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Artistic Reflections on Synthetic Biology and Evolution

(The essay provides a summary of the second part of a talk on “Passion for Science of S-layer Protein and Art” given at the Proteins and Peptides Conference, 23 July 2018 in Geneva)

Since I am working with molecular construction kits, an area which relates to the so called bottom up strategies in Synthetic Biology, I became more and more interested how Synthetic Biology eventually may influence evolutionary events.

In view of the progressing developments in Synthetic Biology, it seems very likely from today's perspective that humans will intervene in biological evolution especially with genome editing applying the CRISPR- Cas 9 method or other even more powerful methods which eventually may emerge. One can leave it at first with this almost stoical statement or ask many further questions in such a dynamically developing field of science. It is also quite obvious that the potential of Synthetic Biology allows very exciting trips into the world of science fiction.

I would like to show from a very personal point of view that it is possible to reflect on the unpredictable developments in Synthetic Biology, even on the path of an artistic form of expression. It should first of all be noted that in the natural sciences, as we progress in knowledge, we move in a network of reproducibility of experiments and results. Thus, scientific progress is regulated and limited by methodological possibilities and theories. In art, this limitation does not exist. In art, we are completely free in our world of thought.

However, it is already clear today that the study of Synthetic Biology has led man, in his present manifestation, to see himself more consciously as a time-limited section in the course of an evolutionary event. The crown of creation has thus lost the position of a final product in its evolutionary course. Art has the potential to tackle precisely such topics and questions. It is particularly capable of extrapolating into the unknown and unimaginable.

Seen from this point of view, our present state of culture corresponds to a very exciting phase, because after a long period of parallel development, science and art also approach each other very consciously. It is also evident that on this way into the new territory, critical considerations and ethical questions are indispensable. Artistic forms of expression thus become initiators, catalysts, but also agents for Synthetic Biology and consequently also a part of the converging sciences.

For me, as a scientist when engaging in art, a mental state of flow, in the sense of the definition of psychology, opens up. This 'happy feeling' happens by itself and goes beyond any strict technical boundaries, as a complete deepening concentration and complete absorption in an activity. As it were, the space left open by the rigid canon of science fills up through the artistic activities.

As an artistic means of expression for the visualization of the unimaginable future of a self-induced evolutionary event, I use mask-like clay sculptures that are gilded with gold leaf after firing (Fig. 1, 2, 3 and 4). These clay sculptures are also the starting point for further work and modifications. I chose gold as the material because it conveys the association of value. Gold also has a strong connection to a temporal tangent for science. The element was incubated in cosmic events many billions of years ago in the course of supernovae. Moreover, reflections on evolutionary events are unimaginable without a direct temporal reference. Masks have an enormously expressive power. They have been and are used in many cultures for a wide range of rites and ceremonies as well as protective armor; just consider the frightening masks that Samurais used to wear. In addition, masks reflect a universal human cultural achievement that came into existence very early and in almost all cultures. Most important, masks do not require language for explanation. Their wide range of expressions derives from the morphology and, where appropriate, their color scheme. Masks can appeal to very deep, archaic levels of our consciousness. I remember very well the fascination and the very strong suggestive effect that masks have exerted on me from my early youth when I visited the ethnological museum.

I do not plan my products and do not make sketches and deliberately do not use any modeling tools in my work. The end products thus show only impressions of my very own morphology. The involved parts of my body symbolize bioparts and biobriks as used in Synthetic Biology. I also try to symbolically approach the unimaginable variety of ways in which genetic material can be combined. Every fingerprint or handprint in the plastic tone arises spontaneously and represents, as it were, a section on the way to a self-induced evolutionary product. In order to make aware of the unpredictable development of humans or other forms of post-human life with particular regard to the results of self-enhancement, the mask like sculptures symbolically multiply the sensory organs, such as

the eyes, the noses, and the skeletal components and cranial dimensions far from human. This is also against the background that the aesthetic assessment of morphologies, which can produce a man-influenced evolution, will decouple from today's conception and assessment. Some sculptures are composed of two or more parts, the lower part of which deliberately contains morphological details of the main body. This symbolically suggests a possible continuing evolutionary development. From an esthetical point of view the sculptures often reveal a strong link to Natural morphologies. As an example I selected this picture of a sculpture mounted in my old Ginkgo tree showing his beautiful golden autumn leaves (Fig. 5).

As a further step towards the extrapolation of an unimaginable evolutionary event, together with the prominent conceptual photographer Fritz Simak, I have sprinkled the sculptures with colored water. Fig. 6 shows a scene from the procedure involving splashing a sculpture and Figs. 7 and 8 show representative images obtained. In Fig. 7 the sculpture was splashed from the front. We used exposure times creating a water structure which generates the impression that the colored water is a viscous organic material. The next image (Fig. 8) shows a sculpture splashed from back. In a modified approach (Fig. 9) colored water was poured over the sculptures from a watering can and by coincidence the striking phenomenon was witnessed that water as a thin layer can form waves in the course of free fall. One can see five waves and finally the disintegration of the thin layer due to gravity.

Again, the unpredictable interaction between the liquid medium and the morphologically complexly differentiated surface of the sculptures should make clear that the post-human future defies any serious prediction. In an alternative exploration of this dilemma, I depicted the clay sculptures in deformed mirror foils. Fig. 10 shows the assembly used for obtaining these images. One can see the mounted deformed mirror foil, and the camera behind the sculpture which is suspended on wires. Since the sculptures are only gilded with gold leaf on the front one sees the bare clay on the back side. Fig. 11 shows a characteristic image. The sculpture used was the one which was mounted in the Ginkgo tree (Fig. 5). For the next picture (Fig. 12) I used the sculpture where colored water was poured from a watering can (Fig. 9). The variable mirror images shall symbolize snapshots of an evolutionary event induced by Synthetic Biology

Finally, to symbolize the post-human situation that will remain forever unimaginable and inaccessible due to our intellectual limitations, I chose extremely distorted images in which the mask-like sculptures could hardly be recognized as an integral part of the image. These pictures (Figs. 13 to 18) symbolically depict the furthest limit for our current epistemological horizon, which stands out as speechlessness at the transition from man to a post-human future. In Fig. 18 the morphology of the mask is completely disaggregated.

Selected images from both the splashed sculptures and images obtained in deformed mirror foils have found a permanent place as the exclusive decoration in the building of the Vienna Institute of Biotechnology (Fig. 19), which belongs to the University of Natural Resources and Life Sciences Vienna. Several pictures are also decorating rooms of the Complexity Science Hub Vienna in the Palace Stozzi (Fig. 20). There are also regular exhibitions at art galleries and other locations.

General remark: Art should generate an emotional resonance in the observer and should not leave one in an unconcerned state. There may be a broad spectrum of reactions, reaching from rejection to admiration.

Summarizing:

Considering the developments in Synthetic Biology there remains a crucial question of principle: Can we, at the level of the human cognitive horizon, with all the information and data that we have and still produce, seriously consider or even plan a next stage of evolution derived from us? It is not rather our fate that we are the first form of life, which has the possibility to change its own genetic material but that at the same time we can not generate appropriate rules for all visionary concepts for the further development of our species. More broadly, humanity gains the ability to separate the evolution of life from its previous evolutionary rules. The question could also be formulated in a very simple way: Are we in a position like primates would be who are supposed to invent man? I also have to stress that in the course of a self-induced evolutionary event, a co-evolution will take place on technical aids and electronic components to expand the capabilities of the senses and the body. Particular importance will be attached to signal transmission and signal processing at the interfaces between body and technology. Above all, networking with ever more powerful artificial intelligence systems could make a significant contribution to ensuring that humans are not anymore affected by the randomness of evolutionary events.

For the illustration of the dynamic procedures during splashing sculptures and obtaining images in distorted mirror foils short videos on the links. <https://vimeo.com/29911150> and <https://vimeo.com/166921083> are available. For Synthetic Biology and Art see also Interview in OKTO TV <https://vimeo.com/166921083>, the book: U.B. Sleytr. Curiosity and Passion for Science and Art: Series in Structural Biology Vol. 7 (2016) p. 480 World Scientific Publishing ISBN 9813141816, as well as articles in the ScienceBlog <http://scienceblog.at/uwe-sleytr> and the homepage: www.art-and-science.eu

Uwe B. Sleytr Geneva, 23 July 2018



Figure 1



Figure 2

Figure 3



Figure 4





Figure 5



Figure 6



Figure 8

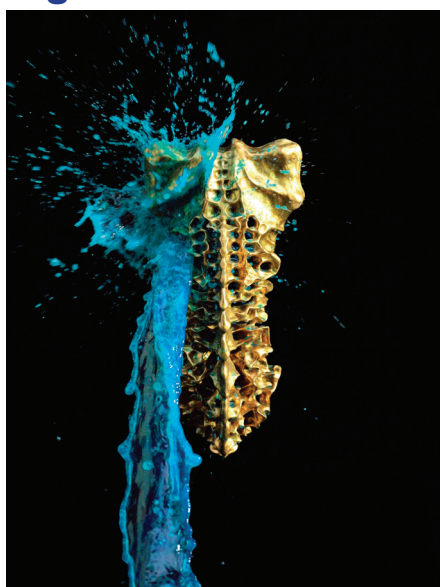


Figure 7



Figure 9



Figure10

Figure 11

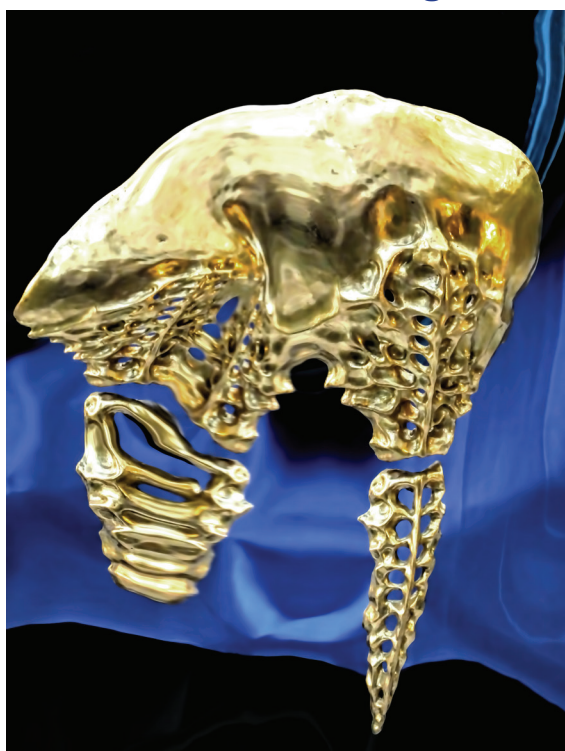


Figure 12



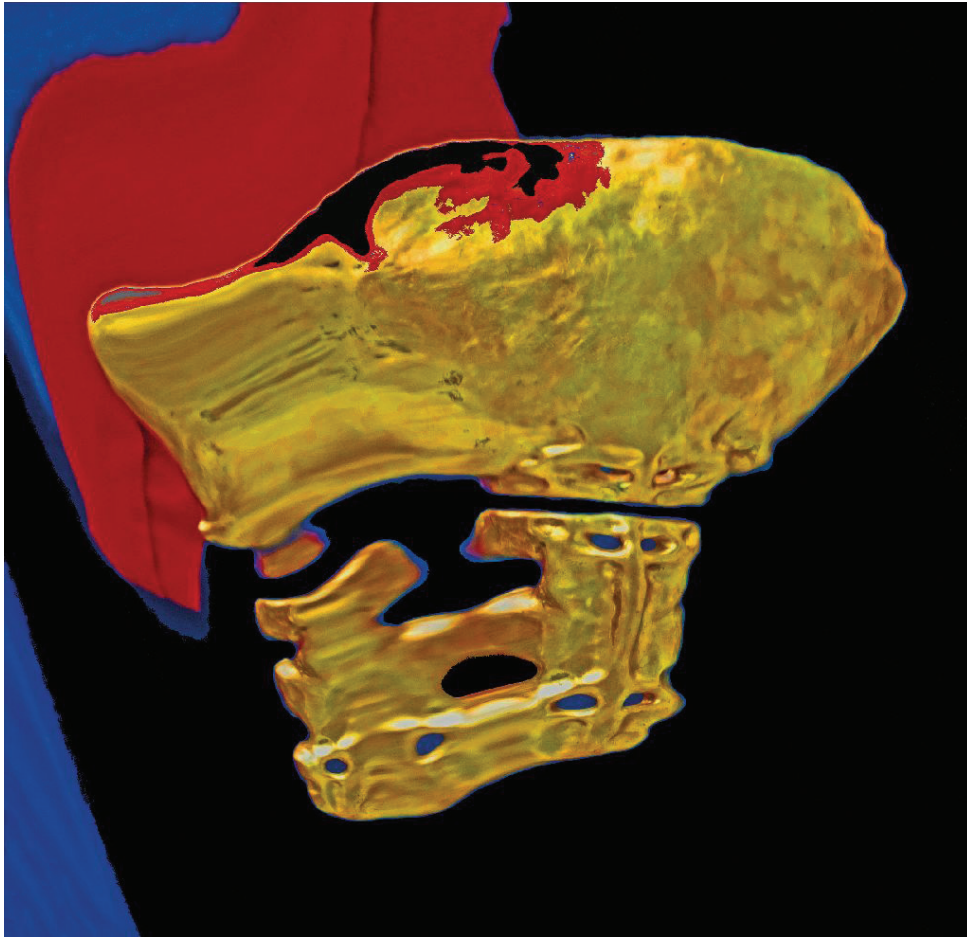


Figure 13

Figure 14



Figure 15



Figure 16

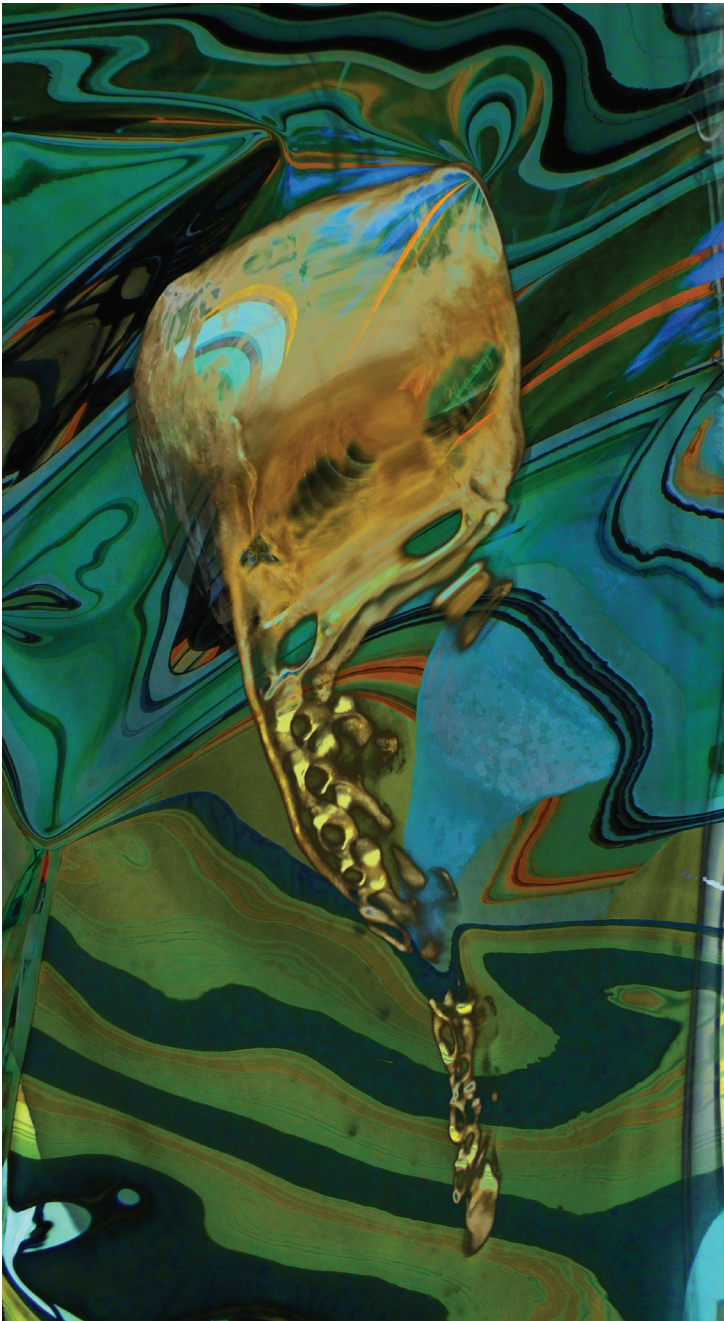


Figure 17

Figure 18

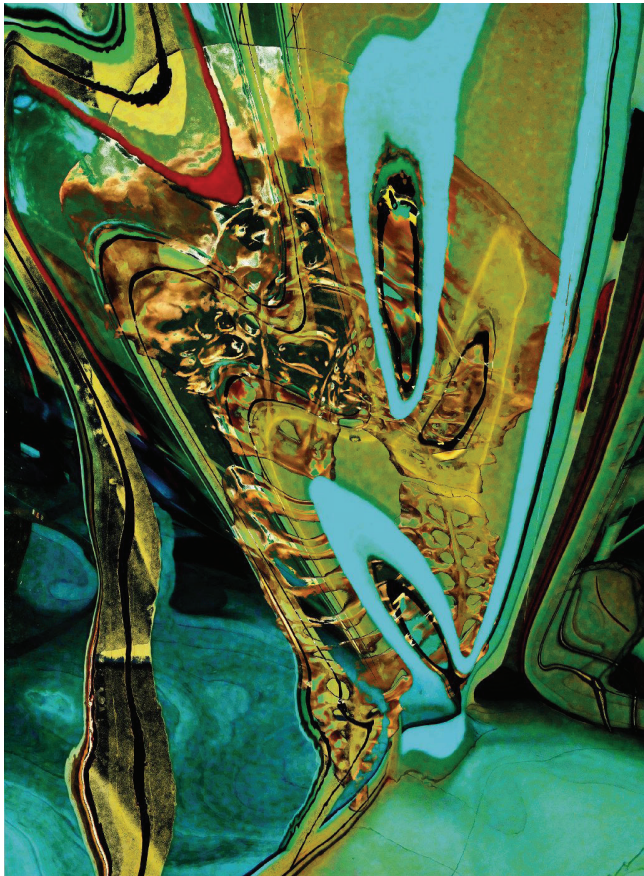




Figure 19

Figure 20

