

## WHAT YOU ALWAYS WANTED TO KNOW ABOUT EVOLUTION

The theory of evolution is able to explain part of the mechanisms behind the wonders of nature. It provides information about how life develops and how human beings became what they are today – why we have a large brain, why walking upright is an advantage and why we display certain behaviours even in the 21st century that are in crass conflict with our presumed civilised status.

While Darwin's theory of evolution allows us to understand the history of our development better, it is less helpful in looking ahead. Because of the long period required for evolutionary modifications and the large number of factors influencing our future development, scientifically based forecasts are virtually impossible. Nevertheless, there are signs that point to certain future scenarios for Homo sapiens. Many factors that influenced human evolution in days gone by no longer exist. Food shortages, wild beasts, cold

and heat can barely touch us these days, the corresponding survival characteristics are now superfluous. They have, however, been replaced by new environmental conditions that could shape our species to a marked degree. For example, we have more food than we need, technologies make communication easy, more than half the human race live in mega-cities in increasingly cramped space and with increasingly polluted air.

The precise importance of these environmental conditions to human evolution is uncertain. However, it is highly probable they could result in new selection criteria. In the metamap, we venture an outlook for the long-term future of mankind. On the basis of today's apparently dominant environmental factors, which are likely to shape our world in the coming centuries, and on indications from the essays and interviews in this book, eight scenarios have been devel-

oped for tomorrow's man that describe possible "vanishing points" for Homo sapiens sapiens. These portraits of our descendants have been translated by US artist Chris Scarborough into oil paintings that make up an "Ancestors' portrait gallery of the future". They are deliberately exaggerated so as to stimulate debate. Because the evolutionary drivers behind them are perfectly genuine. And it is absolutely essential to think about the possible consequences.

The metamap also provides an overview of the history of man's development and the most important mechanisms directing his evolution. Two basic mechanisms are central. One is the creation of individual variety. This is based first of all on the generation of genetic mutations – in other words, arbitrary changes in the genetic code – at the individual level. These can create random modifications in characteristics which then deliver an evolutionary advantage, for example immunity to a disease. However, mutations can also have a detrimental or no impact at all on the individual's survival capabilities. Certain behaviours – e.g. fasting, frequent consumption of alcohol or cigarettes – can also activate or block genetic functions. However, no research has been done to date on whether the epigenetic changes that are passed on as a result will persist for more than two generations. In addition, the mixture of our genes through sexual recombination plays a central role in generating variety – as does the excess production of offspring, which also increases variability. The second mechanism is selection. It en-

forces that only the fittest survive, in other words those best adapted to environmental conditions. A distinction is made here between natural, sexual and artificial selection. Natural selection favours the reproduction of those who are better armed against dangers such as food shortages, predators, cold or heat and who are also particularly fertile. Sexual selection does not necessarily favour those who have better physical chances of survival, but those with attributes that make them sexually attractive: for example, harmonious features, an imposing manner or career success. Artificial selection is controlled by technical or medical tools, for example contraception or prenatal diagnostics. Thanks to a kind of "anti-selection" by means of medicine and technology – drugs, visual aids, cardiac pacemakers, but also the production of an excess supply of food – people will also survive today who at one time might have fallen prey to natural selection. As a result, genes are passed on that do not actually meet the criterion of the "fittest" – which in turn increases the variety of the gene pool. Another complementary form of selection is based on sudden events: natural disasters or wars can randomly wipe out entire genetic populations, regardless of their genetic predisposition.

## GENERATE VARIETY

## VARIABILITY

EVOLUTIONARY FACTORS

### MUTATION



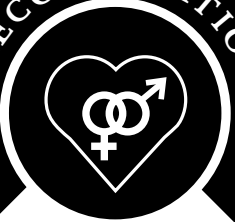
Genetic mutation by accident or by external influences

### EPIGENETICS



Activation or inactivation of genes by lifestyle

### SEXUAL RECOMBINATION



Exchange of genes between two people

### MIGRATION



Increase of the gene pool due to immigration

### OVER-PRODUCTION



Increase of the genetic variability due to a high number of offspring

### NATURAL SELECTION



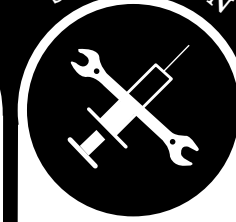
Reproductive performance of those individuals who are best adapted to environmental requirements, for example natural enemies, the availability of resources, the climate or pollution.

### SEXUAL SELECTION



Reproductive performance of individuals based on selection by sexual partners. Attractiveness depends on appearance, health or behaviour.

### ARTIFICIAL SELECTION

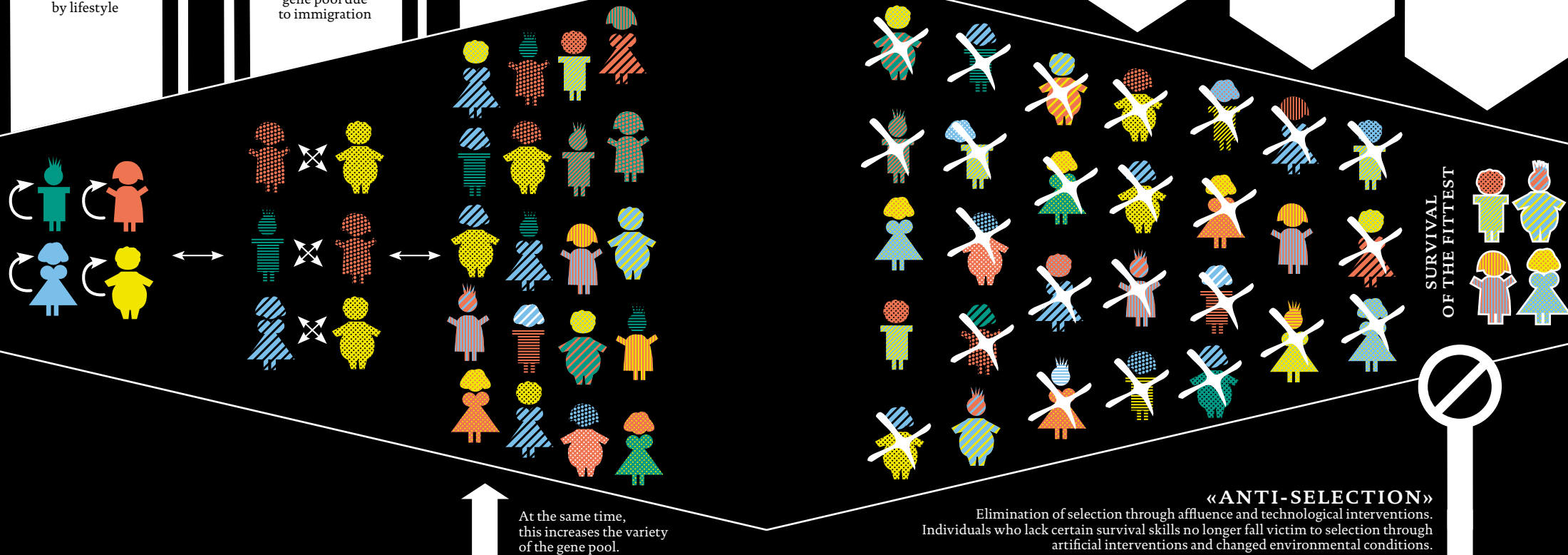


Reproductive performance based on human control of selection by means of technological tools. These include birth control methods, reproductive medicine and genetics.

### RANDOM SELECTION



Reproductive performance of individuals who fall victim to random events like natural catastrophes or wars.

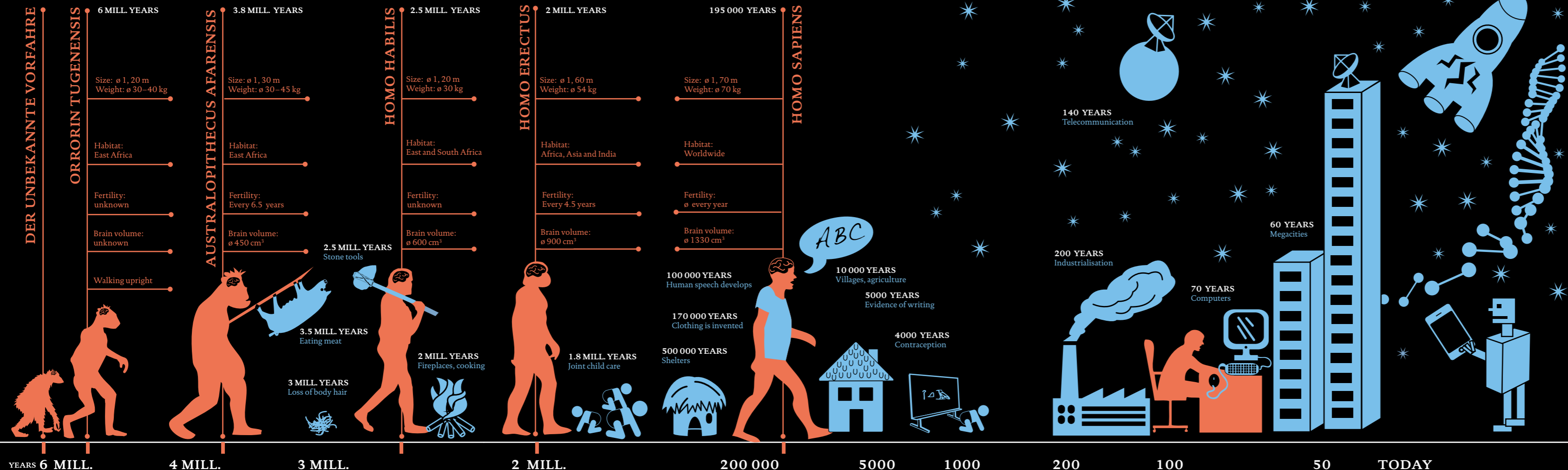


# THE HISTORY OF HUMAN EVOLUTION

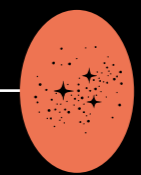
SELECTION FACTORS

Predators	
Competition, war	
Food shortages	Surplus food
Infectious diseases	Lifestyle diseases, chronic diseases
Heat, cold, drought	Climate change
	Pollution
	Shortage of space
	Information technology
	Medicine

■ Cultural achievements  
■ Evolutionary steps



FUTURE



**8. THE DROPOUT**  
Biological warfare, the unexpected radical climate change or the consumption of all natural resources has led to the inevitable downfall of human beings, who are displayed in museums by our descendants just like the dinosaurs. In an alternative scenario, humanity's increasing intelligence has made it realise that the Earth will be better off in the long run if we transform ourselves into spiritual beings and abandon the earthly world for the benefit of all others.



**7. THE THINKER**  
Life in the knowledge society places ever higher demands on our brains. The body, on the other hand, is becoming increasingly superfluous and can be replaced as ageing progresses. At the end of a life cycle, brains look for a new body, knowledge and experience remain immortal with their brains – just like on the Internet.



**6. THE SYMBIONT**  
Microbiology has become the leading science and makes it possible for people to adapt faster and better to the demands of the environment. Suits made of symbiotic microbes help to filter polluted air and harmful substances. Part of the human race has begun to populate the seabed because of the shortage of space and the stress of high population density. The symbionts filter oxygen from water, so that people can breathe beneath the sea.



**5. ARCHAIC MAN**  
Civilisation is in decline due to the bankruptcy of Europe and the USA and the dramatic consequences of climate change and pollution. Nature has regained territory. Cities are overgrown, battles are being fought over food, the principle of "might is right" prevails. Muscle power is the crucial factor for survival. Instincts have replaced rational behaviour. At the same time, natural sensors help people to detect environmental toxins and thereby avoid risks.



**4. RESOURCE-EFFICIENT MAN**  
Life in times of scarcity means that people who need less resources assert themselves more effectively. Reduced body size and flexible bone structures enable people to cope better with the minimal space provided by the megalopolises' tiny homes and with food and water rationing.



**3. AFFLUENT MAN**  
The constant surplus of became established high-quality nutrition and the conveniences of the automated service society make muscle power and exercise superfluous. A well-nourished body has once more become the symbol of quality of life. The degeneration of redundant legs is considered a mark of progress and is a feature of attractive people.



**2. THE MUTANT**  
Crossing with DNA from other species makes genuine multitasking possible. To cope with growing demands on flexibility and efficiency, genetic enhancement with autonomous, intelligent arms allows several tasks to be performed at once, from child care to project management.



**1. THE MAN-MACHINE**  
The convergence of biology and electronics enables us to control our digital environment with thoughts, as cyborgs. Telephones and computers are obsolete. Data are exchanged directly person to person.

© W.I.R.E. Sources: www.newscientist.com/movie/becoming-human; Leonard, William R. (2002); Food for Thought – Dietary Change was a Driving Force in Human Evolution. In: Scientific American (13.11.); Wrangham, Richard (2009): Feuer fangen – Wie uns das Kochen zum Menschen machte. Eine neue Theorie der menschlichen Evolution; humanorigins.si.edu/evidence/human-fossils/species