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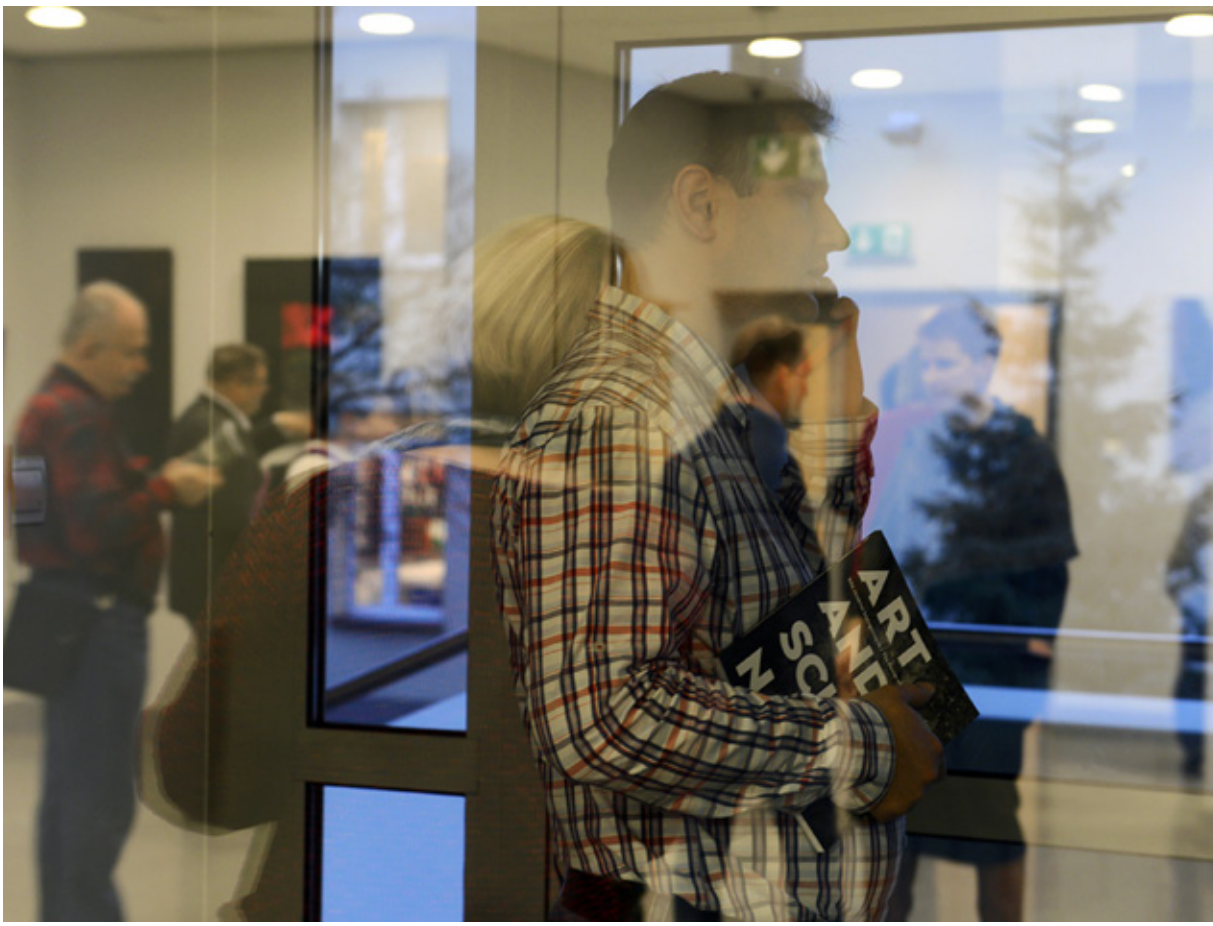

Art & Science: The Art of the Origins of Life

What shared intellectual foundations underpin collaboration between the artistic community and scientists? What benefits can artists and biologists derive from working together? Can their very different spheres of creativity support one another?

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For several centuries now, registering and analyzing images has been a fundamental and essential element of research in biology. Observation of the natural world on the macroscopic scale has always been part and parcel of human experience. At some point in the development of science, however, a new tool emerged, allowing people to observe organisms and structures invisible to the naked eye. The first optical microscopes were created at the turn of the sixteenth and seventeenth centuries. Another breakthrough in understanding the animate world at the cellular level came in the twentieth century, with the invention of the electron microscope and the high-resolution fluorescence microscope. Modern bioimaging at the level of cell ultrastructure is based mainly on high-resolution fluorescence microscopy and a new form of electron microscopy – cryo-electron microscopy. These techniques make it possible to visualize with great precision both previously uncharacterized cellular structures and various dynamic processes that occur in the cell. One can say that modern molecular biology is becoming a biology of visualization. This prompted us to consider what seemed to us to be an obvious question: Can the images recorded in biological laboratories serve as a source of new inspiration for artists active in the field of visual arts?

Art and Science

At times it seems that art and science are very distant realms of intellectual activity and any similarities between the two are merely accidental. Some, however, claim that art and science are different forms of expression that both stem from a single foundation: curiosity about the surrounding world. Jan Dembowski, an outstanding Polish biologist and long-standing director of the Nencki Institute of Experimental Biology discussed similarities in science and art in an article published 1937 ("Zagadnienia podobieństwa w nauce i sztuce" [Issues of similarities in science and art], *Wiedza i Życie*, No. 4/5). At the end of the article, he wrote: "clarity of thought and precision in the use of concepts are as important in art as creative imagination is in science." It is hard not to agree with this statement!

At least three fundamental issues facilitate collaboration between scientists and artists. Firstly, both communities are deeply curious about the world, and such curiosity is precisely what drives the creative pursuits of both scientists and artists. Someone who does not ask themselves questions about the world around them can be neither an artist, nor a scientist. Secondly, creativity is an immanent feature of both activities. Following Polish philosopher Władysław Tatarkiewicz, we might say that "a man is creative when he does not restrict himself to stating, repeating, imitating, when he gives something from himself, of himself" (*A History of Six Ideas*, 1980, trans. C. Kasparek). In other words, it is the ability to come up with something original and make it a reality. It is hard to imagine a good scientist or an outstanding artist who is not creative. Finally, both realms highly value the freedom to choose the direction of action. Freedom understood in this way is probably one of the most important guarantors of progress in science and art alike. Curiosity, creativity and freedom create a space for collaboration between scientists and artists, making it possible.

Artists enjoy a much broader freedom of expression. They can act freely and creatively in the realm of culture and art where – thanks to their sensitivity – their individual approach to the problem at hand and its solution manifest themselves. In the process of creativity, the scientist is more limited, and not only by the fundamental laws of nature. He or she must be objective in presenting the results of his research. A scientist who claims to have truly constructed a *perpetuum mobile* is unlikely to be seen as a person with

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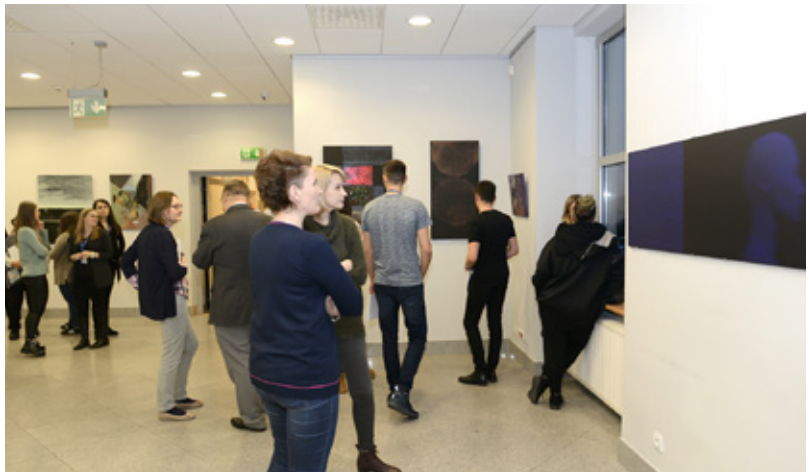


13 January 2020, Hall of the Neurobiology Center, Nencki Institute, vernissage of the Art & Science exhibition – "The Power of Biological Structures." On the right, work by Prof. Mirosław Pawłowski Camouflage-Scan 4 Blue, 2019, UV print on aluminum plate, 35×100 cm

a creative imagination. On the other hand, no reasonable person would accuse the surrealist paintings by Salvador Dali or Rafał Olbiński of being bad because they do not obey the laws of nature.

Finally, the modern molecular biologist is limited in his research by the availability of sophisticated (i.e. expensive) apparatus. In the "technological desert" the creative abilities of the scientist are very limited! Here the artist has definitely more freedom in pursuing his or her aims.

The immense "visuality" of today's molecular biology prompted us to launch the Art & Science initiative. Could contemporary biology, perceived through the primacy of intellectual creativity, be itself viewed as a form of conceptual art? We were curious about how inspiration drawn from the ideas of contemporary biology would be received by the art community. To begin with, we used images of biological objects (obtained by various types of microscopes) to inspire artists active in the field of visual arts. The experience was a bit like taking artists out into the outdoors for the very first time in their lives!

Meetings between artists and scientists

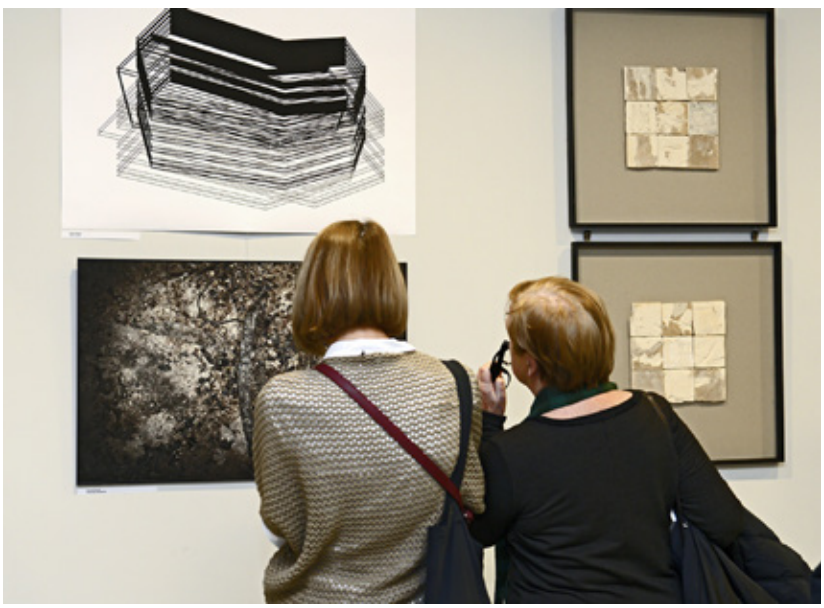
Art & Science events are held at the Nencki Institute of Experimental Biology in cooperation with the Marceli Nencki Foundation for Supporting Biological Sciences and the Institute of Fine Arts of the University of Rzeszów. The Faculty of Art of the University of Warmia and Mazury in Olsztyn was also involved in the first project. The Art & Science project was launched at the research station of the Nencki Institute of Experimental Biology in Mikołajki in September 2017. The topic of the meeting stemmed from the fact that one of methodological priorities of the Institute is biological imaging with the use of various microscopic techniques. After discussions with Prof. Marek A. Olszyński (then Deputy Dean of the Faculty of Art of the University of Rzeszów) about the possibility of holding meetings between artists and scientists, we proposed a title that allowed us to integrate the scientific activity of the Nencki Institute of Experimental Biology into joint activity with visual artists. This is how the project entitled "Biological Imaging: Inspiration by an Invisible World?" was born. The meeting kicked off a series of lectures showing various visual aspects of contemporary biology and the interaction between modern science and art. At the research station in Mikołajki, there are also biological laboratories were workshops with the use of microscopes were organized.

After the seminar, a week of creative work began at the station in Mikołajki, during which the artists created works using various art techniques on the basis of microscopic images of cell structures and aquatic microorganisms.

On 17 January 2018, in the hall of the Neurobiology Centre of the Nencki Institute of Experimental Biology, an exhibition vernissage took place, opening the cycle of exhibitions entitled Art & Science "Biological Imaging: Inspiration by an Invisible World?". The event marked the 100th anniversary of the Institute, proving that a modern scientific institution is a place for creative activities in the broad sense. A Polish-English catalogue of the event, designed by Mirosław Pawłowski (*Art & Science – Biological Imaging: Inspiration by an Invisible World*, ed. by A. Drońska, M.A. Olszyński, A. Szewczyk, P. Woroniec Jr., Olsztyn – Rzeszów – Warsaw 2018), was presented during the exhibitions.

Autumn 2018 was the launch of the the second edition of the Art & Science project – "The Art of Biodiversity." From 29 September to 5 October 2018, a scientific and artistic symposium on biodiversity in the modern world took place in Dylągówka near Rzeszów. Its effects were displayed at an exhibition that ran from 19 November to 19 December 2018 at the Nencki Institute of Experimental Biology. In January 2019, the exhibition was presented in Rzeszów. As previously, the idea resulted in a bilingual catalogue describing the works by the presented artists (*Art & Science – The Art of Biodiversity*, ed. by A. Szewczyk, H. Fabczak, M. Pawłowski, A. Iskra-Paczkowska, M.A. Olszyński, Warsaw – Rzeszów 2018).

From 28 April to 5 May 2019, the third Art & Science initiative – "The Power of Biological Structures" – took place in Przeworsk. Lectures were given by scientists from the Institute of Philosophy of the University of Rzeszów and the Nencki Institute of Experimental Biology, among other speakers. The sym-



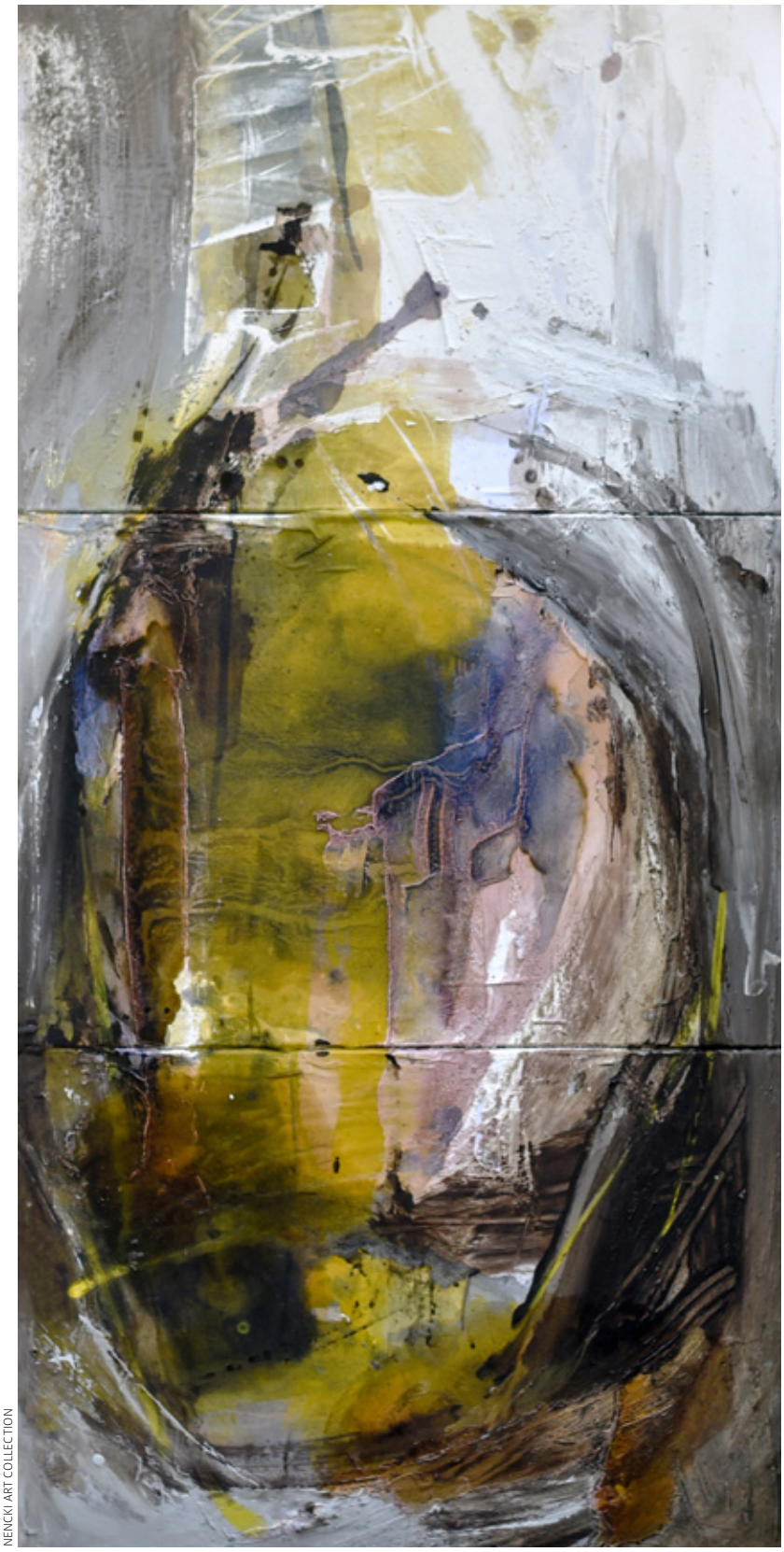
13 January 2020, Hall of the Neurobiology Center, Nencki Institute, vernissage of the Art & Science exhibition – "The Power of Biological Structures." Visible works from the left: Robert Rabiej, "Time Structure m2.1," 2019, digital print, 30×42 cm, Dominika Surmacz, "Reduction I and II," 2019, original technique, 70×70 cm, Krzysztof Pisarek, "Form in Decay," 2019, photography, pigment print, 61×91.5 cm

posium was accompanied by an exhibition of works created by its participants (students, graduates and teaching artists from Lublin, Szczecin and Rzeszów) displayed in the gallery Galeria Magistracka in Przeworsk. The aim of this meeting was to create artistic works inspired by biological structures at various levels of complexity: from cells to organelle structures observed through the use of microscopic techniques and molecular structures imaged with high-resolution tools (e.g. cryo-electron microscopes). Work on the project started with the invited authors working independently. The results were collected in a subsequent catalogue designed by Mirosław Pawłowski (*Art & Science – The Power of Biological Structures*, ed. by A. Szewczyk, H. Fabczak, M. Pawłowski, A. Iskra-Paczkowska, M.A. Olszyński, Rzeszów 2020). The series of exhibitions planned for autumn 2019 were aimed at the general public, in particular the scientific circles of the Ochota Campus in Warsaw (University of Warsaw, Warsaw Medical University, PAS institutes), as well as Lublin, Szczecin and Rzeszów.

The Art of the Origins of Life

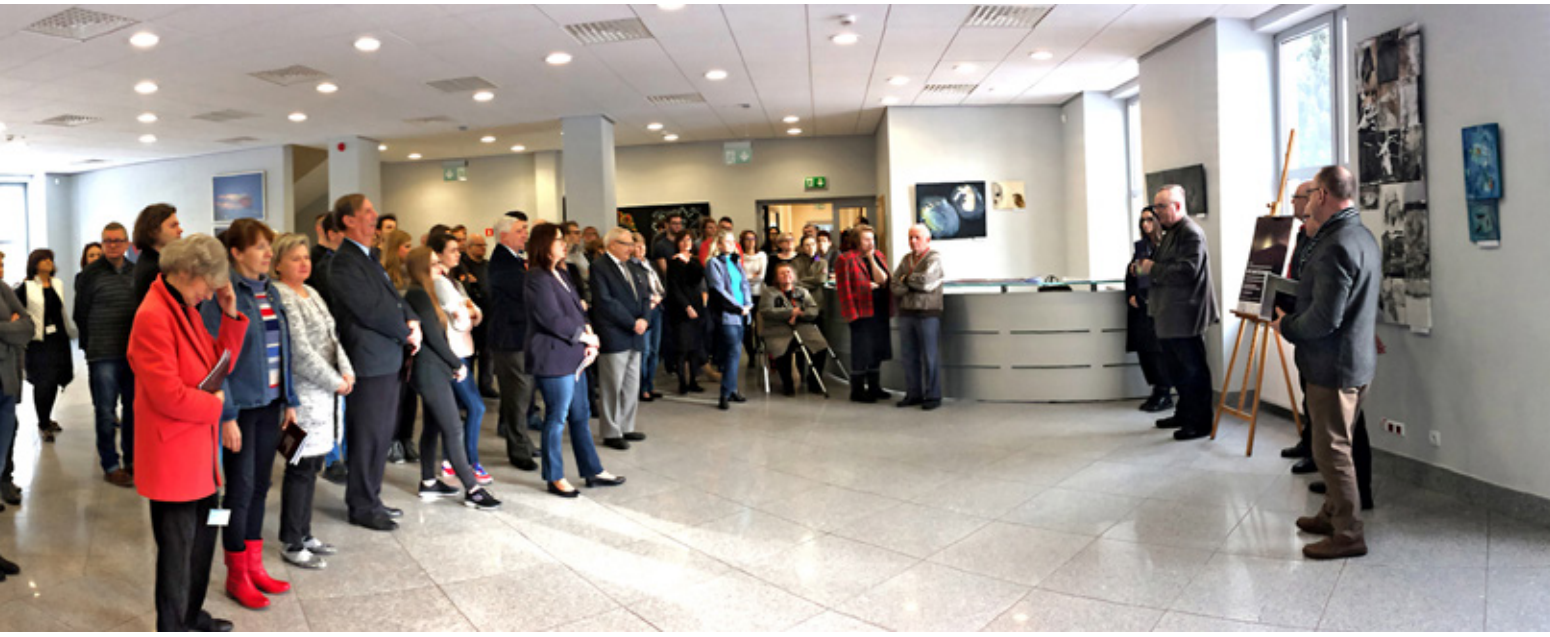
In early 2020, we were planning another, fourth Art & Science gathering, to be entitled "The Art of the Origins of Life." The choice of the project theme was inspired by recent events related to space exploration. The mysteries of the biological basis underpinning the origins of life seem to present unlimited visual challenges – and that goes for both molecular and macroscopic imagery.

Nevertheless, the outbreak of the COVID-19 pandemic in the spring of 2020 disrupted our organizational plans. It seemed that the most sensible solution would be to postpone the project for a year or two. After numerous discussions we decided, however, to follow through with our plans even so, making maximum use of online tools, while hoping for a quick return to normality. To facilitate communications among the several dozen artists taking part in the project, a Facebook group was created, which was ultimately followed by over 2000 people. The project was opened by a three-day scientific symposium, "The Art of the Origins of Life," held online on the Zoom Webinar platform. More than 300 people registered for the symposium, which was open to the public. Lectures on molecular evolution, the functioning of simple organisms and aspects of ontology were given by 12 molecular biologists and philosophers from various research centers from Poland and the United States. The lectures were made available on the open YouTube platform and over the next few months were viewed by nearly 1000 people. The exhibition catalogue was published in a classic book form, presenting the works created by the participating artists and the texts of lectures (*Art & Science – The Art of the Origins of Life*, ed. by A. Szewczyk, H. Fabczak, M. Pawłowski, A. Iskra-Paczkowska, M.A. Olszyński, A. Nikiel, M. Wnuk, Warsaw – Rzeszów 2020/2021). It featured over 50 works by artists from Polish art schools, including the Institute of Fine Arts of the University of Rzeszów, the Academy of Art in Szczecin, and by artists from Hungary and Slovakia. For



NENCKI ART COLLECTION

Kamila Bednarska, "26.0044," 2017, mixed technique, 190×80 cm



17 January 2018, Hall of the Neurobiology Center, Nencki Institute, vernissage of the Art & Science exhibition – "Biological imaging: Inspiration by Invisible World?"

the first time our meeting was attended by world-renowned poster artists representing many centers from around the world. Promotion of the catalogue was supported by a video in which the artists talked about their works inspired by the theme of the recent symposium, which was also published on YouTube. Thus, in spite of some initial organizational troubles, the online format has brought a whole new dimension to the Art & Science activities. The lectures were listened to by far more people than during previous editions, the reception of artists' works was also multiplied by their presence online. We discovered a simple way to avoid the hermetic character of meetings between artists and scientists!

Certain novelties of this project edition are also worth mentioning. For the first time, the fourth edition of Art & Science "The Art of the Origins of Life" had an international dimension, with artists from Asia, Europe and North and South America being invited to participate. The works created as part of this year's activities have already been presented in the real world: in May 2021, an exhibition was held in BWA Rzeszów, followed by several galleries in Jarosław, such as the Galeria Główna u Attavantich. Exhibitions are planned in Slovakia and Hungary, and the so-called accompanying exhibitions in France at the Wela Art Gallery, entitled "Art & Life," coordinated by Elżbieta 'Wela' Wierzbicka. The last exhibition, closing the promotion of the fourth edition of our symposium, is planned for December 2021 at the Nencki Institute of Experimental Biology in Warsaw.

During the project, a "Bio-Art" competition was held for students and graduates of the Institute of Fine Arts of the University of Rzeszów, associated in the Student Artistic and Scientific Circle "Together." Plenty of extremely interesting works were submitted. The exhibition of the prize-winning works by young artists was displayed simultaneously with the main exhibition in Rzeszów and Jarosław, and they will be featured in the Nencki Art Collection, in the select company of works donated by the participants of previous editions of meetings between scientists and artists.

Contemporary art as a global language of communication?

Art history demonstrates that original and timeless artistic achievements usually exhibit a creative experimentation that is in a way similar to scientific research. In every scientific field, conscious disturbance of the complacent feeling that all available avenues of inquiry have already been tried is a good vehicle for breaking open and exploring hitherto unknown areas. A similar process occurs during artistic creation. A vast majority of artists – with their innate sensitivity to various sensory stimuli – constantly question the styles and artistic strategies hallowed by critics and art historians and change the ways of their interpretation. In the case of artistic creation, the rejection of dogmas, along with intuition and the harnessing of so-called creative errors, are usually the best starting point for innovative discoveries of an original artistic form. Also, the very attempts to adapt a selected technique to the expression preferred by artists are a guarantee of a successful reception of a work.

Nowadays, however, in contemporary art, artworks often become too hermetic for viewers unfamiliar with particular artistic strategies and theories. As

a result, innovative forms of expression – especially in the field of visual arts – are frequently rejected by the audience. Visual art thus inherently involves an element of constant individual discovery, where the very process of searching and attempt at discovery are more important than the "final discovery" itself.

The standards of the process of communication between the artist and the viewer were aptly diagnosed by Umberto Eco. He stated that each modern artwork – as opposed to classical works – is "open" when it comes to its interpretation. Artists consciously leave it to the viewer to interpret their piece, so as to flesh out a more complete message. In this case, in cooperation with biologists and biochemists, whose general working strategy is more about actually crossing the finish line than about the thrill of pursuit, we can confront research methods and empirically check which of them is more effective in the globalized language of human communication.

What can scientists gain from interacting with contemporary art?

This question is often asked by people who observe our projects. In fact, a number of benefits for the scientist of meeting with artists as part of Art & Science projects might be pointed out.

Firstly, contemporary art can help us develop an ability to view reality critically, as a result of independent thinking. It can throw the scientist out of his state of "comfortable intellectual equilibrium." The artist is an ideal candidate to pose a question that no scientist would ask. The uniqueness of such a question comes from the fact that the artist observes, analyses and explains the surrounding world, using different intellectual tools. But can contemporary art actually force us scientists to change our established thinking patterns?

Secondly, the scientist is supported by the artist in the process of science communication – in practice, making people aware of the importance of scientific discoveries. It seems that art can be an effective medium for discovering the deeper meaning of scientific discoveries. In the future, we would like to explore the idea of using contemporary art as a tool for popularizing biological sciences. The idea is very inspiring and innovative. Contemporary science makes use of a highly hermetic language. The results of biological research, similarly to the description of scientists' activities, are difficult to communicate to the public. One of the main ways for scientists to project their own image and present their research results through imagery – the most representative, and currently most popular, form of conveying scientific information. Using images for this purpose requires a combination of text, graphics and, increasingly often, multimedia elements. Might we be able to harness here the language and technique of contemporary art, as an unconventional and effective means of communicating complex scientific content to the public?

Thirdly, recent psychological research indicates that interactions with art can enhance creativity (D. Welke, I. Purton, E.A. Vessel. Inspired by art: Higher aesthetic appeal elicits increased felt inspiration in a creative writing task, *Psychology of Aesthetics, Creativity, and the Arts*, advance online publication, 2021). It is likely that aesthetic experiences resulting from exposure to art are similar to the state of "creative inspiration" that precedes successful creative activity. If these observations are confirmed in future studies, this will be the most important reason why scientists should engage with and analyze contemporary art!

Conclusion: what next?

Some of the works from the successive meetings were donated by the artists to the Nencki Institute of Experimental Biology, giving rise to a contemporary collection now called the Nencki Art Collection. The Institute is thus the first biological unit of the Polish Academy of Sciences to boast its own contemporary art collection, which takes its inspiration directly from Art & Science projects. The collection is supervised by the Marceli Nencki Foundation for Supporting Biological Sciences.

> Curiosity, creativity and freedom create a space for collaboration between scientists and artists, making it possible.

Our practice makes us aware that the scientific and artistic worlds are frequently related and mutually inspiring. The experience of programs implemented by large scientific institutions, such as the US National Science Foundation, the European Organization for Nuclear Research (CERN), Wellcome, Weizmann Institute of Science and IRB Barcelona (Institute for Research in Biomedicine), which continually strive to foster broader dialogue between scientists and visionary artists, only strengthen our conviction that the Art & Science meetings are an initiative that truly deserves to be continued!

PHOTO BY **ANNA MIRGOS**