

## **Exploring the Unknown: Why Curiosity-Driven Research is Key to Europe's Innovation Future**

Opening Lecture at the University of Milan

*Paola Bovolenta, Direttrice del Centro de Biología Molecular Severo Ochoa (CBM), CSIC-UAM e Presidente eletta della Federazione delle Società Europee di Neuroscienze (FENS)*

Magnifica Rettore, Vice-rettore, Rettori, Pro-Rettori, Delegati Rettorali, distinguished guests, colleagues, students, and friends, I felt deeply honored to receive the invitation of Prof. Marina Brambilla and Monica di Luca to be here today to participate in the inauguration of the 2025 academic year at the Università Statale di Milano in this imposing historical venue. L'Università di Milano is at beginning its second century of life, perhaps a baby among Italian and European Universities, but a baby that can already take pride in having among its alumni renown mathematicians, physicists, astrophysicists, immunologists, neurobiologists and politicians. A University that is an integral part of this city with a vibrant intellectual and cultural energy. This is why I feel intimidated in being here for this important occasion for sharing with you some reflections of the fundamental role that Universities need to play not only in educating its scholars and the surrounding the societies but also in driving blue-sky, curiosity-driven and internationally connected research, which is at the basis of promoting technological and medical innovations.

These are all fundamental missions in our fast-evolving society full of contradictions and disparities that often receive with the same indifference the news of the death of thousands of children in different parts of the world or that of scientific discoveries that can save the life of thousands of other. This juxtaposition of tragedy and triumph reflects the complexity of the world we live in—a world where the capacity for both suffering and progress exists side by side. In such a landscape, the mission of universities and research institutions becomes even more vital.

Universities need to educate our future generations, provide role models for them but also, very critically, lead the way in addressing the profound contradictions of our societies and their increasing polarizations often based on profound misinformation. By fostering curiosity-driven research, we enable ourselves to look well ahead and set the ground to solve not only current problems but also those that now we do not even know that there will exist.

### **The value of curiosity-driven research**

It is through this lens that we need to value research for the sake of knowing, discovering and understanding, the kind of research that dares asking the most challenging questions, those that can lead to transformative changes, those that nowadays only a few funding agencies unfortunately dare to support.

The physicist Michael Faraday conducted experiments with electromagnetic fields in the 19<sup>th</sup> century, simply because he was curious about the relationship between electricity and magnetism, but his work has been the foundation for electric power generation, transforming the modern world. In a different field, closer to my expertise, the barely two pages-long study describing the structure of DNA in 1953 is the response to the curiosity of several researchers, besides James Watson and Francis Crick, on the molecular nature of the so-called molecule of life. Their work together with that of other Nobel prize winners, such as Arthur Kornberg and Severo Ochoa, has helped understanding how DNA and RNA are formed, revolutionize medicine or agriculture.

And I beg your pardon, if I selected a somewhat chauvinistic example, in mentioning Severo Ochoa, but this is my tribute to his effort in founding the Center of Molecular Biology in Madrid that that I have the privilege to direct as it celebrates its 50<sup>th</sup> anniversary toward the end of this year.

One example of the revolution I mentioned is the constant development of mRNA technology, which has been the key to obtain, in basically no time, effective vaccines against SARS-CoV-2 during the COVID-19. This breakthrough was made possible by decades of fundamental research into how cells produce proteins. Katalin Karikó and Drew Weissman won the Nobel Prize for their persistent work on RNA research and the generation of a vaccine that turned out to be life-saving for millions of individuals. However, Katalin Karikó has often declared that she was often told to “Give it up” and that “her ideas were not going to work”. Her grant proposals were constantly setback because her work was considered theoretical, until she found support through the European Research Council (ERC), one of the few founding agency that take pride in supporting curiosity driven research.

I had the privilege of serving on the Scientific Council of the ERC for six years in the very recent past, and I have seen firsthand the transformative power of excellent, curiosity-driven research. The ERC’s mission is simple yet profound: to support excellent researchers with bold ideas, irrespective of their discipline or nationality. By funding high-risk, high-reward projects, the ERC provides scientists with the freedom to pursue groundbreaking research. Over the years, ERC-funded projects have led to significant advances in fields as diverse as artificial intelligence, climate science, and biomedicine. Italy, and the University of Milan in particular, has been an active participant in the ERC’s initiatives. The achievements of Italian researchers in securing ERC grants highlight the immense talent and potential within this country. These successes are not just individual triumphs but a reflection of the collective strength of Europe’s research ecosystem. In other words, Katalin Karikó is not the only example of ERC founded researcher who could transform her findings into a powerful application. Indeed, a large amount of the proposals that the ERC identifies and supports are followed by “Proof of concept” grants, a support that the ERC itself provides to its grantees to pursue their results and lead into different kind on innovations.

Why blue-sky research so important? The answer lies in its unpredictability. Scientific discoveries often follow a non-linear path. In my own experience, I had never imagined that the work we were pursuing in our laboratory to understand how the cells of the retina are generated in an embryo would have led us to add a new molecular component to the difficult puzzle that understanding Alzheimer’s disease represent. Honestly, I do not know if our piece of the puzzle will help toward finding a treatment for this devastating disease, but I can tell you that this is one of our finding that I care the most and that make me I stand here today as a passionate advocate for the pursuit of knowledge for its own sake and for the preservation of academic freedom. These principles together with the fostering of international collaborations and the world-wide open access to publicly funded research should not be just aspirations but imperatives if Europe is to remain a global leader in innovation and scientific discovery. The so called “Draghi Report” on the “Future of European competitiveness”, that has been assembled by individuals much more knowledgeable than me, states that “the European Research Council has been crucial to the competitiveness of European science but many promising proposals remain unfunded owing to a lack of financial resources. The report recommends doubling the support for fundamental research through the ERC” and that “the EU should introduce an excellence-based, highly competitive “ERC for Institutions” program to provide the required resources for academic institutions..... to enable

public universities and research centers to design more competitive compensation policies for top talents and to provide additional support for research”. The same report advocates for a “stronger coordination *among institutions...* to develop world-leading research and technological infrastructures”.

### **The value of international collaboration**

I cannot but agree with this view. The challenges that we, as society, educators and researchers face, include climate change, pandemics, energy transitions, economic inequality, and the increase of an aged population, with its associated chronic pathologies and socio-economical cost. All these challenges transcend national boundaries. No single institution or country can address these issues alone. This is why international collaboration becomes not just valuable but critical. Collaborations bring together diverse perspectives, resources, and expertise, enabling researchers to tackle complex problems from multiple angles. The European Union’s research framework programs, including Horizon Europe, have provided instruments to foster such collaborations. To be critical, these instruments could be redesigned and improved but multinational consortia and interdisciplinary projects, need to exist to amplify the impact of research and ensure that knowledge flows freely across borders. This kind of collaboration not only advances science but also strengthens the bonds between nations, reminding us that we are part of a shared intellectual community. Beyond its practical benefits, international collaboration also fosters mutual understanding and trust. In an era marked by geopolitical tensions, science as well as art and music can serve as a bridge across different societies and countries, uniting people across cultures and fostering dialogue. By working together, we not only advance knowledge but also strengthen the bonds that hold us together as a global community.

The COVID-19 vaccines are again a striking example of how international collaboration can provide a rapid response to a devastating challenge. Scientists from around the world came together, shared data and resources, publishers abandoned (unfortunately for a “a too short period of time”) the paywalls behind which many scientific achievements still remain, to achieve what many thought it was impossible. I am afraid that we are perhaps progressively forgetting the power collaboration, sharing data and resources has given us as science and society. Knowledge should not be confined to a privileged few but should be a resource for all, allowing researchers, policymakers, and the public to benefit from the findings of academic work. It accelerates innovation by enabling others to build on existing research, fostering a culture of transparency and collaboration. I need to stress however, that making scientific discoveries openly available implies the responsibility of providing the tools and the education to understand their value and their limits. Too often I read or listen to misinterpretations of scientific discoveries, followed by false expectations. Here I do not want to pose any example but I am sure that anyone of you can think to one. The University of Milan has been a strong advocate for these principles, championing initiatives that promote transparency and inclusivity. As researchers, we have a responsibility to ensure that our work reaches beyond academic circles, contributing to societal progress and empowering the next generation of scientists.

### **Looking ahead**

As we look ahead, it is clear to me that curiosity-driven research and academic freedom must remain a priority. But academic freedom is not just a privilege; it is a responsibility. It requires universities and funding agencies to create environments in which scholars can make their

curiosity flourish. It also requires public trust—trust that the investments made in research will yield benefits, even if those benefits take years or decades to materialize.

As a community, we must advocate for policies that protect and promote this freedom. We must also work to communicate the value of curiosity-driven research to the public, ensuring that the society understand how and why even small and apparently unrelated achievements can lead to benefits. This requires sustained investment from governments, academic institutions, and the private sector. Funding agencies must continue to support high-risk, high-reward projects, recognizing that the most transformative discoveries often come from the most unexpected places.

It is equally important to cultivate a culture that values curiosity and creativity. This begins with education. Education should not be just teaching facts, education needs to spark curiosity, and lead students to wonder about the “why” and “how” of facts. That spark has been a constant in my career, from my early days as a student in Florence, staring through a microscope for the first time, to now, leading research that spans developmental biology, neurodegeneration, and rare diseases. It’s that curiosity that pushes us to ask better questions and to look for connections where others see none. We must inspire students to ask questions, to embrace uncertainty, and to see failure not as a setback but as a stepping stone to discovery. Universities play a critical role in fostering this mindset, providing students with the tools and opportunities to explore their passions.

In times of economic and political uncertainty, there is often pressure to prioritize short-term outcomes over long-term investments in fundamental research. Yet there are plenty of examples of the contrary. history shows us that this is a false dichotomy. The breakthroughs of tomorrow depend on the curiosity we nurture today. By investing in curiosity-driven research, we are investing in a future defined not by limits but by possibilities.

In closing let me mention Max Perutz, a Chemistry and Nobel Prize winner. Max Perutz stated that "Creativity in science cannot be organized. It arises spontaneously from individual talent. Well run laboratories can foster it, but hierarchical organisations, inflexible bureaucratic rules and mountains of futile paperwork can kill it. Discoveries cannot be planned. I cannot but agree more

Thank you, and I wish you all a successful 2025 academic year