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Julia Fendt

The Chromosome as Concept and Metaphor in Amitav Ghosh's *The Calcutta Chromosome*

Abstract: Using the title *The Calcutta Chromosome* of Amitav Ghosh's 1995 novel as a starting point, this paper aims to explore how an object of biomedical research, the chromosome, can be inscribed into a literary text and can provide insights that extend beyond its 'factual' knowledge in the sciences. Referring to a systemic-ecological view of the world and considering the two cultures debate inaugurated by C.P. Snow as a background, scientific and imaginative implications of the chromosome as concept and metaphor are analyzed. The chromosome is translated into new epistemological configurations in the literary discourse, entangling science with mythology, and Western with indigenous Indian forms of knowledge.

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A novel with the title *The Calcutta Chromosome*¹ opens up a large variety of discursive spaces to start from. My particular interest in this paper lies at the very heart of the title: the chromosome, and thus in biology. In molecular biology, chromosomes are defined as "thread-like structures located inside the nucleus of animal and plant cells. Each chromosome is made of protein and a single molecule of deoxyribonucleic acid (DNA)" ("Chromosomes"). If you unfold the tightly packed chromosomes, the double helix structure of the DNA appears, with its four bases adenine, guanine, cytosine and thymine that make up the genes.

Situated within the context of "Science Studies",² the paper is set to explore how a subject of scientific research, in the field of genetics in particular, can be inscribed in a literary text and can offer insights that extend beyond its "factual" or "hard" knowledge of the sciences. By analyzing the text in regard to the function of the Calcutta chromosome, the relation between different systems of knowledge is examined. In order to understand scientific and imaginative impli-

¹ In some versions the full title is: *The Calcutta Chromosome: A Novel of Fevers, Delirium and Discovery*. All quotes are taken from the 2011 edition of the book.

² Science studies "examines the practices, paradigms, and cultural mores through which science produces knowledge" (Blacker 2012: 457).

cations of the concept of the chromosome, a systemic and ecological view of the world as well as knowledge systems in particular are considered as a starting point. For my analysis of the interdependency of systems of cultures and knowledge I will rely on Barry Commoner, Thomas S. Kuhn, David Bohm, Fritjof Capra and the cultural-ecological model for literary analysis developed by Hubert Zapf.

As a further background I will briefly introduce the two cultures debate, as this paper is embedded within its context. Referring to molecular biology, C.P. Snow, who inaugurated the debate and advocated an approximation between the two cultures, proposed in his revised lecture “The Two Cultures: A Second Look” that everyone should understand the subject of molecular biology as compared to the more complex second law of thermodynamics,³ which he had formerly advocated. While in his first lecture in 1959 he exemplified the mutual ignorance of the sciences and the “literary intellectuals” by contrasting the question of the 2nd law of thermodynamics vs. the question if one has read a work of Shakespeare (Snow 2012: 14–15), he subsequently turns to molecular biology:

It begins with the analysis of crystal structure, itself a subject aesthetically beautiful and easily comprehended. [...] It includes the leap of genius by which Crick and Watson snatched at the structure of the DNA and so taught us the essential lesson about our genetic inheritance.

Unlike thermodynamics, the subject [of molecular biology] does not involve serious conceptual difficulties. [...] What one needs most of all is a visual and three-dimensional imagination, and it is a study where painters and sculptors could be instantaneously at home (Snow 2012: 73).

Snow’s insight is predictive of the future, as genetics and genetic engineering have been gaining momentum since the discovery of the DNA’s double-helix structure by James Watson and Francis Crick in 1953 subsequently enabling a “reading” of the human genome. Exactly 50 years later, the National Human Genome Research Institute completed sequencing the human genome (“50 Years of DNA”). What Snow is implying here, is that a “visual and three-dimensional imagination” is essential to grasp and understand scientific concepts, such as the structure of the DNA. The role of aesthetics is emphasized in art, as was famously done by Kuhn and Feyerabend.⁴

³ This second law of thermodynamics means that the “energy of the world is constant” and that “entropy only increases in the course of physical processes until it has reached its maximum” (Fischer 2009: 43–44, my transl.).

⁴ Paul Feyerabend stresses the relation of science and art in his study *Science as an Art* [Wissenschaft als Kunst].

As early as 1896, the physicist John Tyndall argued that the source of imagination is essential for understanding scientific phenomena. In his essay “Scientific Use of the Imagination”, he also mentions an ecological thought that takes into account the “wholeness” of the world, which seems to be an essential stance in the 21st century:

Scientific men fight shy of the word [imagination] because of its ultra-scientific connotations; but the fact is that without the exercise of this power, our knowledge of nature would be a mere tabulation of co-existences and sequences. We should still believe in the succession of day and night, of summer and winter; but the conception of Force would vanish from our universe; causal relations would disappear, and with them that science which is now binding the parts of nature to an organic whole. (Tyndall 1896: 104)⁵

Here, Tyndall argues for the imagination’s role as a binding glue that interacts with science and thus is essential for the development of an “organic whole”, which is only complete when taking into consideration not only the scientific side of nature, but at the same time emphasizes its systemic and ecological embeddedness in a greater whole.

Recognizing the role of a creative or imaginative force, Kuhn also argues that even though aesthetic considerations “often attract only a few scientists to a new theory, it is upon those few that its ultimate triumph may depend” (Kuhn 1970: 156). This is especially prominent when a “paradigm shift” of one worldview to another occurs, as happened from a mechanistic Newtonian view of the world to a quantum-mechanical universe (Kuhn 1970: 48). Tyndall’s notion of an “organic whole” can be expanded to a holistic view of the world, as is inscribed in Barry Commoner’s first law of ecology, which states that “[e]verything [i]s [c]onnected to [e]verything [e]lse” (Commoner 1972: 33). As Fritjof Capra emphasizes, this new ecological view which has been developing over the last decades is marked by the fact that a “shift from parts to the whole” is taking place (Capra 1996: 36). Consequently, from an ecological point of view, one “recognizes the fundamental interdependence of all phenomena and the fact that, as individuals and societies, we are all embedded in (and ultimately dependent on) the cyclical processes of nature” (Capra 1996: 6). Besides extreme specialization in a subject, it is also necessary to take on a view that considers the wider context of the subject analyzed, or put differently, a rather systemic view of the world that does not overlook the interconnectedness and interrelatedness of systems. David Bohm

⁵ He continues: “There are Tories even in science who regard Imagination [sic] as a faculty to be feared and avoided rather than employed” (Tyndall 1896: 103).

argues in the same vein, when he analyzes the role of fragmentariness from an anthropocentric point of view:

[...] it is just because reality is whole that man, with his fragmentary approach, will inevitably be answered with a correspondingly fragmentary response. So what is needed is for man to give attention to his habit of fragmentary thought, to be aware of it, and thus bring it to an end. Man's approach to reality may then be whole, and so the response will be whole. For this to happen, however, it is crucial that man be aware of the activity of his thought *as such*; i.e. as a form of insight, a way of looking, rather than as a 'true copy of reality as it is'. (Bohm 1980: 7, author's emphasis)

What Bohm puts emphasis on, is that we as humans should be able to realize that our worldview is always fragmentary. In order to adopt a holistic worldview, it is important to recognize that human thought processes do not reflect the "whole reality" but actually only a fraction of it. While a "fragmentary approach" of the world leads to a "confusion of the mind", the orientation towards a "totality" is seen as a crucial element "for overall order of the human mind itself" (Bohm 1980: xi). The novel approaches this "wholeness" by emphasizing the role of the Calcutta chromosome as a symbol for interconnectedness of Western and non-Western science and by interconnecting all strands of the story to one bigger 'totality' everything and everyone depends upon. Especially in regards to sciences, "there can be no *conclusive* experimental proof of the truth or falsity of a *general* hypothesis which aims to cover the whole of reality (Bohm 1980: 5, author's emphasis). Rather, humans should acknowledge the fact that the "act of reason is essentially a kind of perception through the mind" and even though "one may be puzzled by a wide range of factors, things that do not fit together" with a "flash of understanding" one will finally realize how the different pieces of the puzzle become one "totality" (Bohm 1980: 13). A chromosome, is, similar to a particle described by Bohm, an entity that "is an abstraction from an unknown and undefinable totality of flowing movement" (Bohm 1980: 49) and becomes describable only through interdependencies and interrelations, which the novel illustrates. Thus, knowledge should be "understood as process" and is developed through "thought". Thought, in turn, as a "*movement of becoming* [...]" is indeed the process in which knowledge has its actual and concrete existence" (Bohm 1980: 50, author's emphasis).

With the emphasis on relations, Zapf develops his literary model of cultural ecology, bringing to the fore a concept of a holistic worldview that considers "imaginative literature, in comparison with other textual genres and types of discourse, [...] [as] an ecological force within the larger system of cultural discourses" (Zapf 2007: 147–48). Thus the concept that the "whole is more than the sum of its parts" is essential. Therefore, cultural ecology regards connectivity not

as “conventional or otherwise enforced logocentric structures and hierarchies” but instead as “features of living processes and conflictive energy-fields which, in literature and art, become sources of aesthetic creativity” (Zapf 2012: 88).

Bearing these concepts in mind, this paper argues that – considering the different discourses or “systems” in Amitav Ghosh’s 1995 novel *The Calcutta Chromosome* and its context – a chromosome can serve not only as a conceptual model depicting different systems of knowledge, particularly referring to indigenous Indian vs. Western knowledge, but also as a metaphorical model, becoming a sign of tradition and progress, entangling mythology and science at the same time.

The novel *The Calcutta Chromosome* revolves around two main characters that both are occupied with historical research on the discovery of the cause of malaria. As the story unfolds, different strands are revealed, similar to a double-helix, presenting two different systems of knowledge: one traditional system of ‘Western’ science which is represented by Ronald Ross, historical discoverer of the Malaria bug and an underground counter-science group that Murugan is advocating and analyzing.

The eponymic Calcutta chromosome does not refer to the discovery of the malaria parasite, but instead assumes various meanings. The chromosome can offer important insights into the understanding of the novel adding to the debate of science studies. Firstly, I will argue that the chromosome transforms into a multifaceted conceptual image of knowledge, thus calling into question the limits of knowledge as well as hierarchies and imbalances in knowledge production. This is reflected in the character Murugan, who, as an extraordinary figure, shows certain traits that unveil him as an enzyme that opens up the ‘DNA’ of the story to reveal the secret Calcutta chromosome. Secondly, the image of the chromosome becomes a sign of tradition and progress at the same time, connecting science with a traditional knowledge, and thus merging different worldviews to a larger whole.

Let me start with a description of Murugan, who acts as the ‘glue’ of the story. Murugan’s first appearance in Calcutta with a “green cap, his little goatee and his mud-spattered khaki trousers”, depict him from the perspective of Urmila, a journalist, who accidentally meets him, as a not particularly charming or inviting person (Ghosh 2011: 26). Nevertheless, Murugan, self-entitled expert and non-conventional, maybe even ‘mad scientist’ and rebel against scientific standards,⁶ becomes the catalyst of the story, who holds the “web of life” together and

⁶ He only published a small amount of articles, one of which with the title “An Alternative Interpretation of Late Nineteenth-Century Malaria Research: Is There a Secret History?” received “hostile reception” and he was thus labeled as “eccentric” and “crank” (Ghosh 2001: 35).

connects all different and seemingly unconnected strands of the narrative to one greater whole by exposing connections of seemingly unconnected characters and showing how Ronald Ross's discovery is actually embedded in a web of an underground counter-science group. When leaving for Calcutta, Murugan intends to do research on the single topic he claims to be a self-appointed expert in, namely the person Ronald Ross, historically well-known for his ground-breaking research on malaria:

[Murugan:] [Y]ou won't find another person alive who knows more than I do about the subject I specialize in. [...] Ronald Ross [...], Nobel-winning bacteriologist. Take it from me, as far as the subject of Ronnie Ross goes, I'm the only show in town. [...] I know it sounds like I'm bragging, but it's not really that big a claim. [...] His stuff on malaria was about the only cutting-edge work he ever did. (Ghosh 2011: 50)

According to Murugan's hypothesis, Ronald Ross's discovery of malaria was influenced by a subaltern "anti-science" group that used traditional Indian, mythological-oriented knowledge to conduct research and secretly helped Ross in finding the cause of malaria. This notion is based on the assumption that, within the vast field of knowledge and knowledge production, there are two specific strands or forms of knowledge identified in the novel: On the one hand there is 'traditional' Western science, represented by Ronald Ross, and on the other hand, "non-Western" knowledge of lived experience, which is represented by the "anti-science" group. These non-Western or "other knowledges" were, especially within the "discourse of colonial science [...] sought to [be] marginalize[d] or erase[d]" (Mondal 2007: 45). The original translation of chromosome as "colored body" directly references this racial distinction between 'white' Western science and postcolonial science. Non-Western knowledge is located at the intersection of faith and knowledge, which is also a difficult terrain, as Mondal exemplifies:

[...] non-Western epistemologies would henceforth be classified under the rubrics of religion, mysticism, superstition, and myth. Non-Western knowledge was quarantined as 'belief' and identified as irrational which in turn helped establish modern Western rationality as a universal Reason applicable to all times, all places, and all peoples. (Mondal 2007: 44)

By calling into question the seemingly binary oppositions of Western and postcolonial science, Murugan acts as an observing force that analyzes both systems, thereby bringing to light new insights on a possible interconnectedness of science and indigenous knowledge.

As David Chambers argues in *Nature and Empire*, the problematic relationship of those two fields of knowledge is also closely connected to the question of hierarchical status and thus, power relations. As "[a]ll knowledge systems are 'situated' in power relationships, value assumptions, and historical frameworks"

it is even more important to recognize that “Western science, in our intellectual calculations, cannot be accorded a privileged status over indigenous knowledge” (Chambers 2001: 235). Thus the debate of different cultures of knowledge that Ghosh opens up here is a debate that “goes to the heart of how different cultures view one another and their ways of seeing the world” (Chambers 2001: 235). It seems that scientific breakthroughs are more likely when enabling a cross-cultural community to work together and exchange their knowledge, mentioning the international Human Genome Project that resulted in the complete decoding of the genome in 2003 as just one example. Another way of differentiating diverse approaches to knowledge is Basarab Nicolescu’s distinction between “in vitro” and “in vivo” knowledge. He differentiates between a disciplinary knowledge that “concerns, at most, one and the same level of Reality”, meaning the external world only as “in vitro” knowledge on the one hand, and on the other hand the “in vivo” knowledge, which refers to the correspondence between the external world and the internal world (Nicolescu 2008: 3). While “in vitro” knowledge would refer to Ronald Ross’s “standard science” that simply takes into consideration the object, “in vivo” knowledge puts emphasis on the relations between observer and observed, between subject and object, and the world of the “counter-science” group which tries to productively merge science and myth.

Let us now turn to the Nobel Prize winning Ronald Ross, a British physician, who is a historical as well as a fictionalized figure in the novel. The historical Ronald Ross received the Nobel Prize in 1902 “for his work on malaria, by which he has shown how it enters the organism and thereby has laid the foundation for successful research on this disease and methods of combating it” (“The Nobel Prize”). As son of a British officer, who served in the Indian army, Ross was born in 1857 and died in 1932, leaving behind his *Memoirs* that include diary entries and letters concerning his research of the malaria cause. Ghosh’s novel interweaves the original diary entries and the fictional context.

The fictional Ronald Ross, as described by Murugan, is “a real huntin’, fishin’, shootin’, colonial type, like in the movies; plays tennis and polo and goes pig-sticking; good looking guy, thick moustache, chubby pink cheeks” (Ghosh 2011: 51). Bitten by the “science bug” one day, Ross starts his adventure on finding the cause of Malaria, conducting research in Calcutta (Ghosh 2011: 52). As emphasized by Murugan, Ross’s fragmentary worldview does not lead him to a discovery, but rather the influence of the secret subaltern group. By connecting the two figures of Ross, on the one hand the diary entries and data of the historical Ross, and on the other hand the fictional Ross, Ghosh creates a third space, what Wolfgang Iser labeled “the imaginary” (Iser 1991: 20), by calling into question the binary opposition of fact and fiction. Emphasizing the role of the “imaginary” within a triadic relation including “the fictive” and “the real”, literature creates a

revealing dialectic consisting of a metaphoric implementation and transformation of the historical figure Ross into a symbol of ungraspable phenomena such as knowledge, cultural relations and perspectives, myth, and tradition. The epigraph of the novel depicts this connection, as it is an excerpt from the poem “In Exile” written by the historical Ross on the day of discovery, which the novel and Ross himself in his *Memoirs* refers to as “Mosquito Day”: *This day relenting God\Hath placed within my hand\A wondrous thing; and God\Be praised. At His command,\Seeking His secret deeds\With tears and toiling breath,\I find thy cunning seeds,\O million-murdering Death* (Ghosh 2011: 40, author’s emphasis). While the historical Ross displays his pride and genius of finding the cause of malaria, Ghosh uses it as a starting point from which he unfolds a complex narrative, connecting the strands of Western science with native knowledge of lived experience. Thus he transforms Snow’s notion of the “two cultures” into a juxtaposition of scientists with their “future in their bones”, (Snow 2012: 11) impersonated by Ronald Ross and the “traditional culture” as the “anti-science” group, presented through Murugan.

Pointing towards the elusiveness and difficulty in grasping and describing the concept of the Calcutta chromosome, which was coined “for the sake of argument”, it signifies an “impossibility of knowledge” (Ghosh 2011: 104) which is reflected in the idea that “knowledge is self-contradictory” (Ghosh 2011: 103). The idea of an “impossibility” of knowledge offers various spaces of interpretation. Concerning the fragmentary view of the world we humans are caught in, it suggests a limit of knowledge, set by anthropological boundaries we cannot transgress. This would mean an acceptance of the impossibility of accomplishing the Faustian drive to know “what binds together the inner core of the world” (Goethe 2000: V. 382–383, my transl.). At the same time, accepting the “impossibility” of knowledge “draws on both postmodernist thought and on a strain of Hindu thought which indicates that one does not know everything, is the first step towards knowledge” (Chambers 2009: 41–42). Furthermore, it relates to the question of what essentially constitutes knowledge and how different factors influence its production: The point of view that the novel offers through the “anti-science” group is particularly striking, as it seems to be analogous to a quantum-physical phenomenon called the “observer’s paradoxon”. This paradoxon, which can be formulated as Heisenberg’s uncertainty principle, means that “even if one supposes that the physically significant variables actually existed with sharply defined values, [...] we could never measure all of them simultaneously” (Bohm 1980: 69). The interaction “between the observing apparatus and what is observed always involves an exchange of one or more indivisible and uncontrollable fluctuating quanta” (Bohm 1980: 69). In the context of the novel, this concept signifies that the observer changes what is observed. The “anti-science group”, in

Murugan's view, "believed that to know something is to change it, therefore in knowing something, you've already changed what you think you know so you don't really know it at all: you only know its history" (Ghosh 2011: 103–104). Thus "if it's true that to know something is to change it, then it follows that one way of changing something – of effecting a mutation, let's say – is to attempt to know it, or aspects of it" (Ghosh 2011: 104).

The very concept of knowledge as a catalyst that leads to a change becomes a "productive force" (Thrall 2009: 296) within the systems of knowledge. As a consequence, the "impossibility of knowledge" is reflected in the "silence" of the "anti-science" group (Ghosh 2011: 104). Ascribing this paradox to the "anti-science" group constitutes "a means of representing counter-science as a knowledge that cannot be fully represented" (Mondal 2007: 58–59). The seemingly separate discourses of science and 'counter-science' in the sense of a native, mythologically-based knowledge are brought together in the concept of the Calcutta chromosome, suggesting an additional element within the "standard" Western system of science, as well as a productive connection between mythology and scientific theory.

Referring back to Snow's term of the "two cultures", systems of science as well as literary and cultural tradition can be regarded as differing, but at the same time complementary forms of knowledge. Viewed in this context, the two cultures can be interpreted as a connective force. Reflected in the figure of Murugan, the ambiguous concept of the Calcutta chromosome becomes a symbolic instance of knowledge. Murugan acts as an essential life force, holding Ghosh's narrative together. Drawing on Zapf's concept of a cultural ecology, he can be viewed as "reintegrative interdiscourse", reconnecting "the culturally excluded in new ways to the cultural reality system" (Zapf 2007: 159) and thus the fragmented strands of the narrative to an interconnected web of knowledge.

Murugan functions as the main storyteller of the text – constantly and suddenly appearing on different occasions and places in the novel. Concurrently, this conveys the sheer significance of an adequate mode of conveying knowledge, as he does through telling a 'good story'. As Laura Otis observes, "[e]ven in fields with the most rigorous demands for evidence, there is a tendency to believe the person who tells the best story: one with interesting characters, engaging conflicts, interpretive challenges, and big surprises" (Otis 2010: 573). Telling a convincing story is one of the most important features in science and literature, for which Donna Haraway also offers a convincing point of view when arguing in her book *Primate Visions* that "[s]cientific practice may be considered a kind of storytelling practice – a rule-governed, constrained, historically changing craft of narrating the history of nature" (Haraway 1992: 4). In *The Calcutta Chromosome*, scientific knowledge is taken as a starting point from which the binary opposition

of fact and fiction is dissolved and extended by Iser's imaginary. Moreover, it is transformed into a cultural-ecological literary knowledge that "fulfills a function which cannot be fulfilled in the same way by other forms of discourse, but which is nevertheless of vital importance for the richness, diversity, and continuing evolutionary potential of the culture as a whole" (Zapf 2007: 161).

The storyteller Murugan binds all strands of the plot to one interconnected "web of life". In an intradiegetic narrative, which Urmila, another character in the novel, remembers having read about from a fictional writer within the extradiegetic level of narrative, the text comments on the intricate ways of storytelling and the diffusion between fact, fiction, and the imaginary. She quotes the story:

[Urmila:] "I have never known," it begins, "whether life lies in words or in images, in speech or sight. Does a story come to be in the words that I conjure out of my mind or does it live already, somewhere, enshrined in mud and clay in an image, that is, in the crafted mimicry of life?" (Ghosh 2011: 226)

In addition to elaborately intertwining the complex relation of story and life, this passage also refers to a "clay figurine" that is found by Murugan while researching on Ronald Ross, which he describes as featuring elements of both 'cultures' of knowledge described earlier. What Murugan observes is that the figurine holds "an old-fashioned microscope" in one hand and a "demiurge of Ron's discovery" in the other, signifying the scientific and religious-mythological influences at the same time (Ghosh 2011: 225).

By advocating an approximation of those different forms of knowledge, Murugan acts like an enzyme that opens binding together each appropriate base to one another. He lives and believes in the story he tells, thereby assuming his role as a "reintegrative interdiscourse", bringing together the seeming oppositions of science and the native knowledge of lived experience. Promoting his point of view, he openly states: "My part in this was to tie some threads together so that they could hand the whole package over in a neat little bundle some time in the future, to whoever it is they're [he is referring to the 'counter-science' group] waiting for" (Ghosh 2011: 303). The "neat little bundle" metaphorically refers to the information the Calcutta chromosome contains in its DNA.

Questioning "standard" Western research techniques, Murugan is convinced that not Ross alone could have found the cause of malaria, even though the historical Ross, as partly quoted in the novel, claims in his *Memoirs*:

I am sure that none of them [other researchers] would ever have embarked on so vast and stormy a sea, would ever have been the Columbus of so wild an adventure, would ever have shown – I will not say the patience, the passion and the poetry – but the madness required to find that uncharted treasure island [...]! (Ross 227)

Ross's metaphorical description heavily relies on the dispute between indigenous and Western knowledge, as Chambers emphasizes when she keenly observes that the "language of this passage explicitly equates scientific discovery with exploration and colonization". While Ross intends to reveal the connotations of "individualism, bravery and pioneer spirit", his narrative leaves out the role of "local knowledge in his discovery, projecting a one-directional process of discovery, when in fact cross-cultural interaction created the possibility of a breakthrough" (Chambers 2003: 61–62). The passage of the *Memoirs* emphasizes Ross's pioneer spirit and his seemingly superior role in the discovery of the malaria cause. The fictionalized figure in the novel questions the established boundaries of "in vitro" and "in vivo" knowledge, and tries to open up a space for a linkage of Western and indigenous science.

After having established the role of the chromosome as a concept of different knowledge systems and its reflection in the character Murugan as a reintegrative force, let us now turn to the concept of the chromosome as a connector between science and mythology in the novel. Whereas a chromosome in the scientific sense is a replicating structure, Murugan clarifies from the outset that the "Calcutta chromosome" differs significantly from the traditional conceptualization of a chromosome:

[Murugan:] For the sake of argument let's call it a chromosome: though the whole point of this is that if it is really a chromosome, it's only so by extension, so to speak – by analogy. Because what we're talking about here is an item that is to the standard Mendelian pantheon of twenty-three chromosomes what Ganesh is to the gods; that is, different, non-standard, unique – which is exactly why it eludes standard techniques of research. And which is why I call it the Calcutta chromosome. (Ghosh 2011: 246–247)

With this description of the chromosome, Murugan establishes important insights concerning its 'nature'. It differs from a "standard" conception of a chromosome, as its function is rather oriented toward an "ultimate transcendence of nature" (Ghosh 2011: 105) and cannot be grasped easily.

In fact, it symbolizes an imaginative 'stretch' extending the limits of "standard techniques of research" and transforms into a mythological image. This is emphasized by Murugan's connection of the chromosome to the Hindu god Ganesh, who has an Elephant head in Hinduism and is "invoke[d] at the start of any important undertaking [...] so that through his **grace**, potential obstacles may be removed or avoided" ("Ganesh" 2002: 237, author's emphasis).

Consequently, the chromosome is situated in "Calcutta" – signifying a place that is virtually "outside" of Western knowledge. The differing nature of the chromosome is emphasized even more by Murugan's continuous speculation about it:

[Murugan:] it's not symmetrically paired. And the reason why it's not paired is because it doesn't split, into eggs and sperm. And guess why that is? I'll tell you: it's because this is a chromosome that is not transmitted from generation to generation by sexual reproduction. It develops out of a process of recombination and is particular to every individual. (Ghosh 2011: 247)

As the chromosome only appears in “non-regenerating tissue”, which means in the brain, it would be hard to find and to accept for a “conventional scientist” because it is “a biological expression of human traits that is neither inherited from the immediate gene pool nor transmitted into it” (Ghosh 2011: 247). Thus it can be regarded as an imaginative counter-discourse to “conventional” Western research, which has turned its back on myth and tradition:

Biologists are under so much pressure to bring their findings into line with politics: right-wing politicians sit on them to find genes for everything, from poverty to terrorism, so they'll have an alibi for castrating the poor or nuking the Middle East. (Ghosh 2011: 247)

Not surprisingly, Ronald Ross is – even though located in Calcutta – strongly influenced by Western science and thus unable to see a chromosome, such as described by Murugan. In contrast, only a person who operates outside of Western power influences, as the “subaltern” woman Mangala, representing the head of the “anti-science” group, is able to adopt a perspective that offers another approach towards discovering a cure for malaria, or as an even more speculative and romancing strain of the story suggests, immortality. Murugan assumes that

[Murugan:] what these guys were developing was the most revolutionary medical technology of all time. Forget about the Nobel, forget about diseases and cures and epidemiology and shit like that. What these guys were after was much bigger; [...] the ultimate transcendence of nature. (Ghosh 2011: 105)

Suggesting that the long-pursued dream of immortality as the driving force of the “anti-science” group brings us into the realm of science fiction and at the same time renders Mangala as a “goddess”. The reason for conducting research is not because she “wants to be a scientist” but rather that “she wants to be the mind that sets things in motion”, comparable to the Hindu God Ganesh (Ghosh 2011: 249). Furthermore, the relation between humanity and nature is questioned and the novel suggests an inherent connection between mind and body, immaterial and material components, human nature and its environment. The literary rendition of the Calcutta chromosome as a metaphor and thought concept assumes different meanings, and blends different concepts of knowledge, while parts of it always remain ungraspable. Similar to particles as described by Bohm, the chromosome is part of a “totality” that cannot be known in all its details and thus cannot be grasped fully, but only through its interdependencies and relations. Kroeber re-

flects this assumption in reference to the role of an organism to its environment, which holds also true for the chromosome in Ghosh's novel. "[T]he individuality of an organism is not definable except through its interactions with its environment, through its interdependencies" (Kroeber 1994: 7). Interrelatedness plays an essential role, finding its expression in the characters Ross and Mangala being guided by the 'stage director' Murugan, thereby revealing accidental or surprising intersections of the seemingly separate strands of the story. Thus, it is not the genome alone that defines a human being, but living in and interacting with the environment.

As I have shown, the function of the Calcutta chromosome in the novel is manifold. The subject of molecular biology is taken up by literature and translated into new forms of knowledge within the literary discourse. Consequently the novel becomes, in an ecological sense, as Zapf argues, a "laborator[y] of human self-exploration" and "imaginative biotope", testing the limits of knowledge, thought and culture (Zapf 2007: 155). In the process, the novel metaphorically transforms scientific knowledge concerning the research on malaria and molecular biology in a way that adds to the literary discourse, by suggesting imaginative forces that bring together cross-cultural science and knowledge of lived experience. By analyzing instances of chromosomal structures as conceptual and metaphorical images in the text, new spaces of imagination are opened up and epistemological value is added to the debate of an interconnectedness of science and literature, acknowledging different ways of perceiving the world and of acquiring knowledge, such as "in vivo" and "in vitro" knowledge, and trying to waive hierarchical structures in favor of regarding different forms of knowledge as equivalent and complementary rather than hierarchical and self-contained.

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