8 Lucy in the sky: celestial bodies

Ever since humans ventured beyond their cradle in East Africa, they have advanced their exploration of the rest of Earth step by step, with the most spectacular successes during the past two centuries. Now that most of the habitat of the globe has been charted and conquered, humans are increasingly turning their attention to the "remotest corners" of both living organisms and outer space. Focusing on languages of voyaging and mapping, this chapter discusses the similarities and differences between research on what biologists sometimes refer to as the "universe" within the human body (in particular the foetus and the genome), on the one hand, and, on the other hand, the exploration of outer space. The enterprises of the Big Sciences of molecular biology and astrophysics, I argue, zooming in and out, are related in many ways – and not just through similar languages and metaphors.

During the past half century, both molecular biology and space science have made immense progress. Some of the significant events generated by the former were Rosalind Franklin's photography of DNA (1952), the discovery of the double helix (1953), and the drafting of the human genome (2000). Among the critical events taking place in space during the second half of the twentieth century were the launching of Sputnik (1957), blasting Gagarin into orbit (1961), landing humans on the moon (1969), and establishing the International Space Station (1998). To celebrate half a century of human exploration in space, the *Guardian* (2007) published a series of photographs showing astrophysicist Stephen Hawking, accompanied by his assistants, floating on a zero gravity jet above the Florida coastline. The plane made several parabolic dips, giving Hawking the experience of weightlessness. The images powerfully underline both the mastery of space and the dependence and fragility of the human being. Newton's apple is not far. Or is it perhaps a reference to the sinfulness of human digression into the heavens, a modern version of the story about the Tower of Babel?

Since the European Middle Ages, the notion of "celestial bodies" or "celestials" (from *caelum*, the sky) has usually referred to heavenly bodies belonging to reigning gods or emperors on Earth. With the advances of molecular science, including those of genetic engineering and synthetic biology, the idea

of constructing corporeal bodies *for* outer space has become possible. While hitherto human exploration has taken place without subspeciation, this is unlikely to be the case in the event of human settlement in outer space. Indeed, the future may bring forth a post-human settler in space, a celestial "Lucy in the sky" – or, more likely, several kinds of them.

8.1 Foetal space

Several scholars have drawn attention to the parallels between imagery relating to, on the one hand, human foetuses and the womb, and, on the other hand, the celestial world. As Michaels (1999: 125) points out, "[p]lanets, supernovas, and galaxies have been showing up alongside foetuses, embryos, and blastocysts during the past twenty-five years, and their visualization occasions comparable journalistic indulgences and epistemic quandaries." Duden (1993) explores the path-breaking photographs of Lennart Nilsson documenting "the beginning of life," published in the *Life* magazine in 1965 and 1990, pointing out that the photographs, the first ones of their kind, and the accompanying text in *Life* repeatedly juxtapose foetuses and astronauts, bodies and space. The 1990 issue elaborates on the first stages of human life by means of celestial language and imagery, starting with a foetus aged two hours:

> Like an eerie planet floating through space, a woman's egg or ovum ... has been ejected by one of her ovaries into a fallopian tube ... The luminous halo around the ovum is a cluster of nutrient cells feeding the hungry egg. (Quoted in Duden 1993: 13)

Eight days later, *Life* goes on:

> The blastocyst has landed! Like a lunar module, the embryo facilitates its landing on the uterus with leg-like structures composed of sugar molecules on the surface. (Quoted in Duden 1993: 14)

The fascination with the foetus and outer space underlines human curiosity at the border of the unknown, the urge to extend one's sight by zooming in or out beyond the "natural" horizon of the human eye. New images and visual horizons, however, sometimes take on a life of their own, informing perception and politics. Thus, astronauts tend to speak of a gestalt shift as a result of their voyages into space, when seeing Earth from a distance, a "Gaia" perspective that seems to facilitate global, environmental concerns. No doubt, images from space, including images from Neil Armstrong's "giant leap for mankind" when landing on the moon, have also informed public discussions on Earth on several scores. Likewise, the kind of fatal imagery presented by the famous *Life* photographs just discussed is likely to have had an enormous impact on public discussions of biopolitics – in particular, abortion and the rights of women. Duden (1993) addresses the issue with reference to what she calls the

"Nilsson Effect," highlighting the shift in emphasis as a consequence of Nilsson's photography from the pregnant woman to the foetus and the resultant alteration in power balance between those advocating "pro choice" and others in favor of "pro life."

Some other works make similar analogies and connections between foetuses and astronauts, from the vantage point of outer space. An article by Sofia (1984), largely devoted to a commentary on the film *2001: A Space Odyssey* (1968) by S. Kubrick and A.C. Clarke, suggests the film establishes what she calls "Jupiter Space" through the imagery of the foetus, a space "whose contours are elaborated in visual complexes which equate the male brain, the womb, outer space, city landscapes, grids of light, microcircuits, the interiors of computers, skyscraper façades, and so on" (1984: 48). More generally, she argues, the human foetus operates as a symbol for Earth: "It is a cosmic symbol. It is not entirely inappropriate that the planet be represented by a signifier of unborn life, for it presently contains all of the possibilities for future life forms. From this perspective, disarmament might be seen as an act to prevent a cosmic abortion" (Sofia 1984: 56). While Sofia's article is highly playful and speculative, it draws attention to military concerns and the Cold War and their impact for both biopolitics and space exploration. With the development of digital technology, bioinformatics, and the new genetics, voyaging into the human body was escalated and extended to specific organs, in particular the brain, cellular material, and the genome.

Eventually, "Man the Hunter" and "Woman the Gatherer," made in East Africa a long time ago, turned to hunting and gathering in their own genome. What project could be more anthropological? *Homo viator* navigating waters right at home. One of the characteristics of the genome era is the application of a cartographic language to the human body. In year 2000, the first draft of a "map" of the human genome was announced. On that occasion, the journal *Nature* triumphantly invited its readers on a tour into the "universe within" with the following grand statement:

> Since ancient times we have drawn charts of the sky, of the world, and of our anatomy. Today, a new chart is added to the collection: The map of our genome. Its purpose is to synthesize the insights and meaning gained from the sequence of the human genome. We invite you on a tour of the geography of the genome, exploring the chromosomes, the sequence, and the differences between individuals and populations. The integration of these exciting new findings ushers in a new era of scientific and medical progress. (*Nature* 2000: 395)

Impressed with their ability to zoom in on the minute details and contours of hereditary material and their power of visualization, geneticists and molecular biologists have firmly reinforced their language of cartographies, a language that echoes the modernist notion of expansion and mastery.

8.2 Out of Africa, out of Earth

In 1974, a 40 percent complete *Australopithecus afarensis* skeleton was discovered in the Awash Valley of Ethiopia's Afar Depression. The fossil (AL 288–1) was nicknamed Lucy after the Beatles song "Lucy in the Sky with Diamonds," which was being played repeatedly at the time of discovery in the archaeological camp at Awash Valley. Lucy was estimated to have lived 3.2 million years ago, firmly establishing human origins in East Africa. For a long time there has been a rich discussion of the roads out of Africa, their timing and significance for the understanding of hominid evolution and history. Recent archaeological findings from Dmanisi in the Republic of Georgia shed new light on some of the issues involved, possibly documenting the earliest members of the genus *Homo* outside the continent, thereby filling in significant gaps in current knowledge about a critical phase in human evolution (Lieberman 2007). Dated to 1.77 million years ago, the fossils involved indicate great variability in body and brain size, in the size range of *H. habilis* and *H. erectus*, reflecting, among other things, selection for improved terrestrial locomotion. These findings, then, provide an image of scattered and variable hominids adapting to time and place outside Africa. Will there be a parallel development in outer space, in the event of human settlement on different asteroids, space stations, moons, and planets?

One of the most important contributions to the anthropology of space is the volume *Interstellar Migration and the Human Experience* edited by Finney and Jones (1985). Written in the heat of the Cold War, under the threat of nuclear war, it represents a particular "galaxy of discourse," to borrow a term from another important contribution to the field (Battaglia 2005). For Finney and Jones (1985: 5), it is human "biocultural" nature to venture into new areas, to explore the entire globe and eventually head for the sky: "Sometime in the not too distant future a space traveller will do something science fiction writers have been talking about for decades: A human being will jump completely off a small world. Asteroids and small moons have very weak gravity indeed." "Barring total nuclear war, a devastating collision with a comet or asteroid, or some other calamity on a worldwide scale," they conclude, "there is a good chance that this initiative will soon result in settlement in near space and that eventually our descendants will scatter among the stars" (Finney and Jones 1985: 333). No doubt, the birth of the first human child in outer space will be an event of enormous symbolic significance, underlining human *settlement* outside Earth in contrast to the relatively brief visits of the past, much like the birth of the first child outside Africa.

The likely consequence of human settlement in space is one of the themes explored by Finney and Jones (1985). For a long time, they suggest, the hominid species has formed one interbreeding world population and speciation

has not seemed possible. That, however, would not hold in space since our descendants will probably be scattered throughout the vastness of space that would set up the conditions for the rapid speciation of *Homo sapiens*:

> If the technology of space colonization really works, if our descendants do settle throughout the Solar System and then migrate to other star systems, humanity will never be the same again. The course of human evolution will change utterly and inalterably ... The threshold of space is also the threshold to quantum biological evolution. (Finney and Jones 1985: 22–23)

Time, no doubt, has complemented and qualified the predictions of Finney and Jones on several scores. For one thing, the obvious post-Cold War candidate for what they refer to as "some other calamity on a worldwide scale" is not nuclear war but massive environmental change generated by humans, including global warming. Our successes at exploration, colonization, and resource use have made Earth a rather messy place for humans and many other species, and unless the problems at home become paralyzing this is likely to escalate the exploration of outer space. Colonization and modernization have been taxing to the planet, a point emphasized by Mahatma Gandhi. Asked whether independent India would follow the British pattern of development, Gandhi replied: "It took Britain half the resources of the planet to achieve this prosperity. How many planets will a country like India require?" (quoted in Moran 2006: 150). How many planets will the world require to satisfy the needs of the masses and to clean up the mess?

Finney and Jones (1985) did not anticipate (or at least they did not comment upon) the successes of the new genetics and their potential relevance for settlement in space. Thanks to the spectacular advances of biotechnology and genetic engineering long-term biological adaptation to outer space is no longer pure science fiction. As Rheinberger (2000a: 19) suggests, modern gene technology along with the molecular biology developed between 1940 and 1970 facilitate "the prospects of an intracellular representation of extracellular projects – the potential of 'rewriting' life." The key tools of recombinant DNA work are not "sophisticated analytical and electronic machinery" but "macromolecules that work and perform in the wet environment of the cell ... The scissors and needles by which the genetic information gets tailored and spliced are enzymes. The carriers by which it is transported into the cells are nucleic acid macromolecules" (Rheinberger 2000a: 24–25). As a result, Rheinberger argues, the traditional dichotomy between "nature" and "culture" no longer makes much sense. Quite possibly, in the future life will be "written" and "edited" for outer space, inviting new kinds of citizenship and biosocialities and new kinds of hybrids of technologies and organisms. Some of the early speculations along these lines are those of Sofia (1984). If the Earth is an embryo, Sofia suggests,

then its womb is space. Although we know of no other living worlds, centuries of extraterrestrial fantasies capped by several decades of off-world practice have encouraged us to think of space as a good womb, full of inhabited planets. From this view, the Earth is just one of many cosmic pregnancies. It doesn't really matter if we abort it, for we can always escape to one of the new Star Children we pluck from the vacuum; we might even mutate into extraterrestrial cyborgs. (Sofia 1984: 57)

Not only does modern biotechnology increase the likelihood of human and post-human variation, encounters with radical "others" from space cannot be ruled out. Ufology, as Roth (2005: 39) points out, the study of unidentified flying objects and extraterrestrial visitors, "is a discipline that has tried to understand racial diversity. Ufologists do not always call it 'human' diversity, but then the earliest European anthropologists were not sure that all speaking bipeds outside Europe were human either." The difficulties of adapting to permanent settlement in space should not be underestimated, in particular the damaging effects of radiation on human bodies and problems relating to what might be called the "phenomenology of space," the challenges posed by our Earth-bound perceptual, cognitive, and psychological capacities in the context of space. Addressing the relations between humans and the material world from a phenomenological perspective, Ingold suggests what he calls "a view from the open"; rather than imagine "that life is played out upon the surface of a world already furnished with objects," he argues, people "make their way *through* a world-in-formation rather than *across* its pre-formed surface. For that reason, the fluxes of the medium through which they move are all-important" (2007: S32; emphasis in the original).

Such a view emphasizes the everyday human experience of wind and weather. There is no compelling reason, however, to imagine that the "view from the open" does not apply to life in space; in fact, it may be even *more* relevant for astronauts than earthlings. Space is a particular kind of medium with its own formations and fluxes – a medium where everything floats, where solar particles ("winds") blur vision, and where Earth may not even be in sight. While space, much like the alien medium of water, poses particular problems for a species thoroughly adapted to terrestrial life, these can at least partly be suppressed by means of technological and informatic enhancements like robots and artificial intelligence. The mere fact that settlements in outer space *are* a possibility underlines that space is just as "natural" for humans as Earth.

There are profound problems to face in outer space, and, indeed, they may slow down attempts to establish human settlements outside Earth. Some of the problems likely to be encountered are unprecedented biopolitical and bioethical issues that will inevitably be distracting, issues relating to inequality, difference, citizenship, race, and, possibly, eugenics. Humans, however, have been moving fast on the space front for the past half a century and their journeys seem likely to continue. Given the spectacular advances in travels

in outer space over the past decades, following the launch of Sputnik, it is quite conceivable that in the future life will be "edited" for outer space, inviting new kinds of citizenship and new kinds of hybrids of technologies and organisms, new kinds of celestial bodies. While such issues have long been relegated to fiction (for recent examples, see Moseley 2002 and Crichton 2006), now they are very much on the academic agenda (Valentine, Olson, and Battaglia 2012). The original meaning of the title of "Lucy in the Sky with Diamonds" has always been a matter of debate, but whatever John Lennon's reasoning when writing the lyrics – in one theory there was a psychedelic element induced by drugs (LSD) – Lucy seems to be heading for the sky.