

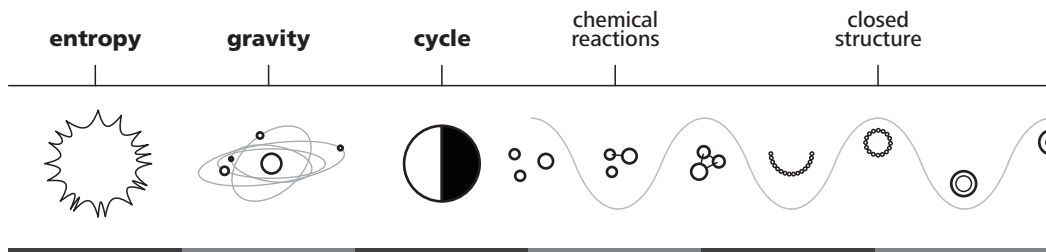
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The biological matrix of evolution

This paper's approach on biology is based on the attempt to understand the universal mathematic of biological evolution and later confront this mathematics with the human evolution and thus, the evolution of design. Some aspects were decisive in this endeavor, such as the comprehension of the relativity of life and the deep connection between the development of life and the physical and geological formation of the planet.

After an overall study of four billion years of biological evolution, it was found that not just the mathematics is similar, but also that the processes are connected. Some theorizers (Adams 1909, Smart, 1999) place all evolutionary processes as phases of the same evolution, beginning with development of Physical System, than Chemical System, Biological System, Societal System, Technological System and speculatively, the Universe as a System. Adams, focusing more on human evolution, established phase divisions from the Societal to the Technological Systems development as Mechanical, Electrical and Ethereal. Life is thus a late phase of evolution and not the only condition for evolution to happen, especially considering the time variable.

Earth's biological evolution is a process that started ages before life, through many cumulative chemical reactions, with a first important step, the first being. It was a non living hydro carbonic tissue that by a magnetic principle attracted its loose ends together, sealing it. It was the first chemical natural phenomenon towards the creation of semi closed beings and later life. It Divided the shapeless mass of chemical elements into two different things,



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inside and outside, “being”, and “not being” Margulis, 1991, p48).

For an entity to be considered alive, some other characteristics must be added. One of them is autopoiesis, the reaction to harm, reproducing and recreating damaged parts, the urge to preserve one's structure. The advent of this phenomenon presented also a big duality in life and evolution. The need to both preserve the original identity and to change.

“Per essere viva, un'entità deve essere autopoietica, cioè deve mantenersi attivamente contro i guai prodotti dall'ambiente. La vita reagisce a una perturbazione, ricorrendo a materia ed energia per conservarsi intatta. Un organismo scambia costantemente le proprie parti, sostituendo le sostanze chimiche che lo compongono senza mai perdere l'identità.”

“To be alive, an entity shall be autopoietic, i.e. must remain actively against the harms presented by the environment. Life reacts to a disturbance, through the use of matter and energy to be preserved intact. A swap body constantly their parts, replacing chemicals comprised therein without ever losing the identity.”

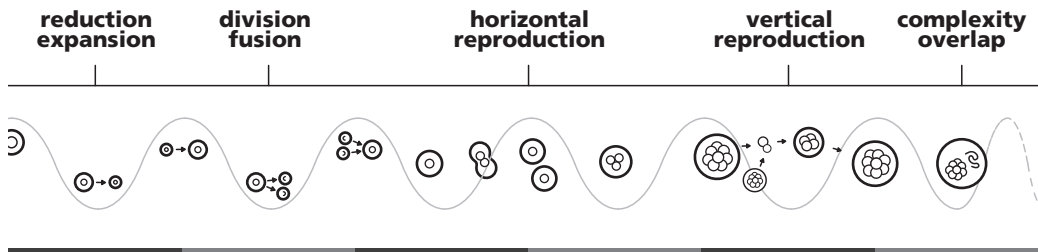
Lynn Margulis

Microcosmo

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If autopoiesis is the main premise for a being to be considered alive, computational systems could already be in that direction, a computer that shuts down automatically when it overheats, to prevent the physical melt



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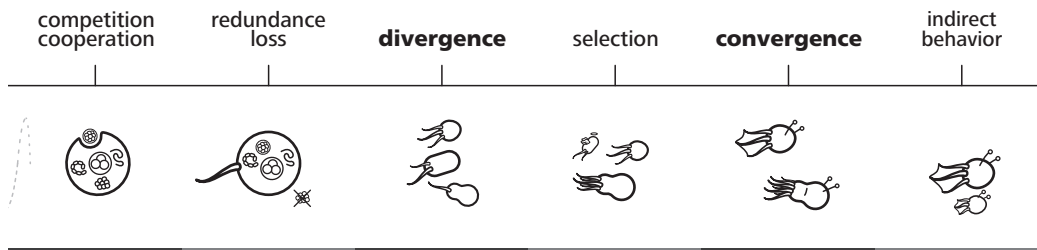
down of its components, is autopoietic, a system that rebuilds missing parts of a software after a disc scratch is autopoietic, even antivirus softwares are immunological auto defensive systems (that comparison was not quite the hardest one, we shall admit).

Other definitions of life take under consideration the capacity to carry genetic information (DNA, RNA) and to perform reproduction. According to that definition, viruses are not living creatures, considering they can't reproduce by themselves autonomously, needing a host to perform reproduction. That definition relates the capacity to evolve to the conception of being biologically alive. It means that the capacity to reproduce and to have a reproducible language are the two keys for life to emerge, According to Margulis, an evolutionary being stops existing the second it loses the capacity to be reproduced. In the microcosm, this evolutionary death may be expressed by the development of a flagellum, what technically would hinder the cell to procreate.

"In generale, una volta che una cellula si impegna a sviluppare un undulipodio, cessa di esistere dal punto di vista evolutivo: non può più riprodursi."

"In General, once a cell commits to develop a undulipodium, ceases to exist by evolutionary point of view: can no longer reproduce."

Lynn Margulis
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This microcosmic principle can be applicable in a large scale, since all pluricellular creatures are different organizations of the same basic nucleated cells. In theory DNA and RDA, or rather, the set of instructions that these cells follow in order to form muscular tissues or to become blood cells are the only things that keep human cells from “thinking” individually and trying expand riotously menacing anything around it.

Actually, that's precisely what happens when a cell develops cancer, it stops following DNA orders and get back to its original primitive form. Apart from the system set ups and DNA, all living creatures have this common denominator, capacity to reproduce and evolve as the condition for it to be considered alive.

“Piante, funghi e animali emersero dal microcosmo. Al di sotto delle nostre differenze superficiali, siamo tutti comunità di batteri in cammino. Il mondo luccica, paesaggio divisionistico costituito da tanti minuscoli essere viventi. Le sequoie giganti, le balene, le zanzare e i funghi sono tante intricate reti simbiotiche, manifestazioni modulari della cellula nucleata.”

“Plants, fungi and animals emerged from the microcosm. Below our superficial differences, we are all community of bacteria in the way. The world glitters, divisionistic landscape consisting of many tiny living beings. The sequoias, whales, mosquitoes and fungi are many intricate modular networks symbiotic, events nucleata cell.”

Lynn Margulis
Microcosmo
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This passage, from unicellular simple organisms to a more evolved cells with complex functionings, capable of performing advanced functions and to form pluricellular creatures eventually happened with the overlap of countless cellular re-combinations (divisions and fusions), the association of different individuals in the formation of more complex ones.

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Since, in the microcosm, symbioses may occur more easily and DNA may change in a much deeper level, in a faster rate, this associations of individuals would happen whenever there was a possibility for them to spare functioning efforts. Their DNA would change eliminating the redundant functionings and the genetic identity of the previous individuals, creating this new ones.

"Il predatore, una volta insediatosi, perdette gradualmente una parte dei propri DNA e RNA. La selezione naturale tende a eliminare la ridondanza quando si sviluppano simbiosi, pertanto se, per esempio, entrambi gli organismi simbiotici sintetizzano una sostanza nutritiva necessaria, gradualmente uno di loro può perdere questa capacità, facendo aumentare così il grado di interdipendenza."

"The predator, once established, gradually lost some of their DNA and RNA. Natural selection tends to eliminate redundancy when developing symbiosis, so if, for example, both symbiont bodies synthesize a necessary nutrient, gradually one of them will lose this ability, thus increasing the degree of interdependence. "

Lynn Margulis
Microcosmo
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The same way symbioses would happen easily, the division of a cell into two cells would happen in a manner that would be impossible for complex creatures to conceive. Cells would literally double in size and get divided. The macrocosmic precise equivalent would be an animal, like a dog for example, that doubles in size, develops eight legs, two heads, two tails, two digestive systems and so on, and eventually gets divided into two dogs. This primordial difference between the direct and the indirect reproductions puts reproducibility in a very flexible perspective, being the reproducibility of the code, the language, the only technical necessary condition for evolution to happen. DNA and RNA are the only two things that can physically be reproduced.

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"I batteri si riproducono asessualmente (agamicamente), raggiungendo una dimensione che è il doppio della dimensione normale, duplicando il loro singolo filamento di DNA e quindi dividendosi: una copia di DNA va in ciascuna delle nuove cellule figlie."

"Bacteria reproduce asexually (agamically), reaching a dimension that is twice the normal size, duplicating their single filament of DNA and then dividing itself. One copy of the DNA goes into each of new daughter cell."

Lynn Margulis
Microcosmo
1991
p. 86

Those expansions followed by divisions and the re-combinations of simple organisms would have triggered the production of innumerable slightly different beings with different behaviors, mutations that occurred randomly and spontaneously over millions of reproductive processes. Another phenomenon responsible for mutations was the cyclical scarcity of resources provoked by the occurrence of moments of warmth and coldness, day and night, summer and winter. It forced simple individuals to break into loose incomplete parts and recombine with other different partial individuals when the environment was less rigorous.

Although these associations were and still are a lot more common and easily established in the microcosm, the current large scale versions of fusions, symbioses and organism cooperations and associations can be found even among complex creatures (such as the partnership among raccoons and wolves on hunting) or between complex and simple organisms, like the bacteria that aids the digestion on herbivore animals intestines, or the bacterial based bioluminescence in some fish. The mitochondria, which is responsible for the production ATP through respiration, and to regulate cellular metabolism, for example are supposed to have a similar associative past with cells. Their DNA has a bacterium like shape, which makes them

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genetically separated from other animal cells by millions of years of evolution and indicates a late association.

The evolution of this phenomenon of spontaneous breaking, recombining, dividing and mixing eventually established itself in a more periodical division and fusion behavior among similar compatible individuals, That was the first manifestation of a reproductive cycle.

“in primo luogo, il numero cromosomico in alcune cellule deve ridursi esattamente della metà: un processo che dà origine o a cellule uovo o a spermatozoi. In secondo luogo, queste cellule devono successivamente riunirsi e fondersi nell'altro della fecondazione, reintegrando così il numero cromosomico normale nella nuova cellula che si forma e che si divide per diventare un nuovo individuo”

"first, the chromosome number in some cells must be reduced exactly in half: a process that produces or egg or sperm cells. Secondly, these cells must subsequently meet and merge another insemination, restoring the number chromosome normal in new cell shape and that splits to become a new individual "

Lynn Margulis
Microcosmo
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Sex, according to the biological definition is not the capacity to reproduce, the act of coupling or necessarily a sequence of procedures such as courtship and intercourse, concepts very intrinsically related to the human conception of sex. It is in actuality merely the recombination of genetic information from two different sources (Margulis, 1991, p. 80). The process of coupling is actually a series of simpler phenomena. These procedures that could be defined abstractly as a sequence of expansion; division; fusion in a cyclical pace are the basis of what could be defined as the sexual deed. Microcosmically speaking, it would be the numerical reduction of chromosomes followed by the fusion of nucleons of

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different sources. The differentiation among the new breeds followed by the impositions of the environment would perform natural selection, the more adapted would survive, and perpetuating their differentials, as a evolutionary divergence. Once organisms reorganized themselves as different types, with different behaviors by random assortment and a later selection of the more adapted, another force starts constraining the organisms into certain directions, characteristics of the environment would influence the flux of evolution, if the environment provides light, light will probably be used somehow by the organisms that live in it. If the environment is rich in carbon dioxide, organisms will find a way to use this gas in their benefit. The opposite is also true, an environment poor in luminance, will drive the organisms that live in it to lose their capacity so perceive light, this elimination of non necessary functions and organs is one of evolutions most important characteristics, it means that the option that prevails is not the most powerfull in a general sense, but instead, the most adapted, if physical strength is a non necessary attribute, slenderer and smaller individuals will prevail and this characteristic will be lost over generations. The convergence may occur not just by the absorption of a substance, physically efficient shapes and methods could be developed by organisms with distant common ancestor. The same principle could be applied to human culture and design.

“è un segno dell'interferenza dell'ambiente nei processi evolutivi che può portare allo stesso risultato elementi di origini diversi. Esempi: piramidi, arco e freccia, lancia, tamburo ecc.”

"it is a sign of environmental interference in evolutionary processes which can lead to the same result elements of different sources. Examples: pyramids, bow and arrow, spear, drum etc. "

Lynn Margulis
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The slow adaptation process took individuals to always toil in a more competitive and demanding environment where the number of tasks necessary to perform a function was continuously increasing. The growth in complexity of organisms, having more complex functionalities and needs would push the growth in complexity of the whole system. Over time, organisms capable of developing non immediate behaviors would emerge. Eventually, it was also born the complex cooperative behaviors, the establishment of relationships of cooperation or competition among systems or groups of individuals that would regulate the functioning of the whole environment. A predator, in that sense would be an important regulation system to keep under control the population of the prey.

“Essi (fenomeni evolutivi) si sovrappongono fra loro, convergono, traggono alimento l'uno dall'altro e prendono in prestito l'uno dall'altro.”

“They (evolutionary phenomena) overlap between them, converge, derive nourishment from one another and borrow from each other.”

Lynn Margulis
Microcosmo
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As organisms grew in complexity, the capacity to evolve, mutate, and recombine got affected, even the already mentioned reproductive process had to become indirect. And it became more and more direct over time. In fact, today, very few things can be reproduced autonomously like bacteria, Almost every other creature or evolutionary being follows an indirect process of reproduction, other reproductive processes such as molecular duplication, cellular growth and constructive activities were actuated before complex beings could be able to emerge.

That consideration brings to light a very important argument, what is life and what is not. Autonomous reproducibility is one of the processes through

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which living things reproduce themselves. Artificial or indirect methods or reproduction must not be illegitimated since almost every evolutionary and living being use different and indirect methods to reproduce.

“Se pensiamo che la riproduzione sia il carattere più saliente della vita e la biosfera una unità fondamentale, allora neppure la Terra può essere considerata vivente, poiché non si è ancora riprodotta. In verità, solo il DNA e l'RNA si possono riprodurre direttamente. Ogni altra cosa (batteri, fanciulle, balene, salici piangenti, McDonald e veicoli spaziali NASA) si riproduce indirettamente attraverso queste molecole.”

“If we think that the reproduction is the character most salient of life and the biosphere a fundamental unit, then even the earth can be considered as a living thing, because you have not yet reproduced. In truth, only the DNA and RNA are able to reproduce directly. Everything else (bacteria, maidens, whales, weeping willows, McDonald and spacecraft NASA) reproduces indirectly through these molecules.”

Lynn Margulis
Microcosmo
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The indirect character of this complex organic processes and complex functionings led some animals to develop the capacity to think, take decisions, plan and accumulate knowledge. That was the key for the development of culture, the next phase of evolution (Societal Systems), according to Smart. It was a slow and gradual (tendency) process of loss of the spontaneous character of evolution (Pierce, 1935).

The methods through which things work and evolve in this more complex system are different from the ones of microcosmic but the motivations and results are similar. Human society, as a complex system, caters to specialization, which mirrors the behavior of the cells that constitute its members, but this specialization, which confers survival value, would not have

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started without the previous overabundance or redundancy of items that reproduce themselves, would not happen without the establishment of an evolutionary set of rules.

With complexity, there came uncertainty. Along with this indirect behavioral system, there was also a set of non functional characteristics that in some cases can be associated with genetic vestigium, sometimes with cultural anomaly or side effect. The religious thinking was a manifestation of this cultural development and this trend to have knowledge of the course of existence. As the capacity to perceive surrounding phenomena and make calculations got more accurate, humans needed an explanation for this inevitable complex explanations. The passage from explaining everything with a divine supernatural intention and will to the scientific thought was a gradual learning process. This scientific thinking eventually reached the point in which men understood the mechanisms and potentials of evolution. This control over earthling evolution by humans is at the same time an inevitable responsibility and a volunteer telos on modern society. As in any other evolutionary model, there are the two evolutionary behavioral forces acting as counterparts, one of them playing a direct part on the balanced relationship with the other systems, and the other just craving to dominate and prevail.

"In realtà, l'evoluzione umana, come ogni evoluzione, presenta entrambi gli aspetti: la condivisione e l'eccidio, la competizione e la cooperazione."

"Actually, human evolution, as every evolution, presents both aspects: sharing and slaughters, competition and cooperation."

Lynn Margulis
Microcosmo
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The functioning of man's matrix is a fractal repetition, an ethereal variation of the basic structure and functioning of the original biological system. The

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societal system is a variation of the neural structure of a living creature, the cooperative and competitive relationships also variations of the most fundamental inter cellular connections.

Processes as symbioses are an expression of a universal phenomenon repeated in many levels and scales, the principle of remixing and assortment. Two bodies, or systems, or objects, well developed and adapted it continue, react, develop again, redefining, adapt, and something new will ultimately emerge. Human inventions continuously exploit this remixing and replenishment. The biological system itself would follow more primordial rules. That might be the key for the complete control of complex systems and evolution.

“è come se ci fosse un sistema nervoso sociale collettivo per gestire milioni di nostri problemi e la sua importanza per il futuro a lungo termine può essere altrettanto grande di quella dei primi sistemi nervosi in grado di apprendere.”

“it is as if there were a social collective nervous system to manage millions of our problems and its importance for the long-term future can be just as great as that of the first nervous systems capable of learning.”

Lynn Margulis
Microcosmo
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The egoistic vision of the human condition as a completely different element, a leading figure in a master plan must be taken with caution. Humans are not just part of the system, they are as vulnerable to the same harms, sensitive to the same adversities and disposed to the same irrational destructive behaviors as all successful and fallen creatures may have been. Men are not the evolution of more primitive creatures, they are a successful choice as any other creature and all currently living being shares the same ancestors.

The comprehension of the great advances that occurred spontaneously over those four billions of years and the humbleness of accepting and use in the

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best way this information is the only possible way of evolving in a long term. The outstanding human evolution cannot be separated from the convolution of the microbes, their ancestors, the bacteria that compound their cells and the cells of plants, animals and fungi that allowed and made possible that evolution.

Understanding how spiders produce their super resistant, strong, elastic and instant air catalyzing fluid, in their minuscule body structure, how geckos climb any surface with no use of adhesive substance or electrical or magnetic devices what so ever, how flies manage to have better reflexes than any human being and dodge any human pathetic attempt to smack them with a brain smaller than a pin head is the next challenge of evolution.

It's important to comprehend the phase shift humans are about to accomplish, the passage from one system to another, the creation of a new kingdom. The development of computational bionic conscience, capable of sensing and perceiving and reacting to surrounding stimuli, the rationalization and development of an artificial autonomy are the phenomena that are going to change the world the in a way similar to the biggest geological crises did in the past. Evolution is a process that started aeons before biological spontaneous life and will continue, if managed the right way, aeons after it.

