

A Time of Change: Updates Since the First VHGS

Virtual Human Global Summit II
October 23-24, 2025
Barcelona and New York City

Eric Stahlberg, PhD
Executive Administrative Director
MD Anderson Cancer Center
Institute for Data Science in Oncology
eastahlberg@mdanderson.org



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- Forward looking statements are not commitments.

Conflicts of Interest:
Nothing to declare



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'A Life Like No Other:' Remembering Beloved ISB Professor Ilya Shmulevich

People

Thorsson-Shmulevich Lab

Devoted husband and father. Animal lover. Accomplished pianist. Avid cyclist. Compassionate human. Exceptional scientist. The ISB community mourns the loss of Professor Ilya Shmulevich, PhD, who died on April 13, 2024. He was 54 years old.

June 5, 2024

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Dr. Ilya Shmulevich in front of his office door at ISB in November 2023. (Scott Eklund/Red Box Pictures)



Uniting Global Perspectives Around Medical Digital Twins and Virtual Human Models



Research
Infrastructure
Industry
Clinical Translation
Community Health
Government
Global Collaboration



First Virtual Human Global Summit – October 3-4, 2023



VHGS I : Organizational Representation



Challenges Facing Medical Digital Twins (2023)

- **Social and Societal Challenges**

- ◇ Achieving cross-stakeholder buy-in starting with education
- ◇ Cultural and social changes needed
- ◇ Setting accurate expectations of use of medical digital twins

- **Technical Challenges**

- ◇ Establishing baseline healthy state for each individual
- ◇ Quality data
- ◇ Affordable and accessible computational implementations
- ◇ Methodologies for trust

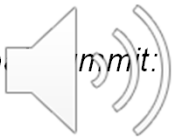
- **Financial Challenges**

- ◇ Cost of first implementations
- ◇ Reimbursement pathways

- **Regulatory, privacy, and liability concerns**



Source: The First Virtual Human Global
Prepublication Meeting Report,
<https://www.osti.gov/biblio/2428904>





Medical Digital Twins: Looking Ahead (2023)

- ❑ **Focus on personal health and wellness, not just treatment**
- ❑ **Organize the global community**
- ❑ **Engagement and communication**
 - ❑ Communicate across stakeholders and expand participation
 - ❑ Engage with patients and patient advocacy groups
 - ❑ Build awareness of benefits
 - ❑ Identify problems to be addressed in the clinic
 - ❑ Develop training opportunities for stakeholders
 - ❑ Build trust in technologies
- ❑ **Technical foundations**
 - ❑ Create framework to develop individual patient health baselines
 - ❑ Provide structure for mechanistic models, AI models, and data to move ahead together
 - ❑ Identify approaches for sustainable and equitable access to data

Source: *The First Virtual Human Global Summit: Prepublication Meeting Report*, <https://www.osti.gov/biblio/2428904>



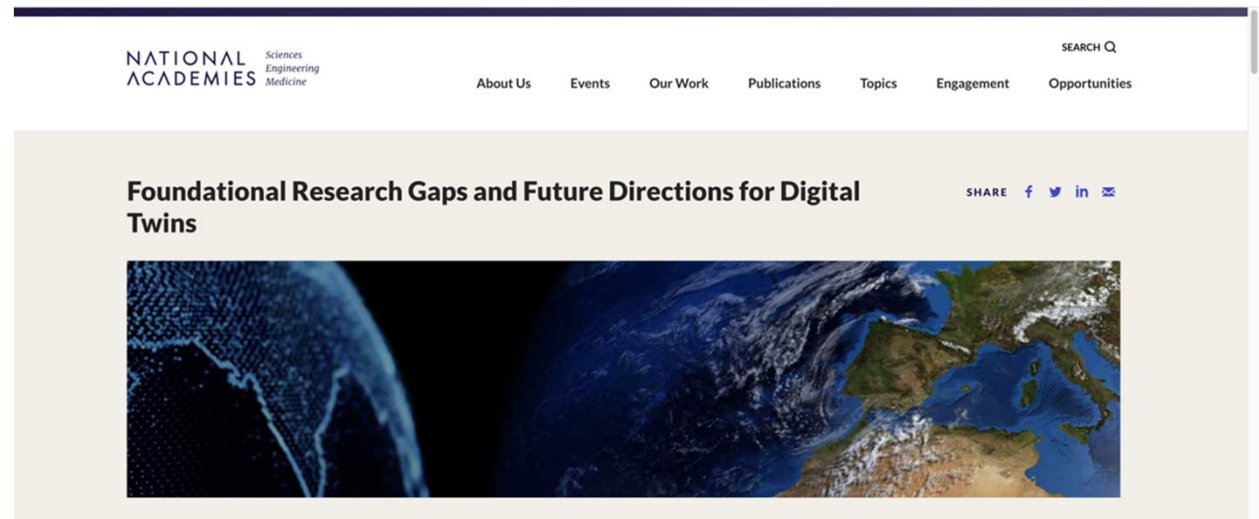
Six Key Developments

- **Data and Compute Infrastructure**
- **Artificial Intelligence**
- **Model-based Treatment Development**
- **Personal Health/Wellness Monitoring**
- **Digital Twin Approaches**
- **Whole Patient Approaches**



National Academies of Science, Engineering and Medicine: 2023 Report on Digital Twins

- US National Academies of Science, Engineering and Medicine Report released December 2023
- Emphasized Research Gaps and Future Directions



Download:

<https://www.nationalacademies.org/our-work/foundational-research-gaps-and-future-directions-for-digital-twins>

“A digital twin is a set of virtual information constructs that mimics the structure, context, and behavior of a natural, engineered, or social system (or system-of-systems), is dynamically updated with data from its physical twin, has a predictive capability, and informs decisions that realize value. The bidirectional interaction between the virtual and the physical is central to the digital twin.”



Frederick National Laboratory for Cancer Research

Cancer Patient Digital Twins

- Digital twin brings predictive analytics to the forefront
- Explore possible treatments
- Pursue and refine hypotheses
- Explore conditions and scenarios
- Progressively iterate and integrate understanding and insights

REAL WORLD PATIENT

The patient and the tumor from which data is gathered using various clinical assessments to inform the digital twin.

VVUQ →
Verification, validation, and uncertainty quantification
As the patient and tumor are constantly evolving and the data collection can also change over time, VVUQ must occur continually for digital twins.
Uncertainty quantification needs to be addressed for all aspects of the digital twin, including the patient's data, modeling and simulation, and decision making.

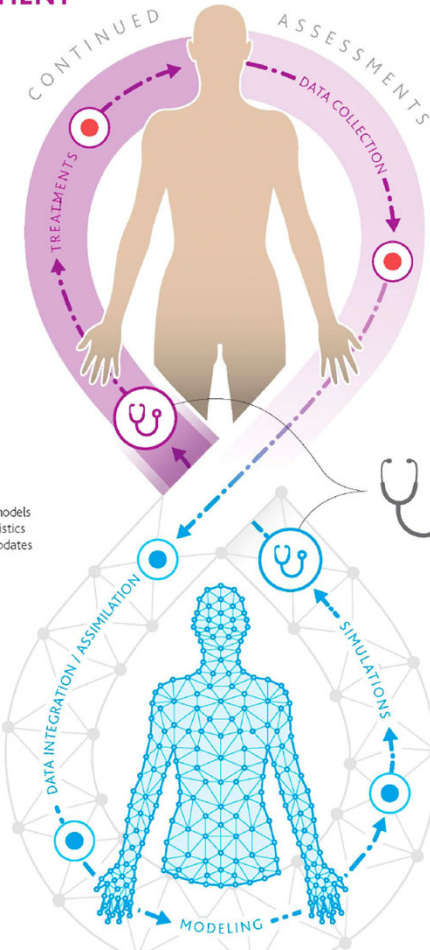
DIGITAL TWIN

The virtual representation comprised of models describing temporal and spatial characteristics of the patient and tumor with dynamic updates using data from the real world patient.



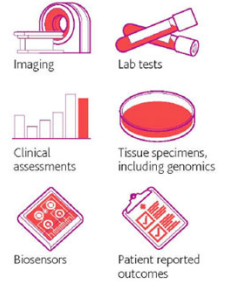
Modeling

Models spanning a range of fidelities and resolutions may be utilized and potentially integrated together.
As new observed data are acquired, the data are assimilated and the models are calibrated, updated, and estimated.



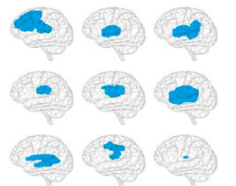
Clinical assessments

Data are collected in many ways:



Human and digital twin interaction

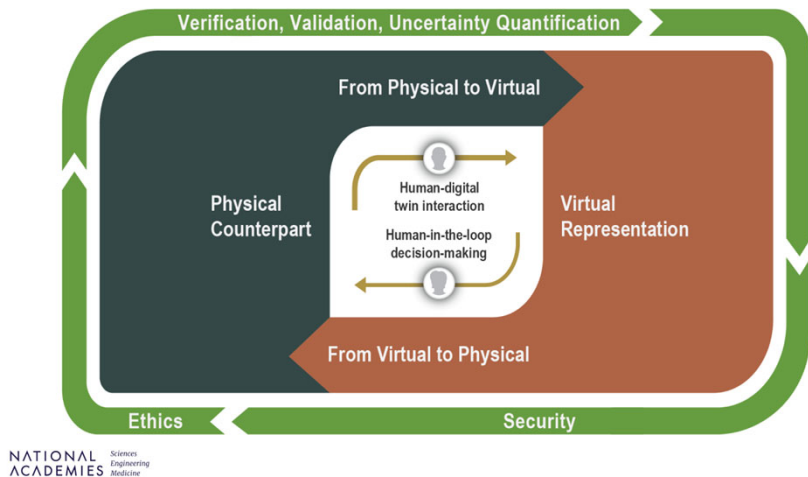
Utilizing the simulated predictions and related uncertainties, the clinician and patient can make informed clinical-decisions around treatment and also the clinical assessments, which affect the data informing the digital twin.



Simulations & predictions

Simulations of potential treatments can generate predictions of outcome and in turn can be optimized to determine the most favorable treatment options.

Emerging Directions

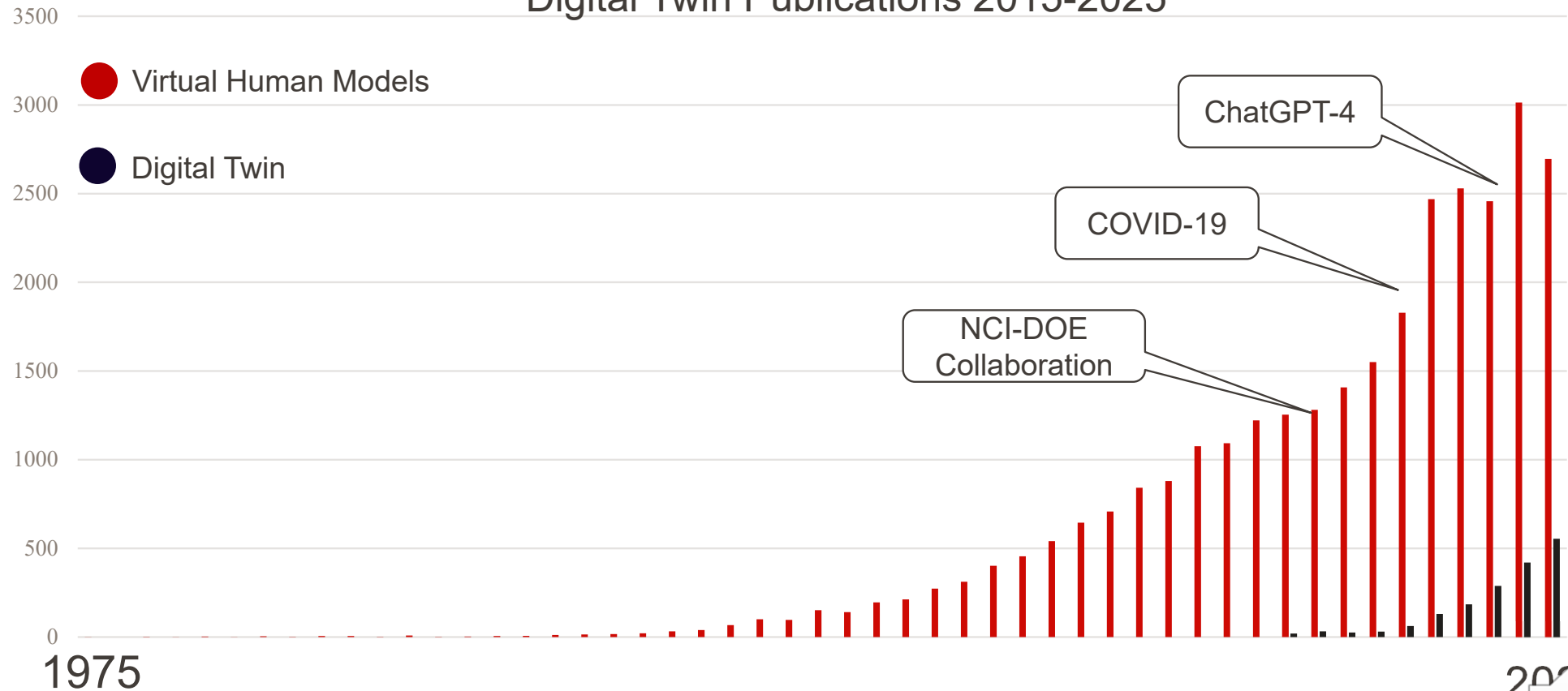


- **Digital Twin Consortium**
- **Digital Twin Report - National Academies of Sciences, Engineering and Medicine**
- **EDITH – European Union Digital Twin for Health**
- **NIH IMAG-MSM**
- **ARPA-H Programs**
- **Virtual Human Global Summit**
- **Interdisciplinary Institutes**



50 Years of Virtual Human Models

Virtual Human Model Publications 1975-2025
Digital Twin Publications 2015-2025

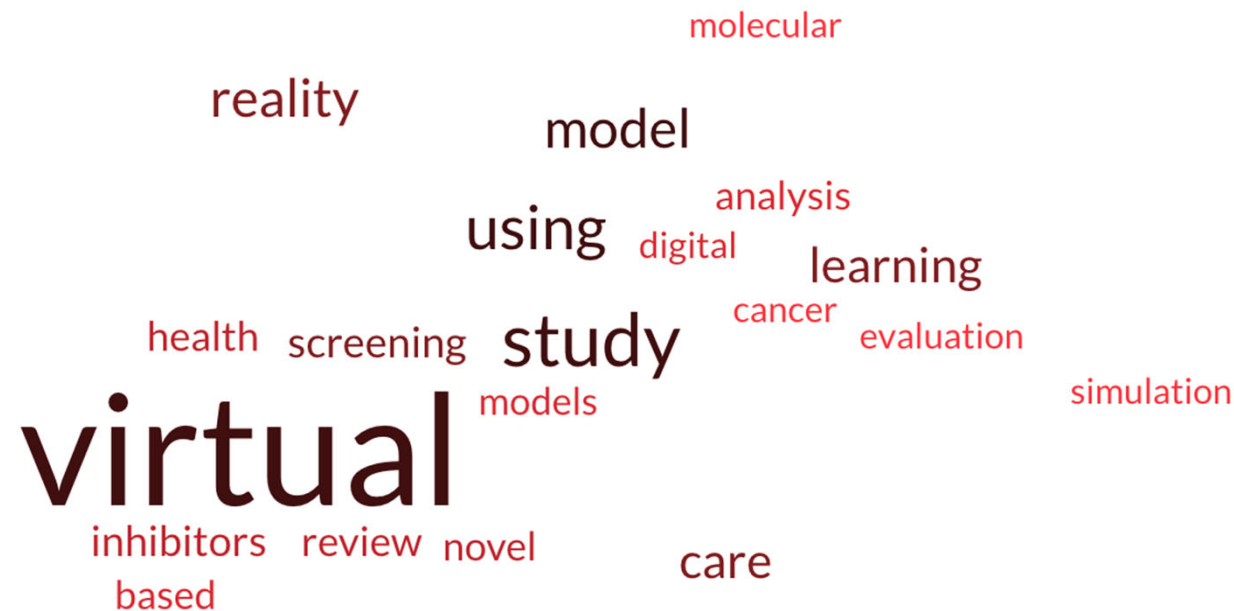


Source: Pubmed query October 18, 2025



Publication Activity in Virtual Human Models 2024-2025

Top 20 words from 5710 titles virtual human models query

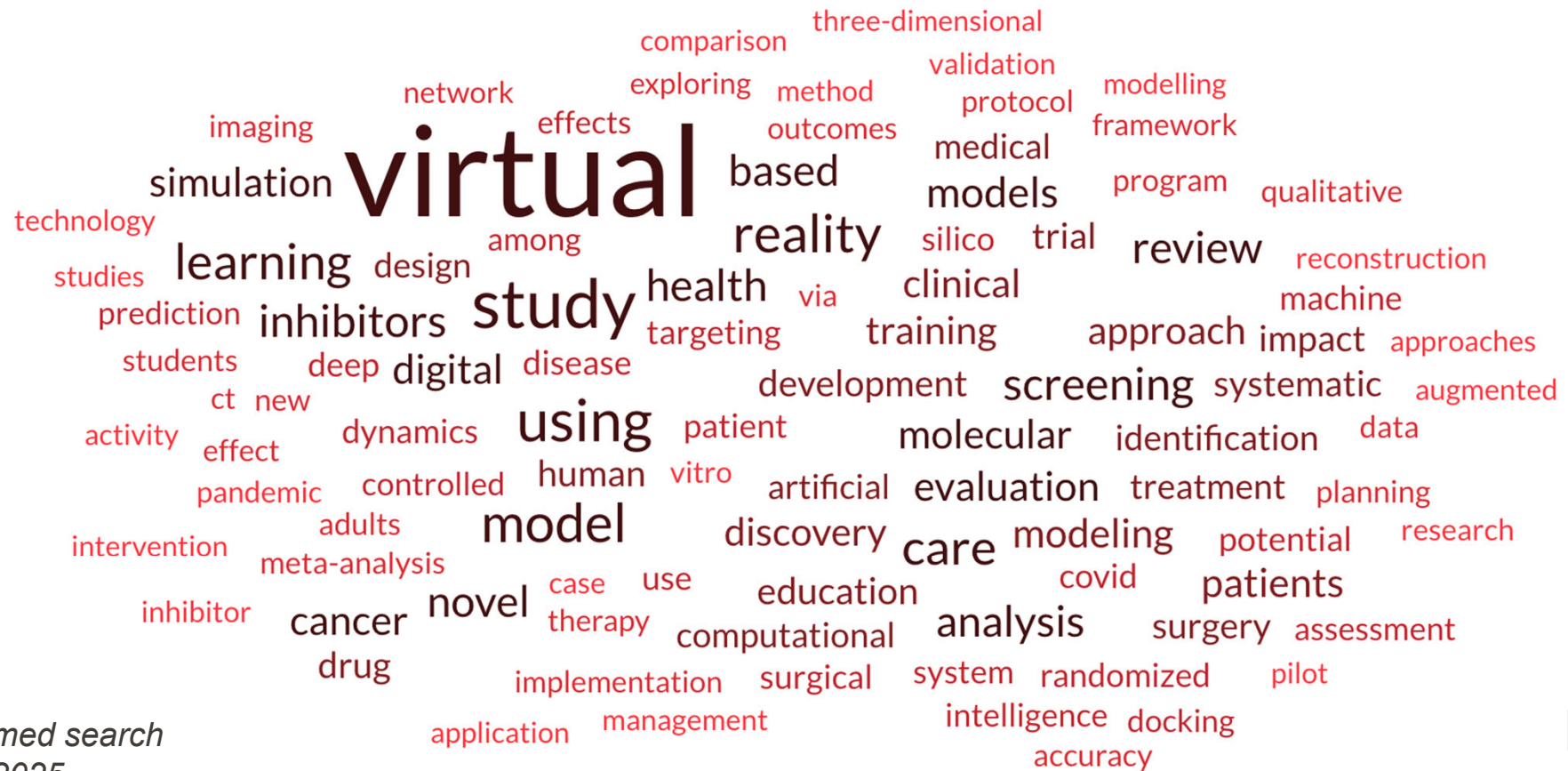


Source: Pubmed search October 18, 2025



Publication Activity in Virtual Human Models 2024-2025

Top 100 words from 5710 titles - virtual human models query



Source: Pubmed search
October 18, 2025



January
2023

NASEM
Workshop on
Biomedical
Digital Twins

July
2023

EDITH Draft
Roadmap
Released

October
2023

First Virtual
Human
Global
Summit

In 2023...



**And in just
two years...**

January
2023

NASEM
Workshop on
Biomedical
Digital Twins

July
2023

EDITH Draft
Roadmap
Released

October
2023

First Virtual
Human
Global
Summit

November
2023

First Digital
Twin
Workshop at
SC23

December
2023

NASEM
Digital Twin
Study
Released

December
2023

NCI Releases
first NOSI for
Cancer Digital
Twins

July
2024

Second
EDITH
Ecosystem
Public
Meeting

June
2024

MD Anderson
hosts first
Digital Twin
Summit for
Cancer

March
2024

NSF, NIH,
FDA release
first RFA for
Biomedical
Digital Twins

January
2024

First
EDITH
Ecosystem
Public
Meeting

October
2024

ARPA-H
Launches
CATLYST
Program

December
2024

EDITH: VHT
Ethics and
Code of
Conduct

May
2025

Second NSF,
NIH, FDA
RFA in BDTs
closes

October
2025

Second MD
Anderson
Cancer DT
Summit

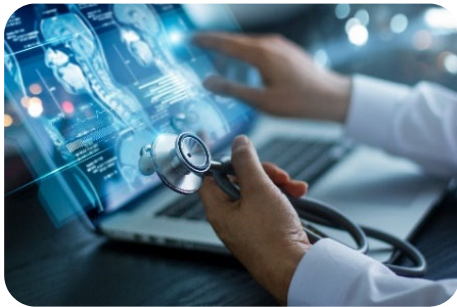
October
2025

Second
Virtual
Human
Global
Summit



MD Anderson Cancer Center Institute for Data Science in Oncology

Unlocking the power of data and enabling impactful change through team data science



Intelligent Systems for Quality and Safety:

Safer and more cost effective.
Improve cancer patient safety for
our patients and beyond



Streamlining Operations for Access:

Continuous monitoring and modelling
of our operational performance for improved
access/scheduling



Predicting Outcomes for our Patients:

Finding the optimal combination of our current
and emerging treatments.

And so much more...

The Talent:

Attract, Engage, and Build the
Best Minds and Partnerships



The Culture:

Enabling
Team Data Science



The Ecosystem:

Engineering a World-leading
Data Science Capability





IDSO integrates the tremendous power of data science with the institution's unparalleled scientific and clinical expertise to transform research and care to impact patients in ways only possible at MD Anderson.

To advance this collaborative, industry-leading approach, our teams have prioritized five focus areas:



Quantitative Pathology and Medical Imaging



Single Cell Analytics



Computational Modeling for Precision Medicine



Decision Analytics for Health



Safety, Quality and Access



Virtual Human Global Summit II

October 23-24, 2025

- 16 countries represented 3 continents: Austria, Belgium, France, Germany, Greece, India, Italy, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Spain, Switzerland, UK, USA
- Two venues: Barcelona and New York City
- Over 120 attendees
- More than 7 hospital systems
- Industry including major pharma, cloud computing, small businesses and entrepreneurs
- Multiple international research institutes, centers and universities



Virtual Human Global Alliance vision

- Community development and organization worldwide
- FAIR digital assets for virtual human model applications
- Trust, exchange and interoperability
- Collaborations and cross-organizational efforts
- Education, advocacy and policy
- Access, affordability, and cooperation

Contact: vhga@virtualhumansummit.org



VHGS II Acknowledgments

Organizing Committee:

- Mariano Vazquez
- Eric Stahlberg
- Luciana Marques
- Lynn Borkon
- Meifeng Lin

Platinum Sponsors

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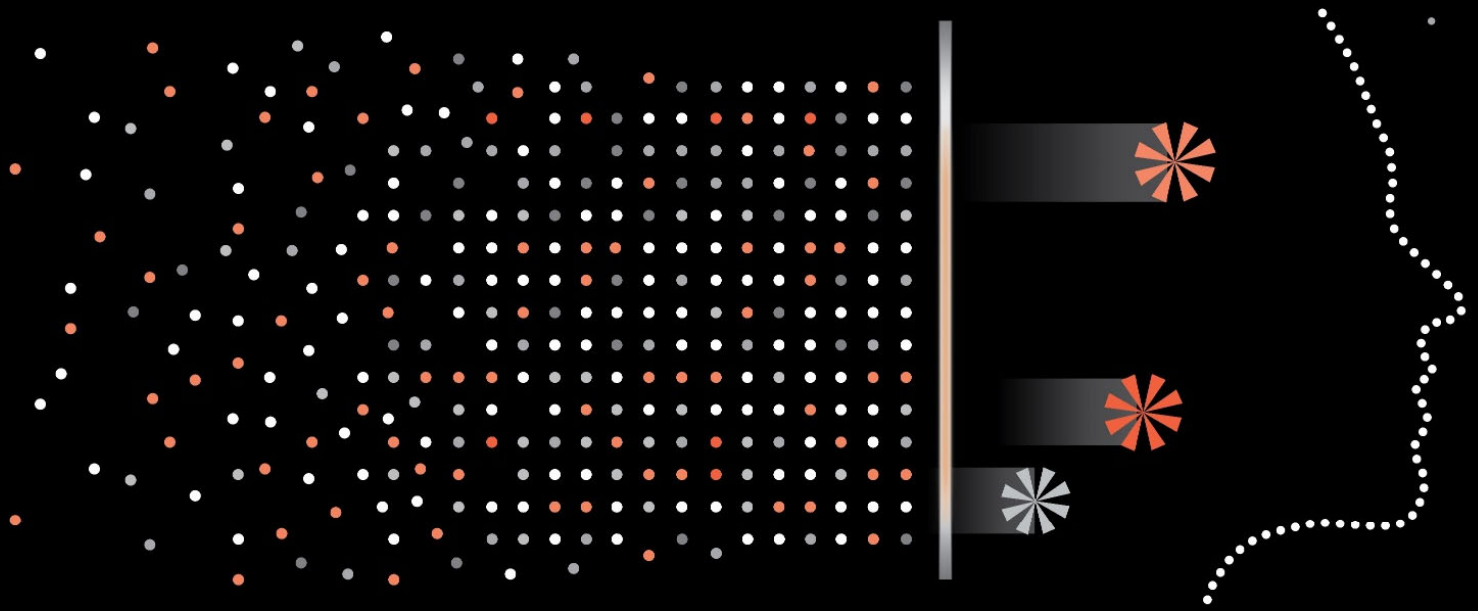
- Boehringer Ingelheim

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- Ravi Mahajan
- Michele Mercuri
- Lynn Borkon
- Luciana Marques
- Anil Strivastava



Institute for Data Science in Oncology



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