

TRANSLATION TRANSLATION

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Translating and Representing Bioscience Through Architecture

This paper examines the widespread inclusion of diagrammes and images from the biosciences in the design of laboratory buildings for that branch of science. It is a practice motivated, as Will Alsop explains in relation to his use of virus cell forms in the Blizzard Building, to ensure "the very fabric of the building speaks about science..." Alsop's remark may well have been flippant or off-the-cuff, but in the light of so many laboratory architects attempting an architecture parlante, this paper investigates the motivations and effects of an architecture that intends to 'speak' about and for science. Heeding the contemporary conceptualization of translation as a process of construction in contexts of power and culture, the rendering of scientific images at architectural scale is one in which the exchange transforms the artefact and the disciplines in which it is found. The case of the double-helical stair, an architectural invention reduced to a 'brand' by the discovery of DNA, becomes here a test case for questions of translation between science and architecture.

The Bioscience Laboratory

The biosciences industry, or biotech, applies knowledge of the way in which plants, animals, and humans function with the goal of developing new treatments, therapies and processes. It is one of the most important economic drivers in the industrialized world and has seen staggering amounts of public and private investment in the lead up to and wake of the sequencing of the human genome, completed in 2001. Since then, biosciences jobs in the US have seen a wage growth of 13.1%, compared with 4.4% in all other industries.¹ In California alone there were 2321 biomedical companies in 2013 with \$69.2 billion in annual revenue and more people employed than in the aerospace industry.² A significant portion of this investment has been in the construction of new multi-disciplinary buildings that bring together research, clinical translation and, even, manufacturing. Bio-X at Stanford University, completed in 2003 was constructed at a cost of US\$146 million, while on the east coast, LISE at Harvard University (2007) cost US\$155 million. In Australia, the AgriBio facility for agricultural biosciences research, is a A\$288 million joint venture between La Trobe and the Victorian Government's Department of Environment and Primary Industries (DEPI). Funding to a total of \$354 million from the Australian and Queensland Governments, The Atlantic Philanthropies, University of Queensland and Queensland University of Technology, went into the realization of the Translational Research Institute in Brisbane. This figure does not include the cost of the adjacent bio-pharmaceutical manufacturing facility. The Francis Crick Institute, a biomedical research centre currently under construction in London, and planned to open in 2015 is budgeted at approximately £660 million and will house 1500 staff.

While the scale of financial investment is impressive and draws in multiple stakeholders and considerable philanthropy, more importantly, the laboratory for biosciences has joined the museum and the gallery as a type deserving of a 'signature' architect, iconic treatment and civic pride and public investment. The buildings mentioned above were designed by Norman Foster, Rafael Moneo, Lyons Architects and Wilson Architects in association with Donovan Hill respectively. Herzog and de Meuron designed the new laboratory building for Acetelion Pharmaceuticals in Basel and, in the same city, SANAA, Tadao Ando and David Chipperfield are just some of the big name architects who have been commissioned by rival company Novartis. These architects were not engaged because they could deliver a no-nonsense functional laboratory, but because they contribute status and a track record of formal and spatial innovation. Scientific organisations are investing in the spatial quality and appearance of their buildings and this is a radical departure from the largely pragmatic and

1 Biotechnology Industry Organization, *Bioscience Economic Development: Legislative Priorities, Best Practices, and Return on Investment* (Washington, D.C., 2012) 3. http://www.bio.org/sites/default/files/State-Leg-Best-Practices_0.pdf

2 California Biomedical Industry: 2013 Report, <http://www.californiabiomedreport.com/highlights/>

introverted laboratories of the mid to late-twentieth century.³ It coincides with what Philip Mirowski identifies as the privatisation of American science, starting in the 1980s when government support for basic research began to decline and for-profit corporations became the largest funders of research.

The Impulse to Expression

The new laboratories are diverse in their stylistic approaches, but many share an impulse towards expression. While for some the expressive ambition is directed towards making evident the collaborative ambitions of contemporary science, either through transparency or dynamic form, for many it is achieved through selecting and re-presenting scientific subjects, images and artefacts. Architect Will Alsop captures this will to express in describing the Blizzard Building (2005) for the Queen Mary University of London, England: "Our aim has been to create a space that avoids the traditionally sanitised environment of laboratory research buildings - here the very fabric of the building speaks about science ..."⁴

Architecture's agency in 'speaking' science is the concern of this paper. This speaking is not a simple act of translation, defined as the substitution of one system of meaning for another in order to preserve meaning. Indeed, it has been argued in translational studies that this never occurs even in linguistic translation for the process is always one of re-construction by agents with motives in social contexts. As Clapin makes clear, "Representational schemes carry significant tacit semantic baggage [which] means that every translation or recoding from one scheme to another must add to or change that tacit content."⁵ Edward Sapir concurs that translation is impossible since "No two languages are ever sufficiently similar to be considered as representing the same social reality. The worlds in which different societies live are distinct worlds, not merely the same world with different labels attached."⁶ Contemporary translation theories stress both the creativity and the independence of the translator. Indeed, the act of translation is viewed "as a process of negotiation between texts and between cultures, a process during which all kinds of transactions take place mediated by the figure of the translator."⁷

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- 3 The Hoffman Laboratory of Experimental Geology at Harvard University completed in 1960 by Gropius's The Architects Collaborative (TAC) and Mellon Hall of Science at Duquesne University in Pittsburgh, designed by Mies van der Rohe are typical of the mid-century laboratory. Each exemplifies the fit between a late modernist architecture of rational organization and industrial construction, deftly conveying the scientific ideal of neutral inquiry pursued dispassionately by experts using logical methods. The Salk Institute of 1965 at La Jolla by Louis Kahn, of course, is a notable exception in its commitment to design quality and oft referred to by contemporary laboratory architects. It is the first laboratory that successfully deploys architecture as a tool of persuasion and human management.
 - 4 "Blizard Building," *arcspace.com*, 21 November 2005, accessed 24 October 2013, <http://www.arcspace.com/features/alsop-architects/blizard-building/>.
 - 5 Hugh Clapin, "Tacit Representation in Functional Architecture," in *Philosophy of Mental Representation*, ed. Hugh Clapin (Oxford: Clarendon Press, 2002), 309.
 - 6 Edward Sapir, *Culture, Language and Personality* (Berkeley, Los Angeles: University of California Press, 1956), 69.
 - 7 Susan Bassnett, *Translation Studies*, 3rd edition, (New York: Routledge, 2002), 5-6.

Neither science nor architecture possess disciplinary-specific coherent linguistic systems that might be demarcated - despite the attempts in the 1970s through the -90s to identify and, later disrupt, an architectural grammar. Each operates through diverse and at times dissimilar media including texts, images and objects, so that translation can only be used as a conceptual framework for thinking through what Jakobson calls "intersemiotic transposition" - the exchange of representations between cultural forms.⁸ As will be argued, historical, disciplinary and social contexts can radically change the interpretation of an image or object. It is, however, a productive framework for thinking through the exchanges that take place between disciplines if we follow the shift from the problem of equivalence to questions of cultural difference, agency and the negotiation of power.

Motivation is the easiest part of the problematic to understand, but is also a complicating and constructive force in the process of inter-disciplinary transposition. The development of more complex science, understood only by a few and taking place in private places, fuels a persistent and widespread view of the scientist that is curiously akin to the alchemist of old. The popular image of scientists is one of obsession, preoccupation and social maladjustment.⁹ In science-fiction the solitary and secretive habits of the scientists are invariably malevolent. In this context, scientific organisations have been eager to convince an ambivalent and distrustful public about the validity of scientific research and to facilitate "the gathering of resources for pursuing certain lines of research."¹⁰ For corporate science "the risk of societal objection to product or research lines" is one of the highest risks to profit, and can only be addressed through controlled communication.¹¹ Architecture parlante, scientists hope might be harnessed to counter scepticism with a demonstrative presentation of the building's function or identity. It is a hope, evidently encouraged by the architectural profession.

Scientific Motifs in Science and Architecture

Fulfilling the desires of clients for a positive image is complicated by the difficulty of achieving anything like precision in the architectural communication of science. The default approach over the past decade has been to inscribe laboratory buildings with references to scientific subjects and to back up these up with public narratives about what it is intended. Alsop's Blizzard Building features four large suspended pods above the laboratory floor intended to resemble different kinds of cells, and its glazed façades depict images inspired by molecular science by artist Bruce Mclean. The most prominent façade of the Science Laboratories at the Chinese University in Hong Kong, by

8 Roman Jakobson, "On Linguistic Aspects of Translation." In *On Translation*, ed. Reuben A. Brower (Cambridge, Mass.: Harvard University Press, 1959), 232-39.

9 Brian Stableford, "Scientists," in *The Encyclopedia of Science Fiction*, ed. Peter Nicholls (London: Granada, 1979), 533-34.

10 Leah Lievrouw, "Communication and the Social Representation of Scientific Knowledge," *Critical Studies in Mass Communication* 17, no. 1 (1990): 9.

11 Bart Penders, John M.A. Verbakel and Annemiek Nelis, "The Social Study of Corporate Science: A Research Manifesto," *Bulletin of Science Technology & Society* 29, no. 6, (2009): 443.

RMJM (2010), is supposed to convey the periodic table of elements through its pattern of coloured glass. Two of the façades of the Walter and Eliza Hall Institute of Medical Research, Melbourne, Australia (2012), designed by Denton Corker Marshall, feature punched-metal elements that are an abstract representation of DNA. La Trobe University's Molecular Science Building in Melbourne by Lyons Architects (2013), has a tessellated façade based on the hexagonal geometry of a molecular structure that the architects claim is "derived from ideas about expressing the molecular research that is being undertaken within the building."¹² Lyons' efforts roused one reader to comment on the Dezeen site: "The scientists have immediately begun work on a vaccination for awful metaphors."¹³

In each of the above examples, biological images or diagrammes have been enlarged and abstracted to generate the building plan or the shape of a room, or rendered on surfaces in two dimensions. In each instance the biological referent is a cultural entity made by scientists, rather than a natural given discovered by science. In the laboratory, natural organisms are extracted from their physical and temporal contexts and subject to multiple interventions - dissolution, heating, evaporation, freezing, fragmentation, miniaturization, sterilization, refrigeration, etc. They are also subject to numerous techniques- such as image processing and genetic mapping - through which science transforms the world into a knowledgeable representation that can be manipulated to produce new knowledge. As Knorr-Cetina describes, experimental science

"rests upon the malleability of natural objects. Laboratories use the phenomenon that objects are not fixed entities which have to be taken as they are or left to themselves. In fact, laboratories rarely work with objects as they occur in nature. Rather, they work with object images or with their visual, auditory, electrical, etc., traces, with their components, their extractions, their purified versions."¹⁴

Objects from the natural environment are installed "in a new phenomenal field defined by social agents."¹⁵

This field is, necessarily, populated by representations and accessed through language. As Ian Hacking notes: "Natural science since the seventeenth century has been the adventure of the interlocking of representing and intervening."¹⁶ Indeed, for some time there has been a raging argument in philosophy about the status of constructed representations in science in relation to the real world they purport to represent and alongside other forms of representation.¹⁷ The problem is something like "what is the difference between Galileo's geometric figures and Vermeer's

12 "The La Trobe Institute for Molecular Science by Lyons," *Dezeen magazine*, 9 April 2013, accessed 21 January 2014. <http://www.dezeen.com/2013/04/09/the-la-trobe-institute-for-molecular-science-by-lyons/>

13 "The La Trobe Institute for Molecular Science by Lyons", *Dezeen magazine*, 9 April 2013, accessed 21 January 2014. <http://www.dezeen.com/2013/04/09/the-la-trobe-institute-for-molecular-science-by-lyons/>

14 Karen Knorr Cetina, "The Couch, the Cathedral, and the Laboratory: On the Relationship between Experiment and Laboratory in Science," in *Science as Practice and Culture*, ed. A. Pickering (Chicago: University of Chicago Press, 1992), 116.

15 Knorr Cetina, "The Couch, the Cathedral, and the Laboratory," 117.

16 Ian Hacking, *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science* (Cambridge: Cambridge University Press, 1983), 146.

17 Craig Callender and Jonathan Cohen, "There is no Special Problem About Scientific Representation," *Theoria* 55 (2006): 7-25.

paintings?" The answer usually points, as Richard Hughes argues, to the fact that scientific representation possesses elements of denotation and interpretation evident in representation generally, but also elements of demonstration – scientists use the model or image to get results.¹⁸ Thus, the mapped chromosome does not resemble its subject, it translates it into mathematical code to enable particular interventions to flourish. Its utility lies primarily on the agreement of other scientists as to its operation, thus the problem of scientific representation is primarily one of disciplinary demarcation, not of translation. Accordingly, a model or image in science is itself often the subject of contestation and research. What this comes to mean in practice is that scientific representations are legible, precise and useful in their intended domains, but to lay audiences may be recognized only as scientific representations, much like a non-Japanese reader may discern that a logographic on a t-shirt is kanji and, not knowing its precise meaning, interpret it as a signifier of the exotic.

Representations are external and public forms of knowledge and science cannot exist without them, despite the fact that they are sometimes naturalized, overlooked, or reduced to questions of isomorphism. They are also historic, being dependent on changing ocular regimes and visual technologies. Moreover, they influence scientific practices, processes and knowledge. Foucault and Roland Barthes have worried about the political implications of representation in science and culture. W. J. T. Mitchell sums up this concern when he argues representation as “the relay mechanism in exchanges of power, value and publicity.”¹⁹ For Bruno Latour the rhetorical power of scientific representations, their persuasive capacity lies in their mobility – their capacity to move across scientific fields.²⁰ What of their capacity to move outside of scientific fields and into other cultural domains? What takes place through the inclusion of scientific representations in architecture – both to the architecture and to the migrated representations? Is there a qualitative difference between Leonardo da Vinci using the form of the volute of a shell that he has observed and recorded in his own drawings, and Alsop's enlarged version of a virus cell, known to him only through the image-making activities of virologists? What are the consequences for each discipline of the engagement between architecture and the biosciences?

The DNA Stair

The most successful scientific representation in terms of its almost universal recognition outside science is the double-helical structure of DNA. Its inclusion as an architectural feature is also commonplace in the genre of bioscience laboratories and, thus, a useful device on which to attempt

18 Richard Hughes, “The Ising Model, Computer Simulation, and Universal Physics,” in *Models as Mediators*, ed. Mary Morgan and Margaret Morrison (Cambridge: Cambridge University Press, 1999), 97-145.

19 W. J. T. Mitchell, “Dinosaurs Decoded,” in *From Energy to Information: Representation in Science and Technology, Art, and Literature*, ed. Bruce Clarke and Linda Dalrymple Henderson (Stanford: Stanford University Press, 2002), 420.

20 Bruno Latour, “Drawing Things Together,” in *Representation in Scientific Practice*, ed. Michael Lynch and Steve Woolgar (Cambridge, Mass.: MIT Press, 1990): 26-27.

to answer the above questions. It is worth sketching just some of the instances of its appearance to establish its appeal and context.



Fig. 1. Helical stair in the Molecular Biology Research Building, University of Illinois, Chicago (1995).

The Molecular Biology Research Building on the University of Illinois at Chicago campus from 1995 features a gaudy double-helix staircase, lights embedded in its treads, that one critic enthuses is “biology as sculpture.”²¹ Floyd Anderson, a principal with Lohan Associates, the Chicago architectural firm in charge of the project, told a reporter: “The first thing we did was ask the university for books on genetic engineering.”²² The exterior of the pre-cast concrete structure incorporates the shapes and patterns of the DNA molecule, while inside the corridors are shaped like both ends of a chromosome. At the BC Cancer Agency Research Centre in Vancouver the architects declare that the central stair “allows scientists to inhabit an oversized DNA spiral while enhancing informal interaction.”²³ The building was designed by Richard Henriquez with the IBI group and completed in 2004. For their 2007 design for the exterior of the Institute of Molecular Genetics for the Czech Academy of Science, architects Jan Sesták and Marek Deyl of the Prague-based firm studio pha appended circular steel emergency stairs “in a shape which represents the symbol of genetic inheritance – the DNA double helix.”²⁴ The Nijmegen Centre for Molecular Life Sciences in the Netherlands by AGS architecten (2000), features a double helix staircase rising eight floors in its research tower. Gnadinger Architects included one in the Technology Centre of Medical Science, Berlin (2009) and a single helical staircase is the centrepiece of the Faculty of Science at the University of Copenhagen by Christensen and Co from 2009. At the EMBL Advanced Training

21 Gordon Wright, “Lab spaces share a genetic link,” *Building Design and Construction*, 1 June 1997, accessed 2 February 2014, <http://www.highbeam.com/doc/1G1-19506604.html>.

22 Joan Giangrassie Kates, “Like a DNA Molecule, Staircase is 1 of a Kind,” *Chicago Tribune*, 3 October 1995, accessed 9 September 2012, http://articles.chicagotribune.com/1995-10-03/news/9510030036_1_genetic-engineering-chromosome-dna-molecule

23 “BC Cancer Research Centre,” *Henriquez Partners Architects*, accessed 31 August 2012, <http://henriquezpartners.com/work/bc-cancer-research-centre/>.

24 “IMG”, *Studio PHA*, accessed 24 October 2012, <http://www.studiopha.cz/en/project/img-building>.

Centre in Heidelberg, Germany (2010) the entire building, which is circular in plan “is inspired by the structure of the double helix, the carrier of genetic information, DNA.”²⁵

The double-helical stair in architecture is a functional element that predates Frances and Crick's 1953 announcement of the shape of DNA. According to Mielke, the double helical stair is an old Islamic device, found for example, in the minaret of the Suq al-Ghash of Baghdad (902-908).²⁶ Scala Leonardesca, as Palladio described it in Book 1 of his treatise *The Four books of Architecture* (1570), was originally an elegant space-saving architectural solution for dividing vertical access, of particular relevance for multi-family housing in Venice. The first realized example in Venice is Jacopo Sansovino's Casa Moro in San Gerolemo of 1544.²⁷ For his own commissions, Palladio adopted the double helix staircase in masonry vaulting in three of his villas for Venetian noblemen: Villa Pisani, now Placco (1552) in Montagnana, Padova; Villa Cornaro, now Gable (1553), Piombino Dese, Padova, and Villa Foscari, known as La Malcontenta (1559-60), Mira, Veneto. Palladio also used unsupported helical and oval staircases for their dramatic sweep, for example at the Gallerie dell'Accademia in Venice, and his direct influence can be found in Christopher Wren's stair for the south east tower of St Paul's Cathedral in London (1705) and Inigo Jones's Tulip Stair at Greenwich house (1616-19).



Fig. 2. Scala Contarini del Bovolo, Venice, Italy (1499).

An extraordinary triple helical stair in the convent of San Domingos de Bonaval, Spain (now the Museo do Pobo Galego) designed and constructed by the architect Domingo de Andrade between 1695 and 1705 consists of three separate coils that each lead to different levels and never join or cross. On the pavement of the stairwell is engraved the construction drawing of the stair, although

25 “New Training and Conference Centre for the Life Sciences at EMBL in Heidelberg,” EMBL Press Release, March 9, 2010, accessed 1 April 2013, http://www.embl.de/aboutus/communication_outreach/media_relations/2010/100309_Heidelberg.

26 Friedrich Mielke, *Die Geschichte der Deutschen Treppen* (Berlin: Wilhelm Ernst & Sohn, 1966), 42.

27 Robert Good, “Double staircases and the vertical distribution of housing in Venice 1450-1600,” *ARQ* 13, no. 1 (2009): 82.

now quite deteriorated.²⁸ Originally the stairs served to connect the north and west wings of the convent where, according to the documentation, the cells of the friars, the wardrobe, the provisions store, the bakery, etc., were located. The last ramp was used to access the lookout tower.

The helical stair may have been argued in terms of the efficiency of multiplying and dividing vertical access, but it was also a dramatic demonstration of the skills of the stonemason whose knowledge of stereotomy made it possible. Numerous treatises on stonecutting appeared in Spain and in France throughout the sixteenth and seventeenth centuries, culminating with the work by Amédée-François Frèzier, *Traité de stéréotomie* [1737-39]. A number of these manuals deal with the construction of helical stairs in stone, such as *Cerramientos y Trazas de Montea* by Martínez de Aranda (1600), which explains the construction of a free-standing helical staircase, called the “Snail of Mallorca” of one or two ramps.²⁹ Manuals by Vandelvira (1575-80) and the *Cuaderno de Arquitectura* by Juan de Portor y Castro (1708) detail the construction of the single helical stair and Italian books on architecture such as that of Vignola, *Le due regole della prospettiva*, describe a helical staircase of two ramps.³⁰

The absence of a central column imbues the stair with the illusion of lightness and ensures an uninterrupted and curvaceous line. The stair embodies structural daring. There is, Blutman writes, “a kind of magic perhaps which is not dispelled by the most elaborate technical explanation of the structural principle on which the form is based and still prompts one to wonder how it stays up.”³¹ Robin Evans describes elements such as unsupported flying and curvaceous stairs as “magnificent demonstrations of stereotomy” that in the seventeenth and eighteenth centuries were increasingly seen as “deformed, showy tricks that had issued from stonecutting” for they lay outside the classical order.³² Indeed, there could be no better vehicle for disporting one’s skills than the helical stair.

From Stair to Scientific Diagram . . .

The double-helix, to summarize, had been used in architecture continuously for several centuries and was referred to in architectural theory. Those who built helical stairs comprehensively understood its geometry and structure and their knowledge of these forms had contributed to new branches of mathematics. Given this long and deep association in architecture, its contemporary re-appearance could be argued as an informed homage to, say, the stairs at Chambord, or a

28 Miguel Taín-Guzmán, “Fifteen Unedited Engraved Architectural Drawings Uncovered in Northwest Spain”, *Proceedings of the Second International Congress on Construction History*, vol. 3 (2006): 3017. <http://www.arct.cam.ac.uk/Downloads/ichs/vol-3-3011-3024-tain-guzman.pdf>.

29 Ginés Martínez de Aranda, *Cerramientos y Trazas de Montea*, edited by de José Manas Martínez, with research by de Antonio Bonet Correa, Madrid, Biblioteca C.E.H.O.P.U. (1986): 287-91.

30 Miguel Taín-Guzmán, “Fifteen Unedited Engraved Architectural Drawings Uncovered in Northwest Spain,” *Proceedings of the Second International Congress on Construction History*, vol. 3 (2006): 3017. <http://www.arct.cam.ac.uk/Downloads/ichs/vol-3-3011-3024-tain-guzman.pdf>

31 Sandra Blutman, “Geometical Staircases,” *Journal of Architectural Historians* 26, no.1 (March 1967): 37.

32 Robin Evans, *The Projective Cast* (Cambridge Mass.: MIT Press, 2000), 213.

revival fuelled by its sculptural qualities. It might also be maintained that the double-helix of DNA carries with it its architectural legacy. Certainly, both its beauty and its use as a stair figured in the discovery of the shape of DNA. Root-Bernstein proposes that “Watson and Crick were strongly disposed to favor helical models for DNA from the very beginning. Upon meeting the two men in 1952 while they were developing models of DNA structure, nucleic acid specialist Chargaff wrote in his diary: ‘two pitchmen in search of a helix.’”³³ The double-helix model, Watson said was “too pretty not to be true.”³⁴ Crick retrospectively refers to “its intrinsic beauty” as a factor in its impact and immediate resonance in the sciences.³⁵ Fifteen years after the event, Watson published a personal version of the story of the discovery. In “The Double Helix” (1968), Watson talks about noticing spiral staircases, and of thinking that the structure of DNA might be like a spiral staircase. Watson admits: “The idea [of helices] was so simple that it had to be right. Every helical staircase I saw that weekend in Oxford made me more confident that other biological structures would also have helical symmetry. For over a week I pored over electron micrographs of muscle and collagen fibers, looking for hints of helices.”³⁶



Fig. 3. Killesberg tower designed by Jörg Schlaich, Stuttgart, Germany (2000).

... and Back to Architecture

Despite the importance of the helical stair in the conceptualization of DNA, its new significance as a symbol of the power of science transforms its use as a stair almost immediately, as is evident from the institutions in which it makes an appearance in the 1960s. The Chemistry Department at the University of Reading by London-based architects Easton Robertson Cusdin Preston & Smith,

33 Robert Root-Bernstein, “Do We Have the Structure of DNA Right? Aesthetic Assumptions, Visual Conventions, and Unsolved Problems,” *Art Journal* 55, no. 1, special issue: Contemporary Art and the Genetic Code (Spring, 1996): 48.

34 James Watson, “The Double Helix: The Discovery of the Structure of DNA, Part 2,” *Atlantic Monthly* 221 (1968): 114.

35 Francis Crick, “The Double Helix: A Personal View,” *Nature* 248 (1974): 768.

36 James Watson, “The Double Helix: The Discovery of the Structure of DNA, Part 2,” *Atlantic Monthly* 221 (1968): 114.

completed in 1961, has a narrow double helix stair with open timber treads. The central stair at Lemieux library at Seattle University (1966) by John Maloney of Maloney, Herrington, Freesz and Lund, is a double helix. Also from 1966 is a 15-metre tall free-standing double spiral stair - called the DNA tower - constructed at the highest point at the Kings Park Botanical Gardens in Western Australia as a viewing tower. A similar viewing tower was erected in Stuttgart in 1990.

The hegemonic identification of the double helix with Twentieth Century science's most iconic diagram obscures any prior architectural associations - as suggested by Ken Woolley's recollection that his proposal to include a DNA stair in the Garvan Building in Sydney produced in his clients "a kind of relief that the building (would) be about them, not (me)." Woolley "tried a double helix as at Chambord", but admits that "The association is blindingly obvious - the moment you hear that you will design a laboratory for genome research, or any aspect of modern biological science for that matter."³⁷ The logo of the Garvan Institute is a silhouetted figure dancing with two ribbons that form the outline of the double helix. The stair and the logo share a common referent, but can also be argued to have the same function: publicity.

Reviewing the exhibition "How Human: Life in the Post-Genome Era", one of the many events that celebrated the 50th anniversary of the discovery of DNA, Catherine Baxter, a science writer, opines "Art can help scientists to communicate the advances that have been made in genetics . . . (the exhibition) will reach more people than would ever visit the labs that are responsible for sequencing the human genome ... these exhibitions might promote links between scientists and artists. Such links can only improve the ability of scientists to communicate their research and explore the ethical implications of their work."³⁸

In Baxter's instrumental view - and this is supported by the artworks - one frequently finds commissioned for new laboratory buildings, the artist's assignment is to serve science in its drive to achieve a sympathetic public for its activities. Art is one component of what Gregory and Miller call "The Movement for Public Understanding of Science".³⁹ They point out that scientists are under pressure to communicate more science in the wake of industrial pollution, pharmaceutical accidents and military nuclear issues that have made the public ambivalent or distrustful. Popularization of scientific ideas is also critical to convince the public about the validity of scientific research and to facilitate "the gathering of resources for pursuing certain lines of research".⁴⁰ Sociologist Stephen Hilgartner finds that "a mountain of evidence shows that experts often simplify science with an eye towards persuading their audience to support their goals: build support for research programs."⁴¹

37 Ken Woolley, email to author, 20 October 2012.

38 Catherine Baxter, "50th Anniversary: The Art of the Helix," *Nature Reviews Genetics* 4, 244 (April 2003).

39 Jane Gregory and Steve Miller, *Science in Public: Communication, Culture and Credibility* (New York: Plenum, 1998).

40 Lievrouw, "Communication and the Social Representation of Scientific Knowledge", 9.

41 Stephen Hilgartner, "The Dominant View of Popularization," *Social Studies of Science* 20, no. 3 (1990): 531.

The diagramme of DNA is one of these simplifications and has been central to garnering support for the biosciences.

The Empty Sign

The repetition of a reduced DNA graphic across several domains, from the logos of companies carrying out medical research to advertisements for moisturiser and IVF, however, robs it of its earlier potency. It has become an empty and dissipated sign. Once of revolutionary importance to scientific knowledge, in its ossified and simplified form, it now circulates as a generic image of science and innovation. Roland Barthes would characterize the DNA stair as performative, for it performs its function simply by being announced. It is a symbol, not for something, but for another symbol. Martin Kemp tracks the intersection of illustration and scientific discovery, noting the challenges the DNA helicoid posed for spatial visualisation. Kemp also observes that outside the specialist fields of genetics and minimal surface mathematics the image of the double helix gradually shifts from one of didactic instruction to "the icon for the communication of a generalized message".⁴² "The double helix of DNA", writes Kemp, "is unchallenged as the image epitomizing the biological sciences." Kemp observes that like the Mona Lisa it is an image that speaks "to audiences far beyond their respective specialist worlds."⁴³

Popularization of scientific ideas used to be seen as critical to furthering the objectives of the scientific community, but numerous studies have shown that, in fact, the less the public know about science the more enthusiastic and trusting they are.⁴⁴ Inversely, "Knowledge often increases the experience of uncertainty rather than reducing it."⁴⁵ The helical form of DNA in stairs and graphic design does little in terms of informational communication, it is not deployed as knowledge per se. Its use in the biotech industry is not didactic, but part of the contest between traditional pharmaceutical companies and the emerging biotechnology industry for the public purse. Gretton finds that control of the image of DNA was from the start grasped by biotech and easily replaced penicillin in the collective imagination: "Whereas penicillin was perceived as simply one single drug, albeit a potent and life-saving one, DNA was a tabula rasa, a blank slate on which humankind would ascribe its most fervent hopes."⁴⁶

The ability of the helical stair to convey people between floors is merely a by-product of its symbolic ambition that serves merely to ease its progress past the scrutiny of clients and those overseeing

42 Martin Kemp, "The Mona Lisa of Modern Science," *Nature* 421 (2003): 416.

43 Kemp, "The Mona Lisa of Modern Science," 416.

44 Mary Roduta Roberts et al., "Causal or spurious? The Relationship of Knowledge and Attitudes to Trust in Science and technology" *Public Understanding of Science* 22, no. 5, (2011): 624-41.

45 "Science for an informed, sustainable and inclusive knowledge society", (policy paper by President Barroso's Science and Technology Advisory Council, Brussels, August 29, 2013): 3.

46 Linda Burak Gretton, "The Rhetorical Helix of the Biotechnology and Pharmaceutical Industries: Strategies of Transformation Through Definition, Description and Ingratiation," *Business Communication Quarterly* 72, no. 238 (2009): 242.

construction budgets. Indeed, the helical stair need not appear in its correct or complete form, but merely suggested as is evident from the stair at the University of Western Australia's Chemical and Molecular Sciences building.



Fig. 4. "DNA stair" at the Chemical and Molecular Sciences building at the University of Western Australia, seen from the ground floor.

It is a single-flight cantilevered dogleg stair rendered symbolic merely through the addition of a wall graphic and referred to by the University as 'the helical stair'. Observing that the double-helix stair in contemporary architecture functions as a representation of a scientific representation is not necessarily to condemn architecture as a discipline to a secondary role in relationship to science - speaking for science, translating its concepts into built form. Indeed, it is wise to remember here Octavio Paz's observation that:

"Every text is unique and, at the same time, it is the translation of another text. No text is entirely original because language itself, in its essence, is already a translation: firstly, of the nonverbal world and secondly, since every sign and every phrase is the translation of another sign and another phrase. However, this argument can be turned around without losing any of its validity: all texts are original because every translation is distinctive. Every translation, up to a certain point, is an invention and as such it constitutes a unique text."⁴⁷

Architecture has the capacity to re-translate and (re)present concepts, images, ideas and ideals. In this sense it may be thought of less as a spatial and generative art and more as an art of semantic elaboration. This would seem to be particularly the case in the capacity for architecture to harvest the images of biology and promote biotechnology, pharmaceutical and medical research institutes. As the example of the DNA stair makes clear, the meanings that specific images and forms convey, depends to such a great degree on audiences and contexts, that these can be radically altered by migration to a new disciplinary location without any change to the image or form itself. Translation

47 Octavio Paz, *Translation: Literature and Literalness*, trans. Anthony Pym, <http://isg.urv.es/library/papers/paz.pdf>. Originally *Traducción: literatura literalidad* (Barcelona: Tusquets Editor, 1971), 9.

in this regard is highly imprecise and political, but also retrospectively influential in terms of the transformation upon original texts. Looking back at the double-helical stair in architectural history, although innocent of the knowledge of DNA, its associations and meanings are forever changed by a discovery outside of the architectural domain.