EXPOSOME MOONSHOT FORUM

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Global bottom-up initiative takes off to map 80% of chronic disease: All health stakeholders herald a new era in diagnosis, prevention & treatment

Washington, D.C., June 2025: In a defining moment for global public health and the fight against chronic disease, more than 350 leading scientists, policy makers, ethicists, journalists and civil society representatives from over 50 countries and 150 major organizations gathered at the inaugural ***Human Exposome Moonshot Forum***[1]. What is expected by participants to be seen, in-time, as a historic event, this Washington, D.C. gathering marks the formal launch of a bold and globally coordinated, bottom-up initiative to map the physical, chemical, biological and psychosocial exposures that people experience during their lifetime. Known as the "exposome" experts agree that these influences account for over 80% of chronic disease today. As Professor Thomas Hartung of Johns Hopkins University, Member of the Organizing Committee and the Forum's Host stated: *"We are not promising a rocket launch to a ready destination. We are building the launchpad. The exposome is not the rocket, it is the moon. Each new data point, each discovery, is a step towards that distant but vital world where prevention replaces reaction and science empowers health."*

Why the Exposome, Why Now?

Completed in 2003, the ***Human Genome Project*** (HGP) was an international scientific research initiative that successfully mapped and sequenced all the genes in the human genome. At a cost of $3 billion, the HGP paved the way for unparallelled advances in medicine and biotechnology. According to a Batelle study, by 2010, mapping the genome had already created an economic impact of $965 billion, personal income exceeding $293 billion and 4.3 million job-years of employment, and counting. Advocates of the ***Human Exposome Project*** (HEP), anticipate similar economic benefit. Their main argument is that genes are responsible for only 3-5% of disease, our exposures are responsible for upwards of 80%. Chronic diseases including diabetes, cardiovascular disease, respiratory conditions, and neurodevelopmental disorders stem from environmental, occupational and lifestyle factors rather than genetic inheritance alone.

Professor Gary Miller of Columbia University, one of the pioneers of exposome research and an Organizing Committee Member stated that: "*The genome gave us one piece of the puzzle. The exposome completes the picture. It marks an unprecedented step-change in how the world views understanding what can harm us and fighting disease."*

Prof. Miller also highlighted a recent landmark paper in the journal *Science* outlining how exposomics must be integrated into the biomedical research enterprise. "*Life exists at the interface of our genetically encoded processes and our environmentally driven realities,*" the article states, "*so too should the research that seeks to understand it.*"[2] He added that: "*We aim to match the Human Genome Project in its scope and ambition. We can develop while running and benefit from interim profits. The convergence of advanced*

[1] https://exposomemoonshot.org

[2] https://www.science.org/doi/10.1126/science.adr0544

technologies from Artificial Intelligence and advanced sensors, to metabolomics and big data analytics, makes this the perfect moment for action."

From Moonshots to Market: Innovation and Investment

The exposome initiative is not only about public health, it is also an innovation driver as well as an economic engine. From environmental diagnostics to personalized exposure profiling, the tools being developed are already generating a wave of start-ups, new therapeutics and digital health applications. For example, A.I.-driven analytics, geospatial mapping, environmental sensoring and high-throughput mass spectrometry are just some examples of the exposome project's technological foundations. A common theme throughout the three-day forum was an urgent call for venture capital, philanthropic engagement and partnerships with tech firms and insurance companies to quickly scale-up implementation.

The ***National Institutes of Health*** (NIH) is an active backer of the initiative, placing representatives of multiple institutes on the Organizing Committee, including its *Office of Strategic Initiatives*.

Acting NIH Deputy Director Nicole Kleinstreuer, Member of the Organizing Committee, announced a novel initiative during the Forum: "*NIH is developing a **Real-World Data Platform**, a bold and transformative infrastructure that will link clinical, genomic, behavioral, and environmental data at scale. Integrating the exposome into the Real-World Data Platform is not just a technical challenge, it's a scientific imperative.*"

Answering this call, this exposome announcement is timed to integrate and compliment ongoing research projects worldwide. From a recent *Department of Defense* report calling for the US to be more exposome-driven, *Cancer Moonshot* initiatives, the *EU's Green Deal*, *One Health*, *Toxic Free Europe* or heightened scientific journal interest, it is clear that research efforts, funding and policy-making are all pointing in the same direction: we need to urgently map the human exposome.

Positive effects are already in-play. The D.C. forum itself has been a catalyst for unprecedented cooperation between exposomics researchers. For example, the *Network for Exposomics in the United States* (NEXUS), *The International Human Exposome Network* (IHEN) and the pan-European Research Infrastructure (*EnvIRonmental Exposure assessmeNt in Europe*, EIRENE), are joining forces and reaching out to others to get a solid framework started.

The Washington Declaration & Emerging Roadmap

The Forum culminated in the unveiling of the ***Washington Declaration***[3], a shared global commitment to advancing exposomics as a scientific discipline, policy priority, and public health imperative. Spearheaded by *Johns Hopkins Bloomberg School of Public Health* in partnership with major academic centers and projects in Africa, Asia, Europe, Latin America and the U.S., the initiative seeks to position exposome

[3] https://exposomemoonshot.org/washington-d-c-declaration-on-the-human-exposome/

science on par with genomics in its capacity to transform biomedical research, public health and healthcare delivery. Its common message is a call for the reassessment of science to enable real transformative change. Acknowledging difficulties in the current international cooperation landscape, the *Declaration* sets out why joint action is all the more necessary today and cannot be held captive by independent and shifting funding cycles.

Critically though, the organizers of the Forum and the Declaration that followed are committed to public participation, input, and interest. For this reason, the same Declaration signed by leaders in biotechnical innovation, AI experts, and NIH directors is being shared with the broader public for signing and support. For members of the public who would like to sign on to this call to catalogue the exposome and dramatically improve public health, the organizers of the initiative encourage them to visit exposomemoonshot.org and click "Sign the Declaration". Signatories will not only be supporting the future of this transformational public health and biomedical effort but will also have the opportunity to seek out greater involvement by being added to a growing community of supporters receive regular updates and news of new opportunities related to the Exposome Forum.

To reiterate this need for change, the *Forum's Welcome Address* was given by **Sir Peter Gluckman,** former ***Chief Science Adviser*** **to the Prime Minister of New Zealand** and current ***President of the International Science Council (ISC)***.

Sir Peter stressed his personal conviction that this Moonshot is a must-do for science, for policy and for society: "*As a scientist who spent most of my professional career studying how the environment influences early human development, both in the fetal and neonatal period, for long-term outcomes on metabolism, body composition and brain development, for the last 30 years, we have focused much of our attention on the genotype and not sufficiently on those environmental and developmental factors that ultimately determine how we will live our lives."*

Sir Peter added that: "*The epigenetic tools, the metabolomic tools, the AI and computational tools are at our fingertips. This Moonshot is a once in a lifetime opportunity to bring together the technologies, computation, ethics and public values to power a truly comprehensive, unifying and bottom-up endeavor. I am confident that there are enough street-smart scientists, clinicians, technologists and organisations in our world to roll up their sleeves to help us understand how we have changed the environment we live in and what that is doing to our lives and to the lives of our children and their children."*

Key Outcomes, Endorsements & Activities Ahead

The Forum deliberately avoided the format of a traditional symposium, opting instead for a dynamic, participatory workshop structure. This allowed attendees to shape the initiative's scientific, policy, and funding roadmap in real time. Examples of concrete outcomes include:

- **Living Labs & Citizen Science:** reaffirming the centrality of citizen engagement. Participants explored living labs, co-designed monitoring networks and mobile coaching tools to bring exposome awareness into everyday life.

  Professor Denis Sarigiannis, President of the *National Hellenic Research Foundation* (Greece) & ***Member of the Organizing Committee*** stated that: *"Exposome science cannot be done without the people … They know their own environments better than we do.*"

  Sir Jeremy Farrar, Chief Scientist & Deputy Director-General, *World Health Organization* stated that: *"If it's a real moonshot … it's about inspiring people, lifting their eyes beyond today's news and saying the world can be better … that's what is behind this project."*

- **Global Research Infrastructure:** The *European Exposome Infrastructure* known as EIRENE is recognized as a major player in the field and is fully on-board with the Human Exposome Project's Moonshot Launch. Backed by 17 EU governments and initiated under the European Strategy Forum on Research Infrastructures (ESFRI), it is projected to receive over €1 billion in combined national and EU-level investments with about €250 million already spent on exposome research.
- **Embedded Ethics & Governance**: Lessons learned from critiques of previous large-scale genomics efforts were front and center throughout the meeting. Going forward, participants argued and agreed that all exposome research must be anticipatory, inclusive, transparent and reflexive. The goals of exposome research from its standards and its tools, to how it studies humans and the consequences of its products, will fully embrace "ethical parallel research."[4]
- **Open Science & FAIR Data**[5]: This emerging global collective commits to making all its tools, data and findings openly available in accordance with FAIR principles: Findable, Accessible, Interoperable, and Reusable. For example, the newly launched *European Exposome Map*[6] part of the FAIR program of IHEN, offering sub-100-meter environmental exposure data across the EU from 2000 to 2020, is already online as a proof of principle.
- **Multi-Omic & AI Integration**: Mass spectrometry, geospatial imaging and wearable biosensors will be integrated with transcriptomic, proteomic and metabolomic data. These high-resolution datasets will be fused using machine learning models to uncover previously invisible links between exposures and health outcomes.

In the U.S. the *Network for Exposomics in the U.S.* (NEXUS) will help coordinate NIH efforts. In Europe, political backing for the ***International Human Exposome Network*** (IHEN) and EIRENE is already enshrined in the intergovernmental agreements of more than a dozen countries.

[4] https://pubmed.ncbi.nlm.nih.gov/37745046/
[5] https://www.go-fair.org/fair-principles/
[6] https://www.humanexposome.eu/2022/09/14/exposome-maps/

During the Forum, a number of governments pledged both institutional support and discussions towards co-investment. For example, South Africa was the first to nominate a ***National Exposome Contact Person*** and to invite the Exposome Moonshot Forum Community to host a follow-up meeting during the 10th edition of ***Science Forum South Africa*** (SFSA) to be held in Pretoria in late November, 2025[7].

Prof. Rémi Quirion, ***Chief Scientist of Quebec*** and current ***President of the International Network for Governmental Science Advice*** (INGSA), organized the high-level exposome policy panel alongside the WHO, UNESCO and the African Academy of Sciences. He stated that: "*... the Moonshot Human Exposome Project, it's huge… we're willing to help … a very stimulating program … it will change the way we do business in the future*."

Post-forum Prof. Quirion volunteered to be the ***National Exposome Contact Person*** **for Quebec and Canada**. Similarly, **Denis Naughten,** former ***Government of Ireland Minister*** & former ***Chair of the Inter-Parliamentary Union's Working Group on Science & Technology*** volunteered to act as a roaming ambassador for the *Human Exposome Project*.

Further endorsements included **Dr Ana Persic (UNESCO)** who stated that: "*It really is an exciting meeting, because the possible impact and implications of a project like that really are global … The message that needs to come from this project is that it will help solve some of the biggest health issues that the populations across the world are facing today"* and **Prof. Peggy Oti-Boateng (President, African Academy of Sciences)** who asked for inclusion: "*The African Academy of Sciences … is open to this new dynamic … open arms. We want to collaborate.*"

Numerous congratulations and firm requests to be involved have been received from a broad array of public health activists, international institutions and private individuals[8]. These include past and present elected officials and ministers, science advisers, diplomats, ethical lawyers & professors, and the talking-heads of major science-led public institutions such as the *International Science Council,* the *Global Commission on Drug Policy* and various science journalist associations. These statements capture unanimous, high-level backing and stress the need to act now and to get this right for science and for global health .

Fenna Sillé, Assistant Professor at Johns Hopkins and Principal Organizer of the Forum, underscored the unprecedented global reach of the initiative. Delegates came from six continents, including robust participation from the 'Global South'. She stated that: "*The Exposome Moonshot is not a Western project. It is an intercontinental project that demands intercontinental participation.*"

As ***Daan du Toit, Deputy Director General, Government of South African*** put it: "*Understanding and fighting chronic disease is in everyone's interest, whether you live in Pretoria or Philadelphia.*"

[7] www.sfsa.co.za

[8] https://exposomemoonshot.org/endorsements/

Theresa Scavenius, Member of the Danish Parliament stated: "*We need a unified and integrated approach, which includes regulatory science and political mobilization … I believe the Human Exposome Project will extend and further accelerate an integrated understanding of human health and environment."*

Professor Roel Vermeulen of Utrecht University, The Netherlands, Member of the Organizing Committee & Coordinator of the EU initiated ***International Human Exposome Network*** (IHEN) authored a recent report on the future of Exposome research for the ***European Parliament***[9]. He stated that: *"What makes exposomics urgent and distinctive is its discovery-based approach. Rather than starting with one specific hypothesis, researchers use new tools and big data to generate new hypotheses and uncover hidden connections between our environment and health - patterns we might not even think to look for … Such a shift is not only necessary to reduce the growing burden on healthcare systems, but also vital for building a healthier, more economically resilient and socially competitive populations."*

The Critical Role of Science Journalism & Public Engagement

Perhaps the overriding, take-home message of the Moonshot Launch was that unless you get the public on-board early, you fail. How to engage the citizen on the ground, also to influence their elected officials, was a constant theme throughout the conference. From the Opening Keynote to the Closing Ceremony, many speakers, delegates and online participants argued that Public Engagement ought to be the number one pillar of the Exposome Roadmap.

Similarly, during a technical briefing given to science reporters, questions were raised about ethical oversight, public understanding and equitable access to the results of the human exposome mapping exercise. As stakeholders themselves, media fed-in as advice that lessons must be learnt from failures to properly communicate GMO's, vaccines, Stem Cell research etc.

In response, the organizers pledged to move early to help train science reporters on the ins and outs of exposomic science. The Conference Director of the ***World Conference of Science Journalists Dec. 2025, Pretoria***[10] has since invited them to take part in their conference. In parallel, both parties are exploring ways and means to potentially fund media grants and are committed to promoting exposome research as a journalistic field in its own right.

What Comes Next?

Organizers are now synthesizing the dozens of breakout reports, roundtable notes and public comments submitted throughout the event into actionable roadmaps to reflect regional priorities, local capacities and disease burdens. For example, tailored implementation plans will need to be developed for urban vs. rural environments, low-income vs. high-income countries, and different demographic groups. This effort will build on and align with existing in-country and regional activities, while aiming to bring a true global dimension. The ***Johns Hopkins Center for Alternatives to Animal Testing*** is playing a key role in

[9] https://www.europarl.europa.eu/stoa/en/document/EPRS_STU(2025)765791
[10] https://www.wcsj2025.org

supporting and facilitating this coordination, alongside contributions from other international partners. Together, they call on all interested parties, public and private, to sign the ***Washington Declaration***, join the community and build a true movement. Follow-up meetings are already planned in Brazil, Chile, Czech Republic, Japan & South Africa in 2025. A second Moonshot Forum will be hosted by IHEN and EIRENE in Barcelona, Spain in 2026.

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