EXHIBITION

Essence of creation

Isabelle Kaufmann

Both biotechnologists and artists create. *Genesis — The Art of Creation*, at the Zentrum Paul Klee in Bern, Switzerland, suggests their methods and aesthetics show unexpected kinships.

The Zentrum Paul Klee houses the largest collection of works by the eponymous early-twentieth-century painter, who spent much of his life in Bern. Working at the interface of figurative and abstract art, Klee studied the forms of plants, shells and stones, and drew from them new and imaginative shapes.

Genesis — the process of creation — was a key theme. According to Klee, the painter starts with the basic elements of point, line, tone and colour (pictured, *physiognomische Genesis*, 1929). He experimented with them, recombining them, and so bringing something new into existence. Replace brush and canvas with pipette and test tube, and this, the exhibition posits, could be a genetic engineer rearranging DNA and creating new forms of life.

Klee's geometric compositions and chimaeric beasts are juxtaposed with paintings by fellow modernists such as Piet Mondrian and anatomical drawings by Leonardo da Vinci. Exhibits by contemporary artists borrow the techniques of biotechnology. A video of transgenic organisms in Eduardo Kac's installation projects a plate of bacteria expressing blue or yellow fluorescent proteins; as the cells grow, mutate and conjugate, new colour variations emerge.

Also on display are paintings and prints inspired by microscopic images. Ross Bleckner's *In Replication* imagines the scene inside a dividing cell: a wild and colourful dance of molecules pairing, entwining and separating. David Fried's bubble shapes recall pictures of fertilized egg cells, captured in reproduction, and growing in harmonic patterns. These pieces demonstrate that scientific images enrich our knowledge and that their unusual beauty has a truth of its own. ■

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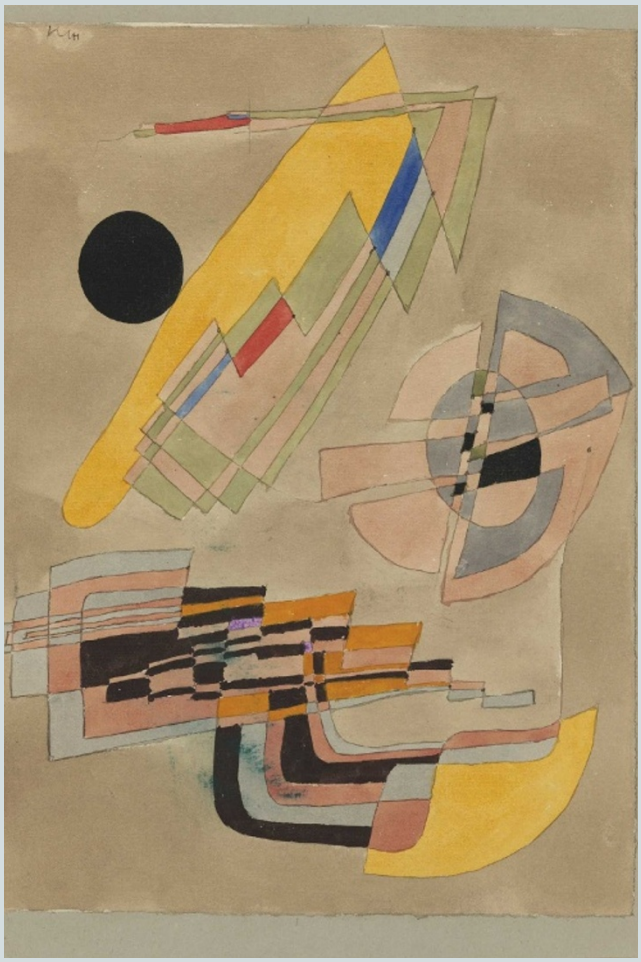
***Genesis — The Art of Creation* (until 27 April) is at the Zentrum Paul Klee, Bern, Switzerland (www.zpk.org).**



PRIVATBESITZ SCHWEIZ, DEPOSITUM IM ZENTRUM PAUL KLEE, BERN

applied to integrated electronics and electromechanical systems, lithographic techniques are reaching a physical limit. Moreover, below a scale of tens of nanometres, fundamental problems such as interconnection and quantum effects arise.

Today, nanotechnology is embracing biology. The authors rightly dismiss fantastic worries that our DNA may be modified by nanobots capable of getting into cells as well as nanotechnology's dubious association with genetically modified organisms. But they are rash to focus on recent controversial observations of bacteria less than 100 nanometres long that might be incorporated into molecular machines. They ought instead to have emphasized current research efforts to build machines from self-assembly and supramolecular chemistry.

Caveats aside, this popular book sets out the science that underpins nanotechnology and in so doing gives a realistic picture of its impact, applications and political, economic and societal context. ■

Vincent Dusastre is editor of *Nature Materials* (www.nature.com/naturematerials).

Genomes evolve, but how?

The Origins of Genome Architecture
By Michael Lynch
Sinauer: 2007. 510 pp. $59.95 (hbk)

Axel Meyer

"Nothing in biology makes sense, except in the light of evolution," said the great geneticist and evolutionary biologist Theodosius Dobzhansky. Twenty-five years on, genomics as a discipline has yet to embrace evolution fully. Michael Lynch is an exception. His timely textbook demands that population thinking, population genetics and evolutionary theory be meshed more explicitly. After all, genomes did not appear suddenly from nowhere, and mutational changes from single base-pair substitutions to whole-genome duplications are at least one basis of molecular as well as phenotypic evolutionary change.

As the cost of genome-sequencing falls and more genomes of the major model systems are sequenced, evolutionary biologists have more say in which organisms will be investigated next. Population samples of, for example, the model species *Drosophila* (fruitflies) are a good target.

Yet this line of research is still driven strongly by technical innovation, such as the speed and cost of data collection, rather than the testing of theories that might direct future experiments. Genomics research is progressing incredibly fast, off the back of genomic data that are being produced ever more rapidly. Still in a stage of wondrous discovery, this nascent field today evokes the excitement of the early days of natural history.

Lynch is a population geneticist who has made major contributions to numerous evolutionary questions and recently expanded his interests to genomics. He has published landmark studies on mutation rates, gene

duplication and the functional diversification of genes.

In *The Origins of Genome Architecture*, he advocates using population genetics to understand genomes because the mechanisms involved can explain changes in gene frequency across generations and elucidate genome evolution. For Lynch, population genetics and some non-adaptive mechanisms in particular suffice to understand genomic evolution. He argues that invoking 'mythical macroevolutionary forces' is unnecessary.

Almost every page introduces interesting, unanswered problems — a goldmine for students in search of a thesis topic.

Lynch goes a step further by combining molecular mechanisms and evolutionary theory into a coherent evolutionary genomics framework and claiming it as the next phase of evolutionary biology. The ability to straddle both disciplines is rare and hardly attempted in the other direction — few molecular biologists know much about evolutionary biology. Rightly, Lynch laments this asymmetry.

This book is a must-read for every genome researcher; evolutionary biologists will also profit. It reviews and analyses, competently and thoroughly, a huge range of topics, from the origin of eukaryotes to sex chromosomes. It is the best, most up-to-date and thorough summary of genome evolution published. Arguments, hypotheses and supporting data are presented clearly and cross-referenced. Only the most necessary equations interrupt the flow. Almost every page introduces interesting, unanswered problems, making it a goldmine for graduate students in search of a thesis topic. Rarely have I scribbled so many pencil marks in a book's margins.

The last chapter, distinctively entitled "Genomfart" (meaning 'place of passage' or 'the way forward' in Swedish), discusses how much scientific meat lies behind fashionable buzzwords such as complexity, modularity, robustness and evolvability. It alone provides enough intellectual fodder for a stimulating seminar series. Not every evolutionary biologist, genome researcher or 'evo-devo-ist' will agree with Lynch's strong opinions that largely non-adaptive forces shaped genomes, but it is a debate worth having.

As long as we remain unsure what a gene is, we are a long way from understanding genome evolution. That so much is still unknown should not worry us. Rather, it should reassure the next generation of evolutionary genomic biologists that there is much to be discovered. ■

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FESTIVAL

Neural networking in Manhattan

Giovanni Frazzetto

New York city will be criss-crossed this spring by a net of brainy ideas. More than a hundred public events will link neuroscience with art, music and meditation in the city's Brainwave festival, which runs until June.

The metropolitan mix gives the festival its peculiar flavour. Musician Lou Reed introduces and discusses his latest compositions about meditation. Neuroscientist Joseph LeDoux examines sources of fear, and asks how Buddhist practitioners seek to master this emotion, before dashing off to play guitar in his band, The Amygdaloids.

The festival's contemporary art show, *Brainwave: Common Senses*, opens this month at the cultural centre Exit Art. Cleverly curated, it features images inspired by brain anatomy and function, as well as representations of aspects of consciousness, cognition and memory. The works on show address new technologies of neuroscience and the joint outputs of artists and scientists who have puzzled together over the workings of the brain.

Suzanne Anker extrapolates neurological processes from images of Rorschach tests and brain scans, and renders them into three-dimensional sculptures that are suggestive of bones, sea creatures and body parts. Levels of cognition and perception are represented in a multisensory and interactive installation by artist collective SERU.

Devorah Sperber's apparently random arrangement of 875 spools of coloured thread (pictured) coalesces into a replica of Leonardo Da Vinci's *Mona Lisa* when observed through a small sphere that mimics the human eye.

All this attention may be symptomatic of the rise of a 'neuroculture', in which neuroscientific understanding becomes part of our daily life. However, some fear that if we gain too much scientific knowledge about how the brain accomplishes creative tasks or causes emotions then it will lead to disenchantment. Brainwave seeks to show that this need not be the case. ■

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Brainwave festival events run across New York City until June (www.brainwavenyc.org). *Brainwave: Common Senses* runs from 16 February to 19 April at Exit Art, New York city (www.exitart.org).