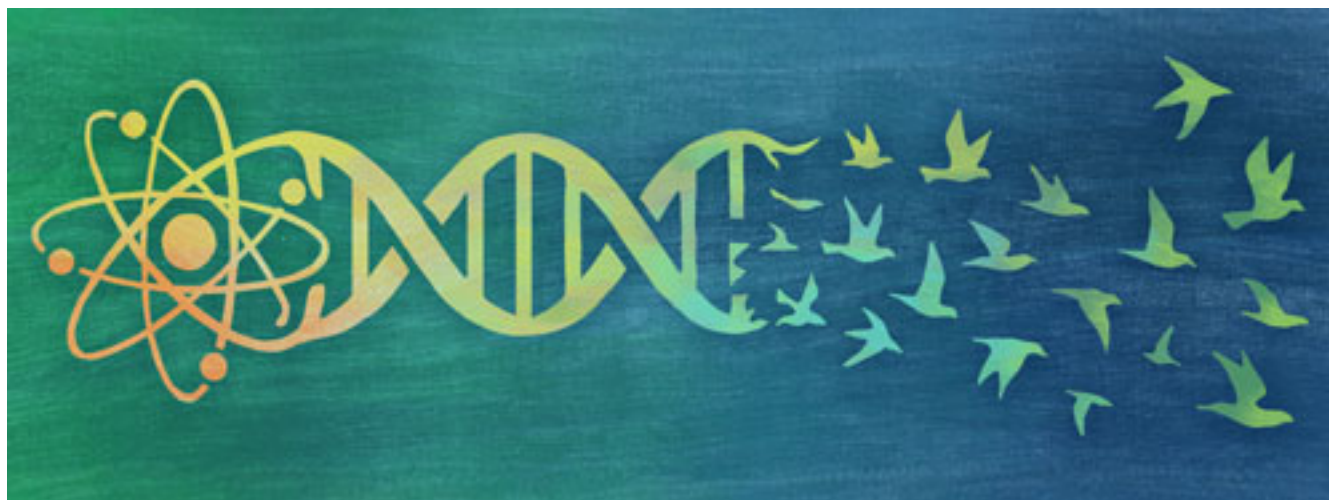# The Future of Science in a Changing World

2026 Plenary Session

The Pontifical Academy of Sciences (PAS) stands as a unique institution that bridges scientific inquiry and moral reflection, faith and reason, empirical knowledge and philosophical understanding. The Academy's 2026 Biannual Plenary Conference, to be held under the theme **"The Future of Science in a Changing World,"** seeks to renew and deepen this mission at a time when humanity faces both extraordinary scientific opportunity and profound risks and uncertainty.

The title acknowledges the transformative power of scientific discovery, while recognizing that the future of science is not determined solely by technological capability, but also by the values, contexts, and ethical orientations that shape its trajectory. This theme is intentionally **broad and inclusive**, encompassing a full spectrum of scientific disciplines—from mathematics and physics to biology, medicine, and the earth sciences—and inviting interdisciplinary dialogue.

By explicitly engaging with **risks and uncertainty**—methodological, epistemological, and moral—the conference seeks to illuminate how science navigates the unknown and how humility, openness, and dialogue can guide scientific progress in turbulent times. The theme is an invitation to ask foundational questions:

- What kind of future does science envision and make possible?
- How does science respond to the world's changing moral, social, and environmental realities?
- How can scientific communities sustain hope, integrity, and trust in an age of complexity and doubt?

While Science has enabled unprecedented human advancement—eradicating diseases, extending lifespans, connecting societies, and revealing the universe's deepest mysteries—it also faces unprecedented scrutiny. Disinformation, ideological polarization, and technological disruption have eroded public trust in expert knowledge. The Plenary's theme, therefore, carries a dual purpose: to **assess the future trajectory of science** and to **renew its moral and societal foundations**. In doing so, we note that faith can offer ethical orientation, purpose, and humility; science offers method, discovery, and evidence. Their dialogue enriches both domains and fosters a vision of science that serves humanity rather than dominates it.

The Plenary Conference will unfold in **three main parts**:

Part I – Opening Session: Science and the Future

The opening session will frame the central question: *How does science think about the future?* It will explore how scientific disciplines use forecasting, modeling, and anticipation—not only to predict outcomes but also to inspire hope and guide responsible action. Discussions will address the **philosophy of anticipation**, the ethics of prediction, and the psychology of hope in scientific innovation. This session may include reflecting on the meaning of "the future" and the interplay between scientific foresight and expectation. Possible focal points include: The future as a domain of ethical responsibility; Anticipation and imagination in scientific creativity; Hope and humility as guiding virtues for the scientific enterprise

Part II – Disciplinary Sessions: Futures Within the Sciences Domains

In this central set of sessions, each scientific domain will be explored in terms of its emerging frontiers, epistemological challenges, and societal implications. Sessions will be organized by major disciplinary clusters, each led by keynote addresses and followed by specialist presentations, commentaries and discussions. However, already during these disciplinary sessions the opportunities for problem solving interdisciplinary research shall be considered.

1. Future of Mathematics, Artificial Intelligence, and Computing

This session will examine how **computation, algorithms, and data-driven technologies** are reshaping the foundations of knowledge. Artificial Intelligence (AI) challenges traditional understandings of reasoning, creativity, and human uniqueness. Mathematical modeling remains essential but now operates within hybrid systems of human and machine learning. Key questions include: How can AI contribute to discovery while respecting human agency and ethics? What is the role of mathematics in a world increasingly defined by data? How might engineering, a discipline often underrepresented in PAS dialogues, be re-integrated as a bridge between scientific insight and social application? This session will also reflect on education and digital transformation.

2. Future of Physics

The physics session will explore both the **continuity and evolution** of the discipline—from classical mechanics and thermodynamics to quantum physics and high-energy particle research. It will reflect on how physics continually redefines the human understanding of matter, energy, and the cosmos. Subtopics may include: Advances in quantum information and their implications for computation and communication; The intersection of condensed matter physics and materials science for sustainable technologies; The role of large-scale collaborations and shared infrastructures (e.g., CERN) as models for global scientific cooperation.

3. Future of Astronomy

Astronomy exemplifies the **global and collaborative nature** of modern science. Progress in this field is driven by collective access to large observational infrastructures—telescopes, satellites, and data archives—whose results are shared openly. This session may highlight: How open-access astronomical data foster inclusivity and democratization of science; The role of space-based observation in Earth and planetary sciences; The philosophical and theological resonance of cosmic discovery: our place in an expanding universe and the possibility for life outside our Solar system.

4. Future of Chemistry

Chemistry remains a cornerstone discipline linking the physical and life sciences. This session will consider how new techniques in **materials chemistry, catalysis, and molecular design** can advance sustainability and address global challenges. Topics might include: Green chemistry and the circular economy; Synthetic biology and molecular innovation; Chemical sciences in medicine and energy transformation.

5. Future of Life Sciences I: Biological and Agricultural Sciences

This session will address the **future of life and living systems**, from molecular biology to ecology. Possible focus areas: Genetic and genomic revolutions; Advances in plant science, agronomy, and food security under climate change; Systems biology and the integration of life sciences with digital technologies. We also encourage speakers to address the rapidly expanding field of epigenetics as complementary mechanism to adapt organisms to the environment. Another field with complex perspectives but also considerable ethical implications is Artificial Life. Both, the life sciences and the computational sciences are active in this field. The former attempting to obtain replicating macromolecules and then mimic evolution, the latter experimenting with self-organizing algorithms.

6. Future of Life Sciences II: Medicine and Neuroscience

This session will emphasize **non-communicable diseases**, such as neurodegenerative and cognitive disorders, alongside innovations in diagnostics and AI-driven medicine. Themes may include: AI in diagnosis and treatment; Neurobiology and the understanding of consciousness and cognition; Translational medicine and equitable access to innovation; Shifting from a reactive to a preventive model of healthcare; Chronic and age-related conditions. We shall consider here the **attempts to expand the life span** of organisms, which have numerous ethical and societal consequences and since there is a chance that some of them will work, we should discuss design and consequences of this field of research. Influences on **mental health,** including genetic and environmental factors (psychological traumata, education, social embedding etc.) shall be addressed. Moreover, neurobiology and AI linkages shall be considered. All these and **Brain Computer interfaces** (BMI) to replace lost functions and to enhance cognitive functions presents a host of ethical challenges for PAS.

7. Future of Earth Sciences

Earth Sciences hold a unique position at the intersection of **data, environment, and ethics**. Much of the field's current progress stems from **space-based observations** and global open-data networks. Themes include: The integration of geosphere, hydrosphere, atmosphere, and biosphere in climate models; The role of Earth observation in water management and land use systems; science of climate adaptation.

Part III – Cross-Cutting Issues and a Reflective Session on Science Futures

Beyond disciplinary boundaries, the Plenary will convene an integrative session that connects science with philosophy, society, and moral reasoning.

1. Interdisciplinary Science and Great Human Challenges

The session will address how scientific inquiry contributes to confronting humanity's greatest challenges: climate change, poverty, conflict, and inequality with an integrated perspective on how science can offer solutions.

2. Epistemology and History of Science

The session may revisit the **philosophical and historical roots** of scientific inquiry, exploring how concepts such as objectivity, evidence, and rationality have evolved. Possible elements are Historical reflections on key scientific milestones; Renewing epistemological reflection as a path toward unity of knowledge.

3. Trust in Science

In an age of **misinformation and public skepticism, the crisis of trust** in science has become a pressing issue. This session will explore causes and remedies—examining how communication, education, and transparency can rebuild credibility. It may revisit the Academy's Statement of Concern from June 2025. Questions may include: How can science better communicate uncertainty without undermining authority? What institutional mechanisms promote integrity and accountability? How can the Academy foster dialogue between scientists, policymakers, and the public? What are responsibilities of individuals and those of national or global health systems for instance related to obligatory vaccination and screening, control of foods, etc.?

Outcome: The 2026 Plenary Conference aims at **a statement with a set of recommendations** to help guide the global science community and the Pontifical Academy's future work and inform the Holy Father's reflections on the ethical implications of scientific progress. This may include a **renewed emphasis on science for the common good**, reinforcing the Academy's commitment to advancement of sciences for peace, human dignity, and ecological stewardship.