural models; X-ray photographs; and a representational diagram of the

replication mechanism. The article is visually stimulating and accessible, and it set the standard for popular depictions of DNA in the media. Media attention to the structure of DNA in the mid-fifties may have been underwhelming compared to the cultural fascination with the image that was to come in subsequent decades (the double helix has become the rock star of scientific forms, regularly gracing the covers of magazines), but interested readers still had easy access to detailed news of the discovery. We have every reason to believe that Bishop was not only an interested reader, but an informed one.

There are two reasons to assume that Bishop's attention would have been caught by the announcements of DNA discoveries in the early fifties. First, many headlines in the news media connected the research with the issue of genetic bases for mental illness. The 27 April 1954 edition of the *New York Times,* for example, ran an article headlined "Science Analyzes Heredity Factors . . . Clue to Insanity Noted" (Laurence 31). With her own mother a victim of mental illness, it is likely that such announcements would have caught Bishop's eye. Although it seems that Bishop maintained a healthy perspective on the genetic aspect of her mother's illness, she obviously considered it. One acquaintance speculated that "Elizabeth felt that fear of inheriting her mother's illness was a terrible thing, but she consciously did not allow it to be part of her life" (Fountain and Brazeau 30). Bishop's own comments on the matter in a letter to Anne Stevenson demonstrate a sense of reserve; she seems to attribute her mother's illness to stress borne of external circumstances, but pauses to note that "it is the only case of insanity in the family, as far as we know" (qtd. in Lombardi 199). This demonstrates that the issue of heredity remained relevant to Bishop's thinking about mental illness, if only to be discounted (perhaps optimistically) in this particular case. In addition to her mother's illness, Bishop had to deal with the reality of her lover's ultimately fatal depression. By 1964, she considered herself experienced enough on the topic of insanity to comment on the progression in treatment from her mother's day to mid-century: "Times have changed. I have several friends who are, have been, will be, etc. insane; they discuss it all very freely and I've visited asylums many times since. But in 1916 things were different. After a couple of years, unless you cured yourself, all hope was abandoned" (*One* 543). Given the pervasiveness of mental illness as a subject in Bishop's own life, it seems logical that she would have paid attention to it as a subject in the popular science media, and this would have included reports on DNA discoveries.

Furthermore, Bishop had a well-developed interest in science, especially biology and biochemistry. This is evident both in her poetry, which often focuses on the natural world, and in her reading interests. Bishop said that her favourite writer was Charles Darwin (Millier 356), and once remarked that "he is one of the people I like best in the world" (Bishop, *One* 543). As a student, biology was one of her enthusiasms, and she

toyed with the idea of becoming a scientist even well into her career as a poet. In a moment of anxiety over her career choice, she wrote to Marianne Moore, "I cannot, cannot decide what to do. I am even considering studying medicine or biochemistry, and have procured all sorts of catalogues, etc. [. . .] I had rather work at Science, at which I was fairly good at college [. . .] than become like one of my colleagues" (*One* 45). She seemed to share the perspective of Moore, close friend and mentor, who once said: "Do the poet and the scientist not work analogously? [. . .] Precision, economy of statement, logic employed to ends that are disinterested, drawing and identifying, liberate—at least have some bearing on—the imagination" (qtd. in Millier 346). With her interest and ability in at least college-level science, Bishop would have been more academically informed than the average reader; with her family history, her interest in DNA would have been more than academic.

One of the most significant aspects of DNA structure that Bishop would have recognized, as both a poet and a science enthusiast, is its synthesis of form and function. Without a tangible sense of the form, Watson and Crick were stymied in their understanding of DNA, precisely because (as they would prove) the meaning is *in* the shape of the thing. In a moment of highly Keatsian science, Watson describes how he and Crick, contemplating their mechanical model, found scientific significance in the physical aesthetics of the double helix: "A structure this pretty," he writes, "just had to exist" (Watson 205). It is a fact of transcendent practicality that the DNA structure mimics so perfectly our metaphoric understanding of heredity: "unlike many other organic molecules, the structure was highly suggestive of its potential biological function" (Olby, "Why" 80; see also Olby, "Quiet" 402). The double helix was "suggestive" of its function both on the microscopic level—the recreation of the strand through division and replication, with the associated repetitions and variations—and on the level of human experience: the repetition and variation of genetic traits as they cycle through the generations. As such, the double helix is a perfect physical symbol of its own function; it is effectively a perfect symbol of itself. Olby suggests it is this quality that accounts for the success of the double helix model in the popular imagination: "It is not just that Odile Crick's [Francis's artist wife] depiction of the model has such an iconic quality, but that the structure embodies the notion of a chemical codescript in which our heritage is written" (Olby, "Why" 83). As Olby's metaphor of "codescript" suggests, the double helix is seen as the word made flesh, the symbol made real, and this quality would have been very attractive to a poet like Bishop.

If the DNA molecule is symbolic of itself—the form reflective of its function—its symbolic value is also easily transferred onto other helical structures: spiral staircases

and coils of rope (Olby, "Why" 82). Northrop Frye has suggested that spirals, ladders, and their synthesis, the spiral staircase, have broad cultural significance, repeating as "complex metaphors" in a wide range of mythological traditions: "The image of the spiral [suggests] among other things the organic process of birth from nothing and death into a second nothingness" (*Myth* 11). The instantly recognizable metaphoric possibilities of the double helix are shared by the sestina form; the spiralling shapes (staircases and rope) implicit in both structures speak of ideas of progression and connection, repetition and variation. This too, would have appealed to Bishop.

Finally, the iconic aspect of the double helix is often expressed in textual metaphors ("code/script," "language," "alphabet," "story," "book of life") and, as contested as these metaphors might be in some scientific circles, the allegiance between DNA and textuality seems pervasive in our culture.[1] Thus, Bishop's use of poetic form to explore the idea of DNA fits into the larger tradition of connecting DNA to text and language.

The spiralling nature of heredity was discovered to be uncannily embodied, then, in the early 1950s, only a few years before Bishop composed "Sestina." As is the case with DNA, the truth of Bishop's "Sestina" is found in the form. It is revealing that Bishop renamed the poem, changing its title from "Early Sorrow" to "Sestina" (Millier 267). The later title indicates that the *form itself* is as much the topic of the poem as is the narrative of the grandmother and the girl, or their shared sorrow. In "Sestina" Bishop's elaborate control of the circularity and spiralling inherent in the form intensifies (or "mesmerizes"—perhaps Heaney's term is better here) the metaphoric associations of progression and connection that are central to our thinking about heredity and genetics. The circularity of the sestina is experienced almost instinctually, and yet it is clear that the form is circular only on a conceptual level, not a literal one. After all, the end-word patterns are not *actually* circles; they do not present themselves as circles on the page. Instead, they move up and down relative to one another as the stanzas progress—the stanzas which are themselves arranged in a vertical column, a line, on the page. And yet, almost all discussions of the form refer to a circularity that is clearly a common experience in reading such poems. This is, of course, born of the fact that the end-words repeat, and human psychology associates repetition with circularity—coming around again. Yet not all repetition is circular; much of it is simply, well, repetitious. Many poems contain repeated words, rhymes, or rhetorical structures, yet we do not experience them as circular. Even the tightest sonnet rhyme pattern, for example, with only four rhymes used throughout, does not tend to be described as a circle. The complicated circularity of the sestina is frequently described as spiralling, in fact, in recognition of its simultaneous repetition and progression

from stanza to stanza. This spiral metaphor reflects our understanding that although there is repetition, we do not revisit the same starting point at the outset of each stanza-circle. The stanzas are not identical, independent rings, but conjoined turns in a long, spinning structure. If we push the geometrical metaphor a little further, these conjoined rings become conjoined hexagons, each defined by six discreet points of its end-words; each linked by its final end-word/point to the next hexagon in the chain. Hexagons are commonly used in chemical Lewis structures, as in one of Crick's diagrams of DNA in the *Scientific American* article (Crick 54–55).

The "spiral" form of the sestina is both closed and open. Each stanza is, in some sense, "closed"—circumscribed by its closed set of end-words—yet each stanza is also linked by those shared, repeated end-words to the next. The form, in some sense, encloses the poet, presenting her with prescribed limits; in Bishop's poem, as Jeffrey Donaldson points out, these limits are even more rigid than in other sestinas: "Very little variation is offered on the six words, no nouns returning later as verbs, no phonetic play or paronomasia employed to avoid mere repetition or expand our sense of what sort of verbal shell we are moving about in" (141). Yet the effect of the repetition of this closed set of end-words is, paradoxically, to open the words up, revealing layer on layer of meaning.

The interplay of closedness and openness that is integral to the sestina form is picked up in the poem's imagery. The image of the darkened house in the September rain is claustrophobic; the child's "rigid" and "inscrutable" house is yet another closed polygon, in which both child and grandmother are imprisoned by the shared, unarticulated trauma. Yet this trauma, because it is shared (linking the characters with the past and future, as well as with each other), counterpoints the closedness I have been discussing; the individual within the family is not as singular, or as "closed," as he or she may appear. Shared trauma may link people, figuratively speaking; genetic material links them quite literally. Our inherited genome opens us up to others, before and after us, just as the end-word patterns of the sestina, closed though they seem at first, in fact build physical links between the stanzas and open up interpretative possibilities.

The structural tension of the spiral form—which is both linearly progressive and circularly repetitive, both "open" and "closed," both singular and multiple—is echoed in the phenomenon of genetic heredity. The generations progress in a similarly spiralling fashion: DNA is replicated endlessly, but not identically. Small ruptures in what has gone before—small differences—prevent "perfect" repetition (which, biologically speaking, would produce mere clones of individuals) in order to progress the familial line from grandparent to parent to child (who in turn becomes the parent, then the grandparent, etc.).[2] Yet a massive proportion of the DNA material is inherited from and identical to that of the previous generation.

The form of the sestina, like the form of the DNA strand, is invested in the numbers six and two. I have already mentioned the "hexad" formed by the sestina's set of six end-words, which echo the hexagonal Lewis structures of DNA diagrams and also the six molecular components that make up the basic helical shape of DNA: the four base pairs that combine and recombine to form the genome, plus the two sugar-phosphate chains that form the armature of the molecule. In turn, the paired sugar-phosphate chains have their counterpart in sestina structure in the "matched pairs" formed by the last end-word of one stanza and the (identical) first end-word of the next. These pairs frame the "spin" of the six stanzas, forming a kind of doubled backbone that twists from bottom to top (or, perhaps, from back to front). This image is obviously resonant with the double helix, described by Watson as "two sugar-phosphate backbones twist[ing] about on the outside with the flat hydrogen-bonded base pairs forming the core" (202). He goes on to say that "Seen this way, the structure resembles a spiral staircase with the base pairs forming the steps," an image that again returns us to the spiral-like sestina (202). Like the sugar-phosphate chains, the first and last end-words in each six-line stanza flank the remaining four components—the four other end-words in the case of the sestina, and the four base pairs in the case of the double helix—framing them, anchoring them, and holding them in.

These double-spiral structures, which link the poem's end to its beginning (or link us, through the genome, to our ancestors and descendants) are echoed in the poem's imagery: the "winding pathway" the child draws in her picture, which likewise signifies a connection between the past and the future. There is also the doubled armature of the poem's two characters, the grandmother and child, who frame both the absent parents and the unmentionable sorrow. The poem is about the circuitous and twisted knowledge that is exchanged between this pair. The melancholy refrain "*I know what I know*" is not only circular in its logic, but it posits two "I"s: two knowing identities, two bases of knowledge. It is the "what" framed by these two assertions of personal understanding that is obscured from the reader; we ask, "*what* is the tragedy?" Other dualities frame the reader's experience of the poem: the warmth of the stove and the chill of the house, the darkness and the light, the laughter and the tears, the spoken and the unspoken, the known and the unknown. The grandmother's tears are described as "equinoctial," the balance point between seasons, or between day and night, or between the hemispheres. Her sadness is a hinge by which she and the child are joined, and her tears mix the pain of a tragic past with hope for a joyful future embodied by the child. The grandmother and the child are the "backbones" of the story, and Watson's anatomical metaphor for the sugar-phosphate chains is eerily appropriate to the grandmother and the child, who are the only embodied vertebrate subjects in the poem (although

not the only cognizant ones, given the talking stove and almanac). It is such bodies, and their genetic transmissions, that are the ultimate subject of DNA research: what tragedies have our bodies inherited? What ancestral sorrow brews and sings quietly to itself within us, planted, waiting for its tearful time to appear?

Bishop's choice of end-words in "Sestina" is further consonant with DNA structure. Four of the end-words—almanac, grandmother, tears, and child—begin with the same letters as the names of the four base proteins of the DNA strand: Adenine, Guanine, Thymine, and Cytosine, which are represented diagrammatically by their first letters, A, G, T, and C. The four bases always pair up in set combinations: G with C and A with T. In the poem, the G and C words represent an obvious conceptual pairing: grandmother and child. Their relationship to each other, or their bond if you will, is quite clear. Interestingly, A and T (almanac and tears) are paired by Bishop in the first line of the envoy ("*Time to plant tears,* says the almanac"), which is a variation (or perhaps mutation) of the standard pattern of sestina envoys. Bishop's line demonstrates the nature of the relationship between her A and T terms: planted sorrows (tears) will grow in due time (almanac).

"Tears" and "almanac" have fairly obvious implications in the context of heredity, referring to the sorrow that might be experienced over time through genetic destiny. The sestina form itself, as Marianne Shapiro has demonstrated, functions as a symbol of time in classical and Christian cosmology, through its number symbolism and through its spiralling linear/circular structure (53–89). With the end-word "almanac," Bishop is making these temporal connotations overt. Furthermore, an almanac is a good symbol for human lives and generations; indeed, the comparing of human lives to the four seasons is a tradition that dates back to the classical-medieval trope of "the four seasons of man." The almanac—particularly the farmers' almanac variety—is a weird mix of reflection on past patterns and prediction of future growth. The predictive aspect of the almanac is, however, somewhat tenuous; like genetic predictions, it both reveals a possible future and resists absolute knowledge of that future.

In the humid atmosphere of "Sestina," the rigid, inscrutable form of the poem is soaked in water imagery, just as the rigid, inscrutable house is soaked in rain and tears. The rain and the tears are both fairly straightforward symbols of misery, pain, loss, and mourning, but they also broaden towards more complex meanings in this text. They evoke bodily fluids—not only tears but blood, another metonym for heredity—and they connect the body's tears to the environment outside the house, merging interiority and exteriority once again. The tea, also, is linked to concepts of fluidity and the body, as the liquid in the teacup is described as "dark brown tears"—a link that is tightened by the similarity of the words "tea" and "tears."

The tea symbolism creates a bond between "tears" and "stove." As a referent to DNA, the stove is a diffuse symbol, but it obviously reflects the idea of warmth. As an object, we tend to connect it with cooking, which is in turn associated with ideas of production, nurturing, and "generation," both productive and reproductive. There is a sense in this poem of something being *forged*—a bond, definitely, between the grandmother and child, but also something more abstract.[3] Perhaps it is the sense of understanding without actual knowledge that is forged in the reader, so that, like the Marvel Stove, we know what we know, and we know "*it was to be.*" The repetition of the end-words and ideas creates a sort of ontological thermodynamics: the density of our comprehension increases with each cycle we take through the stanzas. As the end-words are pressed closer and closer to each other in our minds through the sestina's form, we forge an empathetic bond with the family, and this "warmth" is what generates our sense of understanding, ultimately making us the inheritors of their familial sorrow. In this respect the DNA structure is actually replaced by the sestina structure. This is why, despite its high level of abstraction, the poem is emotionally effective, not cold or alienating in the way often associated with abstraction. Bishop is enacting what nineteenth-century Italian philologist U.A. Canello envisioned as the emotive power of the sestina's form: "[Canello believed] that the sestina form makes the reader feel, by its disruptions and tensions, a torment and release analogous to those felt by the poet. That is, the sestina embodies its meaning. The conjunction of the squared and circular forms, both of which have traditional claims to emblematic significance, has created a composite form, the reader's experience of which is in fact emblematic: the poetic tension (form) transmits an intuition of the emotional tension (content) it describes" (Spanos 549). "Sestina" connects this emotional transmission from poet to reader with genetic transmission from (grand)parent to child. In this respect, we cannot say that Bishop's poem is purely biographical. If the sestina form transmits her genetic sorrow to its readers, then the poem has "opened" beyond the strictures of biology and biography. This is a purely metaphoric transmission, of course, but it carries a powerful ethical message. We are never as distinct from each other—physically or emotionally—as we might think; just as the double helix reveals our physical bonds with one another, "Sestina" reveals our emotional bonds. "Sestina" is thus emblematic of a greater human tragedy—and of a greater hope—that is embedded in our ideas about genetics. Just as we each share the vast majority of our genetic makeup with the entire human race, this poem shares the vast majority of its emotional freight with a larger humanity.

For a mother and a child who have seen the destruction of their daughter and mother (respectively) by mental illness, the pain and hope of genetic research must be considerable. As much as they mourn their loss, they must hold onto shreds of hope that the disease will not be passed on—not to the child's generation, at least. For this is the conundrum of genetic information: it catches us at an impossible, equinoctial point between the known and unknown. We know, for example, that many mental illnesses have genetic components to them, and that the health of the parents can often predict the health of the children. But heredity is a fickle shaman that refuses to commit to absolute assertions of what will and will not happen: you might inherit genes that will destroy you, you might not. Or even: you might inherit the genes, and they may or may not destroy you. Our knowledge is as certain as it is obscure. At the point at which Bishop was writing "Sestina," genetics were as "inscrutable" as the house that the child produces, a reality that we largely still live with today, despite the huge advances in genetic research that have come since the analysis of DNA in the fifties.

Attempting to map the patterns between generations produces a pain of its own. We attempt to "imprison" our "old tales" of family pain in the genome—to make that pain visible and spoken, so that it might be controlled. But the structure of our past pain is also the prescription of future pain. The DNA strand, with its spiralling, circular structure, eerily embodies what people have instinctually known forever: that the sorrows of our ancestors will return to us, that we are trapped in our rigid and inscrutable houses, that our genetic entrapment is "ongoing and resolution is something attainable only in imagination" (Heaney 171).

There is almost a kind of mysticism in the consonance of the double helix with our ideas of the progress of heredity, as Northrop Frye once mused: "It's common knowledge that Kekulé's discovery of the circular atomic structure of the benzene molecule is linked to a dream of the ouroboros, and that the DNA molecule is linked to the double helix. Nothing is discovered out there that isn't in some sense already there" (*Northrop* 69). Perhaps for the formalist poet Bishop there was a sort of instinctual linkage between the double helix and the sestina, which linked again to the idea of heredity. For all the excitement and optimism around the discovery of DNA structure, astute analyses were tempered with a certain fatalism. Here was an overt illustration of the structure of our suffering, and of the inevitability of our sorrow. This is what the form knows—what makes the form the meaning of the poem; as Wood reflects, "What 'justifies' the form is what couldn't happen without it" (137). Bishop's change of title to the name of the form of the poem indicates an awareness that her first choice of "Early Sorrow" is only half the story; early sorrow must be conflated

with future sorrow, and therefore the freight of the poem is not just sorrow itself, but its circular nature. The title "Sestina" encapsulates both the past and the future: what the Marvel Stove says is true; sorrow both "was" and is "to be."

NOTES

1/ For extended discussions about literary, linguistic, or textual metaphors in cultural discussions of DNA, see Celeste Michelle Condit, *The Meanings of the Gene: Public Debates about Human Heredity* (Madison: U of Wisconsin P, 1999); Richard Doyle, *Are Genes Us?: The Social Consequences of the New Genetics* (New Brunswick, NJ: Rutgers UP, 1994); Lily E. Kay, "Book of Life? How a Genetic Code Became a Language" (in *Controlling Our Destinies: Historical, Philosophical, Ethical and Theological Perspectives on the Human Genome Project.* Ed. Phillip R. Sloan. Notre Dame, IN: U of Notre Dame P, 2000. 99–124); Evelyn Fox Keller, "Language in Action: Genes and the Metaphor of Reading" (in *Experimenting in Tongues: Studies in Science and Language.* Ed. Matthias Dörries. Stanford, CA: Stanford UP, 2002. 76–88); and José van Dijck, *Imagenation: Popular Images of Genetics* (London: Macmillan, 1998).

2/ Or, as Bishop writes in "North Haven" (in *Elizabeth Bishop: The Complete Poems, 1927–1979.* New York: Farrar, 1983. 188–89), her elegy for the poet Robert Lowell (incidentally, one of her friends who suffered from mental illness), "Nature repeats herself, or almost does: / *repeat, repeat, repeat; revise, revise, revise*" (188). Eleanor Cook (in *Against Coercion: Games Poets Play.* Stanford, CA: Stanford UP, 1998) remarks on the idea of heredity embedded in these lines: "Children *'repeat, repeat, repeat; revise, revise, revise'* their parents and grandparents. Repeat, obviously, but also and happily, revise; nobody wants a clone for a child" (41).

3/ The forge is real in Bishop's "In the Village" (*Elizabeth Bishop: The Collected Prose.* Ed. Robert Giroux. New York: Farrar, 1984. 251–74), where the blacksmith hammers iron as a backdrop to the mother's breakdown. At one point, the child asks him to make her something. He creates (appropriate to the symbolism discussed in this paper) a ring: "Instantly it is made," Bishop writes, "it is mine" (257).

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