



Bionics

- searching for footprints of the Creator



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Nature as our example

Bionics is a modern term for an age-old human practice. It consists of taking ideas from nature - especially living things - and converting them into useful technology. The term itself is a combination of the words biology and technique. Bionics differs from biotechnology, a science in which living organisms are directly used for some purpose, and from technical biology as well, in which the physical characteristics of living things are examined and described. Bionics looks specifically for useful, transferable mechanisms and constructions found in nature. This field of science doesn't want to only copy what nature offers; rather it wants to discover new and constructive principles which are transferable to the field of technology and industry for human application. Such discoveries help to optimize or even revolutionize existing techniques.

The History of Bionics

One could even call Leonardo da Vinci a forerunner in the field of bionics, when one looks at his technical models and experiments. But the actual term „bionics“ was first coined in 1960 by the American Air Force Major J.E. Steele at a congress in Dayton, Ohio. In that decade, German researchers, such as Ingo Rechenberg in Berlin, also began to show more interest in this field. But bionics really first boomed at the end of the 1980's, when industry showed great interest and began serious research in this area. The goal is saving energy and materials. The nature has always been far ahead of human technology in the efficient use of energy and materials. To reduce this gap, the first congress on bionics

took place in 1992 in Wiesbaden, Germany, and it has become an annual event.

Evolutionary strategies

Intensive study of the fantastic construction of living beings naturally provokes curiosity about where these ideas came from! Of course, evolution and so-called evolutionary strategies play a large role in how man regards nature's wonders. Yet, scientists and engineers strive not only to understand and apply efficient techniques and structures found in nature's products: they want to exceed the genius found in nature's systems and even use human intelligence to accelerate the assumed natural developmental stages. Man desires to accelerate the evolutionary process. In the shortest time possible, humans want to achieve more perfect results than nature has (supposedly over the course of millions of years by way of evolution).

However, the „Spiegel“ magazine reports that the more science observes how complex the living things they research are, the more doubts arise as to whether such constructions can be further optimized at all, and if these beings indeed came into existence on their own. „Engineers look jealously at nature's genius achievements, compared to man's simple creations. It's like placing a hand-axe next to a precision milling head. How amateurish do a sailplane's wings look next to those of a dragonfly.

Construction and Constructor

It is natural, therefore, for bionic specialists to be curious about who or what was behind the construction of these living things, as they are constantly discovering and being amazed at nature's intricacies. Normally, scientists ascribe

„nature“ itself or „evolution“ with creative characteristics that would otherwise only be assigned to an intelligent being. Who or what is nature, that people call her a „master builder“? Why then, don't we call a suspension bridge a master builder, but rather the one who designed it? It is therefore not a step backwards, but rather a rational point, to consider bringing the Creator mentioned in the Bible back into connection with bionics discussions. Following are a few examples of living beings and their unique technical features, to raise your sense of wonder.

Trees - Branch supports

Even the simplest-looking structure - how a tree's branches are perfectly supported from the trunk - is really much more complicated than at first look. Claus Mattheck's years of important research on this topic help us to understand a tree's systems better. For example, the notch effect is reduced to almost zero at every point between the trunk and the branches by way of a special cell growth right at that connection, which results in an optimally static system. When part of a tree's crown breaks or breaks off during a storm, increased growth automatically takes place at the statically-critical points of the tree over the following years, until the entire system has reached an optimal state of balance once again. The tree's branching mechanism served as the blueprint for the supporting three dimensional structure of Stuttgart's airport terminal. The results are clear: upon visiting the terminal, one sees a large hall safely covered by a roof made with an extraordinarily small amount of building material. The fields of mechanical engineering and medical technology have also profited from our current understanding a tree's construction. Various motor parts as well as prostheses and artificial joints are now produced in a more improved and durable way.

The Lotus Leaf - self-cleaning!

The so-called lotus effect is, apart from the velcro fastening (TM), probably the most prominent example of practical bionics known today. Nearly everyone has heard of the phenomenon that when you pour water onto a cabbage plant, that the water trickles off like quicksilver. This

effect is clearly seen in the lotus plant as well. The keen observer will notice that when water is poured onto a lotus leaf, the water doesn't slide or run off, but forms beads and literally rolls away. During a heavy rainshower, the leaf's surface is cleaned very efficiently by dust particles. The rolling water drops take the fine dirt particles with them and transports them to the central root area for use as additional plant nutrition. This is the case for the cabbage plant. After a rain, the leaf's surface is perfectly clean and prepared to continue its important task of photosynthesis for the plant. Bionics specialists are most fascinated in this self-cleaning process for human use--but how does the plant do it? As in many cases in nature, the solution lies in the microscopic detail of the plant's construction. The leaf's surface in this case has miniature nubs covered with a waxy layer. This surface structure, in connection with the surface tension of the water which lands on the leaf, results in the self-cleaning effect. The idea is a genius one: not the slickest or shiniest surface is most efficiently cleaned, but rather the one with the most miniature nubs! Man has already made a few attempts at making this concept economically useful. For example, textured paints and lacquers, ceramic tiles, and even the honey spoon have proven to be energy- and material-efficient, because they require less cleaning.

A Butterfly's multifaceted eyes

The principle of the microscopic nubs is also seen where one might least expect it: in the eye structure of moths and other nocturnally-active insects! The eyes of these insects not only consist of hundreds of single lenses, each approximately 0.02mm in diameter; each multifaceted eye is also equipped with an extremely fine surface layer of micro-nubs. And the distance between this nubs is only about 0.0002 mm! Because this distance is still in the domain of visible light waves, this special eye surface reduces reflection and therefore increases the translucency of the eye's lens. Engineers who develop optical systems are currently successfully applying this principle to their products, using a special coating. The results are clear: the transparency of the glass can be increased from 91.5%

to 98%, and the reflection-caused energy losses on solar panels can be substantially reduced! Such a perfectly-created technical structure as the moth's eye is not explainable with today's commonly-accepted evolutionary mechanisms. This argument is strengthened even more by the fact that the microscopic nub technique can be observed in completely different species and on different body and plant parts. One could conclude that the similar structures must have developed independently from one another over time. In light of this last fact, the extremely small probability that such structures came about without an intelligent creator vanishes even more.

The Dragonfly - Amazing Flying Artist

Dragonflies are the envy of every aerodynamic engineer. They are capable of enormous acceleration speed: approximately 10 times that of earth's acceleration ($g=9.81\text{m/s}^2$). They can turn on their own axis, fly backwards, and change directions abruptly at speeds of up to 60 km/h -- they can even glide short distances -- and all this is part of this insect's normal ability! To reduce their acceleration speed, dragonflies have special organs filled with liquid. These „tanks“ have been copied by modern fighter planes. Dragonflies possess a velcro-type (TM) closing between their head and thorax, which allows them to achieve the necessary position for mating, and which can also be useful when carrying heavy prey in flight. The bionics-specialist Roland Stern from Bremen wrote an almost 200-page scientific document solely on the wing joints of the dragonfly, because of their interesting mechanical construction and their extraordinary ability to allow freedom of movement. After reading such a paper, one can only agree that the dragonfly's amazing wing joints are a work of master craftsmanship. Experiments carried out on the dragonfly's wings and flight show that these insects have special sensory cells which register the scope of the current and relay appropriate warning signals to the brain in order to adjust wing position and hinder a fall or crash. These are a few of the many examples the dragonfly can offer us--it is an insect full of biological and bionical sur-

prises. As in the previous natural examples of technology, the dragonfly's makeup is another argument that the more complex the system, the more improbable it is that its existence was caused by a self-organizing process.

The Polar Bear - An ideal solar energy factory
The hair of polar bears is not only white because this colour offers them perfect camouflage protection in his snowy environment; rather, their hair is equipped with light-conduction cells which direct the sun's rays sort of like a fibreglass cable onto the surface of his skin. The polar bear's ideally-black skin stores this heat. Its fur acts as an additional layer of insulation to keep that stored heat from escaping. This system functions so effectively that climate technicians have copied the above-described insulation methods and developed building materials for translucent (also called transparent) thermal insulation. It is almost a miracle that polar bears living in European zoos can withstand the summer heat. It would be better to shave them bald and paint them white to offer them a cooler summer!

Stick Insect - Neurological Network

These animals are very useful to bionics specialists and biologist for experiments with the mechanics of forward movement. Therefore the insect *Carausius morosus* is of special use nowadays with the development of the six-legged walking robot, among them Tarry II. An impressive television broadcast by the Bavarian television station in 1995 showed the building of such a robot in great detail. It took the developers from the University of Bielefeld months before they had sufficiently researched and analyzed the insect's electro physical and mechanical functions. With that information, preliminary mathematical models were designed. The blueprints serve to create an artificial neurological net: researchers found that the stick insect employs the principle of decentralized coordination of movement. Thousands of data must be processed just to make a single step! The nerve cells this insect possesses are more complex than any man-made computer system known today. The research results from the Bielefeld study are being applied at the University of

Munich, where the mechanics of the walking robot are being fine-tuned with at a very high level of technology and intelligence. And even after years of research and work by top-notch scientists, the resulting robot is only a very modest copy of the stick insect found in nature. One film moderator commented: „Especially the perfect coordination of the insect's legs posed a great challenge for the developers. (...)“ Even today there are imperfections in the robot's controlling systems which haven't been ironed out yet. For example, the stick insect recognizes a hindrance in its path and walks over it one leg at a time, whereas the robot just keeps walking forward with all six legs. The robot's computer is not as fast as the insect and is therefore unable to do anything like go around curves or climb.

A Product of Evolution?

Nevertheless, science develops copies of fantastic technology found in nature and boasts proudly that the general public should „be amazed what technology can do these days!“ On the other hand, the stick grasshopper is normally described as a „simple and primitive product of evolution“. Why? How can highly intelligent people work together for years, only resulting in a product that is far from the perfect example commonly found in nature? It is hard to imagine that on the one hand the creative intelligence of man is given high praise, yet on the other hand the existence of the stick grasshopper with its fantastic qualities must have developed by itself with no assistance whatsoever attributed to a higher creative power. The main argument for such a process of self-development is, in the end, always the assumption that the insect had infinite amount of time, through trial and error, to reach its current state. This unimaginably long period of time also allowed the higher animals, including man, to develop fully. Accelerated effects brought about by the development of variations can be proven by the modularity or building block principle, but this only shifts the problem. The question remains: how did these modules come into being?

Self-organization?

Rolf Reiner answers this question in the BIONA Report 8: „The module itself can be made up of smaller modules. All of these qualities didn't always exist as they do now. Rather, they evolved over time. That they developed at all, and how they developed, is one of the most fascinating questions a natural scientist grapples with.“ The unknown complexity of individual living beings and their capacity to fit in with other beings in ecological harmony greatly increases the improbability that such beings were „self-organized.“ Actually, even the existence of a bacterial cell without a creator is statistically quite difficult to achieve. Reiner calculates an improbability of approximately 102.4 million sequence alternatives to choose, of which one must be picked. „The probability of this happening is so minimal, that coincidence and selection cannot continue to be the only principal factors driving the theory of evolution. Surely this specialist can't be completely in the wrong, when he offers modular and hierarchical arguments to counter the theory of evolution. These arguments drastically reduce the improbability of a self-organization process, but the question of how the structure came into being still remains.

Are Change and Development the Same Thing?

No one can argue that Charles Darwin and Alfred Russell Wallace observed: living beings do change and can adapt to their changing environment by way of mutation (random changes in the genetic make-up) and selection. However, the question remains: from where do they have this ability to adapt, and what are its limits? After all, there is a huge difference between the possibility of breeding a dachshund from a wolf and of a fish going on land. Without knowing the genetic code and all its intricate complexity, Charles Darwin in his famous book „The Origin of Species“ says: „We also see that the kind of living conditions of an animal plays a lesser role in determining the sort of variation than that animal's individual structure /constitution /makeup.“ He therefore recognized that the different kinds of animals had the potential to de-

velop variations. And from minor structural changes (microevolution), Darwin concluded that major structural changes (macroevolution) must also take place, due to the correspondence and similarities of structure found in very different animals. Darwin's interpretation of what he observed is not illogical, but not conclusive, and certainly not provable by direct observation.

Each According To His Own Kind

It is just as legitimate to assume that a creator made certain kinds of living beings and equipped them with the capability of limited variation, in order to increase their chances of survival in case of changing environmental conditions. But it is impossible to assume that the word „kind“ in such an old writing as the Bible is defined the same as the word would be in today's modern biological field! If one approaches the Bible as a scientific text, one could say that the creator made genetically-varied „kinds“ of living beings and plants, which because of their variability cannot be exactly compared with the kinds of species we have today. But because of their versatile DNA, all the blueprints for future change were already there. This view conflicts with neither the biblical nor the scientific findings.

Similarities in two plants or animals would therefore not be evidence for an evolutionary development but rather would point to an intelligent creator who apportioned specific structural characteristics to each thing according to its needs. Since the Bible's account of man's fall and its consequence of a broken relationship between creator and created, there is a negative tendency woven into our present-day thinking about creation. In spite of the ability that plants and living beings have to adapt to different environments, the universal gene pool is not getting better, but worse! This includes human beings as well. But evolutionary theory maintains that all species will experience a constant growth and development of their genes and abilities. In practice, this is not what we observe. Many kinds of plants and animals become extinct every year, while new, comparatively rare species can hardly be defined! They are really only a genetic variation of an existing

species and not a truly organically-new construction. One newly-constructed part which hasn't been closely observed up until now is the bird's feather, which is supposed to have come from a reptile's scale.

Birds – Examples of aerodynamic perfection

From a technical perspective, birds are absolute wonders in lightweight construction and aerodynamics. Many birds have a so-called built-in reverse current brake feather on their wing. This hinders in the air current while the bird is flying slowly. Besides the bone structure, muscles and control system of the bird's feathers through sensory nerves and brain cells, the feather has quite a remarkable construction. Popular evolutionary theory holds that the whole feather in all its diversity arose from one scale. Without a creator behind this work, the feather's uniqueness remains a mystery. Hypothetical intermediate stages of evolution most often mean a selectional disadvantage for the animal in question. For example, one frayed scale would necessitate the colonization of parasites. Only the complete system a bird now possesses makes sense and has biological advantages. Finally, it is not enough to say that even a dinosaur could grow feathers and therefore also fly! The development of a completely aerodynamic skeletal structure, optical flight readiness and other factors are all necessary for flight. Otherwise, mutations (which are the rule and not the exception) in development lead to a failed product: an animal that cannot fly. Accepting the evolutionary process in the case of a bird which flies necessitates more faith than belief in a creator God making that animal in all its perfection!

Is it all just coincidence? The Ape Experiment

Does coincidence really result in reasonable results? Richard Dawkin, a well-known evolutionary theorist, says yes. The so-called ape experiment “proves” that mutation and selection do work. In the experiment at hand, an ape types a sentence from Shakespeare containing approximately 50 letters on a typewriter. How does he do it? The tester decides beforehand how many letters and which words the ape should type. Then the ape starts typing until he

has reached the desired results. No one argues that the words typed are incorrect, but the number of letters typed in total was certainly more than 50. This experiment is supposed to simulate the random changes in the gene pool (that is, mutation). The tester compares the results of the typing experiment with the originally-desired final sentence. He observes that the ape has successfully typed the right letters in some of the right places. Because some of them are in the right place (which we can compare with selection advantage in the evolutionary theory), they will be taken as is into the next experiment. This is supposed to simulate sexual reproduction. Like the correctly-typed letters, the “good” genes or parts of genes are more suitable for survival of the animal and are therefore passed on to the next generation through sexual reproduction. Back to our experiment, the ape continues the typing tests with the same parameters as at the beginning. At the end of a few hundred attempts, he has correctly typed the complete desired sentence, without ever actually knowing what he was doing, similar to nature which cannot think by its own.

No Coincidence!

Such an experiment, viewed more closely, has really very little to do with chance. If such experiments are supposed to support the chance development of life, then at least each intermediary stage should be more sensible than the previous one. Selection can only “choose” what really works. That is, not just the final product must be a logical construction, but each intermediary step as well! Besides that, along the way of life's supposed evolutionary path there are no clearly delineated goals, as there should be in such experiments as the one with the ape and the typewriter. There are also no clear criteria of proof, and without these, such an experiment cannot function properly. So really we are looking at most at a controlled or utilized coincidence! Man decides about the setting up of the experiment, running the experiment and monitoring the intermediary results. This is also valid for more difficult technical experiments such as programming robots to push small bricks, to simulate evolutionary optimization, such as the

tube elbow tool or the jet engine.

The results are impressive, but they did not really come about randomly! The participating engineers and scientists always know in advance what has to be optimized and why that is so. Then appropriate strategies and mathematical models are developed before the experimenting begins. Therefore entitling such experiments “blind chance” is purposely misleading the public.

Faith and Science - Enemies or Friends?

The question as to how life came about cannot be neutrally answered. How such experiments can be offered as “proof” for the self-creation of life necessitates a certain ideology. The question is not if one has faith or if one thinks scientifically, but rather in what or whom does one believe when one thinks scientifically?

Methodical Atheism

It is absolutely verifiable that most well-informed scientists feel obligated to follow a sort of methodical atheism when dealing with a non-scientific assumption. “If we assume that evolution occurs without an external planner, then the biologically dominant principle of self-organization is forced upon us?” (R. Reiner) The development of life, according to this assumption, happens without an external force, be that a creator or something else. Here we are dealing with a way of thinking that is decided upon beforehand, in order to organize and interpret all natural observations. This assumption is not a result of neutral scientific conclusions! There is no reason to alternatively consider the field of science from a perspective with faith in a creator. If we want to understand life, all parties participating in research and experiments should know that it is one's faith which sets the course for the interpretation of all observations.

Reasoning of a Creator

Is it faith in the reasoning of man or faith in the reasoning of a creator that motivates and guides scientific research? It is not acceptable for scientists believing in a creator to be poorly treated and their work not honoured because of their Christian thought structures.

After all, in nature there are many indicators that speak for, and not against, a creator force behind what we see. We read in Romans 1:20 in the Bible: “For since the creation of the world God's invisible qualities-- his eternal power and divine nature-- have been clearly seen (for example by looking through an electron microscope) being understood from what has been made, so that men are without excuse.”

A comment by physicist Andy McIntosh confirms that natural science and faith in a creator don't have to be opposing belief systems follows: “Can we truly say that birds, which start and land daily, were not planned? ... If we observe birds and airplanes together, would we still say that one was planned and the other one was not?”

Literature Recommendations

- Junker, Scherer: Evolution - ein kritisches Lehrbuch, Weyel-Verlag: Gießen, 5. aktuelle Auflage 2001.
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