FALLING
WALLS
FOUNDATION

The Science Breakthroughs of the Year: Falling Walls announces shortlist

Berlin, 6 September 2021. The Falling Walls Foundation, Berlin, announced today the shortlist for the prestigious "Falling Walls Science Breakthroughs of the Year". The distinguished jury reviewed over 1.000 nominations from leading academic institutions from 115 countries. The final "Science Breakthroughs of the year" will be presented in Berlin on 9 November, the anniversary day of the fall of the Berlin Wall, at the Falling Wall Science Summit.

The jury chaired by Helga Nowotny, President emeritus of the European Research, shortlisted work from Harvard University, Massachusetts Institute of Technology (MIT), ETH Zurich, University of Science and Technology of China and other renowned international institutions. The jury identified ten shortlist winners in the first seven categories, ranging from life science to innovation management.

From quantum exploration and disease prevention to novel methods of climate preservation and post-Covid societal development, the winners shared the results of their excellent research that combat the most pressing challenges of our time. The complete list of winners from each category can be found further below.

Disease prevention and early diagnostics with special focus on viral and terminal diseases informed the winning research in *Life Sciences.* The category also included a novel therapeutic method to fight SARS-CoV-2 with camelid nanobodies.

Present in four out of ten winning projects, quantum reigned supreme in *Physical Sciences*. Other projects included research on SARS-Cov-2 aerosol transmission as well as a novel approach to environmental preservation by CO_2 dissolution in water and its injection into subsurface basalts.

Healthcare, for humans as well as crops, was central among the winners in *Engineering and Technology,* who explored the potential of small robotic devices for therapeutics and non-invasive surgery and presented the first plant-based robot for potential crop health monitoring.

Science skepticism, online misinformation, and polarisation on social media - the role of the Internet during the Covid-19 pandemic permeated the winning research in *Social Sciences and Humanities*.

The paradigm of human-technology interaction and human impact on environment reflected in the winning projects in the category *Art and Science.*

The research in the category *Future Learning* offered solutions for accessible and inclusive education in underrepresented and marginalized communities with particular emphasis on skill-building and technological education.

The winners in *Science and Innovation Management* put forward solutions for more efficient knowledge sharing and emphasized the connectivity of entrepreneurial researchers within the academic innovation ecosystems.

About the Falling Walls Science Summit

Falling Walls Science Summit is a leading international, interdisciplinary and intersectoral forum for scientific breakthroughs and science dialogue between global science leaders and society. The event takes place every year from 7–9 November in Berlin, commemorating the fall of the Berlin Wall. With formats Falling Walls Pitches (7 Nov), Falling Walls Circle (8 Nov) and Falling Walls Science Breakthroughs of the Year (9 Nov), the Falling Walls Science Summit is the leading forum for global science leaders from academia, business, politics, the media, and civil society to debate the potential of scientific breakthroughs to solve grand challenges and shape a sustainable future. The Falling Walls Science Summit is organized by the charitable Falling Walls Foundation. More: www.falling-walls.com

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LIFE SCIENCES

CYNTHIA SHARMA & CHASE BEISEL - JULIUS-MAXIMILIANS-UNIVERSITY OF WÜRZBURG; HELMHOLTZ INSTITUTE FOR RNA-BASED INFECTION RESEARCH
Breaking the Wall to CRISPR-Cas9 led Diagnostics
Cynthia Sharma & Chase Beisel created LEOPARD diagnostic platform (Leveraging Engineered tracrRNAs and On-target DNAs for Parallel RNA Detection). LEOPARD helps detect multiple RNA sequences of disease-related biomarkers in a single test

PAOLA PICOTTI & VALENTINA CAPPELLETTI - ETH ZURICH, INSTITUTE OF MOLECULAR SYSTEMS BIOLOGY
Breaking the Wall of Protein Analytics
Paola Picotti and Valentina Cappelletti developed a technology that generates a new type of molecular data which can help study the structure and shape of proteins in living systems

PATRICK CRAMER - MAX PLANCK INSTITUTE FOR BIOPHYSICAL CHEMISTRY
Breaking the Wall to replicating Sars Cov-19 Polymerase
Patrick Cramer visualized how the coronavirus SARS-CoV-2 replicates its RNA genome

JEREMY HERREN - INTERNATIONAL CENTRE OF INSECT PHYSIOLOGY AND ECOLOGY
Breaking the Wall to Symbiont-bases Transmission blocking of Malaria
Jeremy Herren developed a self-regenerating system of symbiotic microbe-based malaria control

HEIKO LICKERT - HELMHOLTZ ZENTRUM MÜNCHEN, INSTITUTE OF DIABETES AND REGENERATION RESEARCH (IDR)
Breaking the Wall of Regenerative Approaches to Treating Diabetes
Heiko Lickert discovered the insulin inhibitory receptor with the potential to revolutionise diabetes mellitus care

DAVID MILLER – CORNELL UNIVERSITY
Breaking the Wall to High Resolution Atomic Imaging
David Miller developed a new electron microscopy method that produces the world's highest-resolution image

JOSÉ-ALAIN SAHEL - UNIVERSITY OF PITTSBURGH SCHOOL OF MEDICINE
Breaking the Walls to Restoring Vision for Retinal Degeneration
José-Alain Sahel conceived the first-in-man clinical trial combining a biotherapy with a stimulation device and observed the first clinical evidence for vision restoration using optogenetics

FLORIAN INGO SCHMIDT – UNIVERSITY OF BONN
Breaking the Wall to Treating Covid-19 through Camelid Nanobodies
Florian Ingo Schmidt developed a novel therapeutic for SARS-CoV-2 that relies on camelid nanobodies

KEVAN SHOKAT - UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
Breaking the Wall to Drugging the KRAS Oncogene
Kevan Shokat discovered the first inhibitor of the K-Ras (G12C) oncogene, which is expected to produce the new category of cancer therapies

JANIS TAUBE & ALEXANDER SZALAY – JOHN HOPKINS UNIVERSITY
Breaking the Wall to Mapping Cancer Using Multispectral Microscopy
Janis Taube and Alexander Szalay implemented astronomic methodology for more precise cancer diagnostics

PHYSICAL SCIENCES

ELHAM FADALY & ERIK BAKKERS - EINDHOVEN UNIVERSITY OF TECHNOLOGY
Breaking the Wall to Light Emitting Silicon
Elham Fadaly and Erik Bakkers created photonic chips with a new alloy of hexagonal silicon that can revolutionise computing speed and performance

HUI CAO - YALE UNIVERSITY
Breaking the Wall to Rapid Random Number Generation
Hui Cao invented a scalable method for physical generation of true random numbers using a semiconductor laser chip

JUAN IGNACIO CIRAC - MAX PLANCK INSTITUTE OF QUANTUM OPTICS
Breaking the Wall to Analogue Quantum Chemistry Simulation
Juan Ignacio Cirac introduced a new approach to compute electronic molecule structures based on analog quantum computing

YAFANG CHENG - MAX PLANCK INSTITUTE FOR CHEMISTRY
Breaking the Wall to Understanding Covid 19 Transmission through Aerosols
Yafang Cheng were able to quantify the efficacy of face masks and related measures through his interdisciplinary research

RON FOLMAN - BEN-GURION UNIVERSITY OF THE NEGEV
Breaking the Wall to Proving the Stern-Gerlach Experiment
Ron Folman proved the Stern-Gerlach experiment is a coherent quantum process by successfully splitting a single object into a superposition state

SIGURDUR GISLASON - UNIVERSITY OF ICELAND, INSTITUTE OF EARTH SCIENCES
Breaking the Wall of Capturing and Storing CO2
Sigurdur Gislason invented a novel method to capture and store CO_2 by its dissolution in water and injection into subsurface basalts

JOHANN PHILIPP KLAGES - ALFRED WEGENER INSTITUTE HELMHOLTZ CENTER FOR POLAR AND MARINE RESEARCH
Breaking the wall to Understanding Extreme Greenhouse Climates
Johann Philipp Klages discovered traces of preserved forest soil from the late Cretaceous greenhouse world near the South Pole

CHAO-YANG LU & JIAN-WEI PAN - UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA
Breaking the Wall to Quantum Computational Advantage Using Photon
Jian-Wei Pan and Chao-Yang Lu implemented boson sampling to demonstrate quantum computational advantage

CHRISTIAN OSPELKAUS - GOTTFRIED WILHELM LEIBNIZ UNIVERSITÄT HANNOVER
Breaking the Wall to a Universal Quantum Core
Christian Ospelkaus demonstrated a self-contained computation register, which, if complimented with storage, can realise a universal quantum core.

CHRIS POLLY – US DEPARTMENT OF ENERGY, FERMILAB
Breaking the Wall to Proving Vacuum Interactions
Chris Polly used muon beam to determine undiscovered particles within its vacuum interactions

ENGINEERING AND TECHNOLOGY
DANIEL AHMED - ETH ZURICH
Breaking the Wall to Ultrasound Microrobots
Daniel Ahmed developed ultrasound microrobots for targeted therapeutics

IGOR BARGATIN - UNIVERSITY OF PENNSYLVANIA
Breaking the Wall to Photophoretic Levitation
Igor Bargatin devised macroscopic objects that can fly without any moving parts using photophoresis, or light-induced airflow

WARWICK BOWEN - THE UNIVERSITY OF QUEENSLAND
Breaking the Wall to Quantum Microscopes
Warwick Bowen created the first quantum microscope that detects the smallest biological samples

HUIMING BU - IBM RESEARCH
Breaking the Wall to a 2 Nanometer Chip Generation
Huiming Bu demonstrated novel energy-efficient 2 nanometer nanosheet transistors

XIAODONG CHEN - NANYANG TECHNOLOGICAL UNIVERSITY
Breaking the Wall to Plant-Based Robots
Xiaodong Chen created the first plant-based robot to monitor crop health

DIEGO GHEZZI - ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE
Breaking the Wall to Retinal Implants to Reverse Blindness
Diego Ghezzi developed and validated a neurotechnological retinal implant Polyretina to reverse blindness

JUNG-HO LEE - HANYANG UNIVERSITY
Breaking the Wall to Stable Zinc-Air Batteries
Jung-Ho Lee produced energy efficient stable air-zin batteries able to charge in 15 minutes

THOMAS MASCHMEYER - THE UNIVERSITY OF SYDNEY
Breaking the Wall of Mixed Plastic Waste
Thomas Maschmeyer discovered a novel catalytic reaction cascade that enables high-efficiency recycling of mixed plastic waste

FRANCESCA SANTORO - ISTITUTO ITALIANO DI TECNOLOGIA
Breaking the Wall to Biohybrid Synapses
Francesca Santoro developed adaptive biohybrid synapses that can be used for implantable neuroprosthetics

GEOFFREY SPINKS - UNIVERSITY OF WOLLONGONG
Breaking the Wall to Artificial Muscles in Miniature Devices
Geoffrey Spinks developed artificial muscles in miniature devices that can be used for non-invasive surgery

SOCIAL SCIENCES AND HUMANITIES
CHRIS BAIL - DUKE UNIVERSITY
Breaking the Wall of Polarisation on Social Media
Chris Bail analysed polarisation on social media and proposed new apps and technologies to tamp down extremism

SVEN BECKERT - HARVARD UNIVERSITY
Breaking the Wall to a Global History of Capitalism
Sven Beckert re-charted the global history of capitalism from actor-centric perspective with emphasis on state and the countryside

KORAY CALISKAN - THE NEW SCHOOL
Breaking the Wall to Cryptocurrency Economies
Koray Caliskan analysed cryptocurrencies using big data analysis, sociological surveys and anthropological fieldwork

ELENA ESPOSITO - BIELEFELD UNIVERSITY AND UNIVERSITY OF BOLOGNA
Breaking the Wall to Ethical Algorithmic Prediction
Elena Esposito explored the social consequences of giving up the principle of shared uncertainty in favor of algorithmic systems

MICHÈLE LAMONT - HARVARD UNIVERSITY
Breaking the Wall to Universal Dignity
Michèle Lamont presented research on the concept of worthiness and its re-definition in the post-Covid New Gilded Age

SABINA LEONELLI - UNIVERSITY OF EXETER
Breaking the Wall to Understanding Data
Sabina Leonelli pioneered the epistemology of data and data science with focus on responsible use of data

DILIP MENON - UNIVERSITY OF WITWATERSRAND
Breaking the Wall to a Paracolonial Paradigm
Dilip Menon put forward a theory of the paracolonial history view of the Global South

NAOMI ORESKES - HARVARD UNIVERSITY
Breaking the Wall of Science Skepticism
Naomi Oreskes investigated the reasons behind science skepticism and possible remedies against it

DAVID RAND - MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Breaking the Wall of Online Misinformation
David Rand investigated why people share misinformation to provide scalable attention-based interventions that social media platforms could implement

BO ROTHSTEIN - UNIVERSITY OF GOTHENBURG
Breaking the Wall to Effective Anti-Corruption Policy
Bo Rothstein presented a theoretical reconceptualization of corruption to motivate new anti-corruption policies

ART AND SCIENCE
MELISSA DUBBIN & AARON S. DAVIDSON - PRATT INSTITUTE AND PARSONS SCHOOL OF DESIGN AT THE NEW SCHOOL
Breaking the Wall to Our Stardust Origins
Melissa Dubbin and Aaron S. Davidson created the project Delay Lines, which explores relations between the environment, computing, robotics, and artificial life forms

ANNA DUMITRIU - UNIVERSITY OF HERTFORDSHIRE AND BRIGHTON AND SUSSEX MEDICAL SCHOOL
Breaking the Wall to Beating Climate Change with Yeast Biotechnology
Anna Dumitriu explored the significance of yeast biotechnology and its potential to offer sustainable environmental solutions

JIABAO LI - HARVARD UNIVERSITY
Breaking the Wall to More Comprehensive Human Perception
Jiabao Li proposed new ways to perceive the world by creating tangible narratives which challenge human perception of digital media and climate change

PEI-YING LIN - GARDEN OF FORKING PATHS
Breaking the Wall to Harmonious Human-Virus Co-existence
Pei-Ying Lin's project Virophilia explored harmonious human-virus co-existence

ROBERTINA ŠEBJANIČ – INDEPENDENT
Breaking the Wall of the Aquatocene
Robertina Šebjanič investigated human impact on aquatic environments and the imprint of human intervention on aquatic ecosystems and its ecological changes

MICHAEL SEDBON - STUDIO MICHAEL SEDBON
Breaking the Wall to Ecosystemic Politics
Michael Sedbon's installation installation used algorithm-based decision-making to discuss the governance of ecosystems

RASA SMITE & RAITIS SMITS - RIXC ART SCIENCE CENTER
Breaking the Wall between Terrestrial and Atmospheric Ecosystems
Rasa Smite and Raitis Smitis visualized relations between forest emissions and climate change with an immersive VR artwork

DORIS SUNG - UNIVERSITY OF SOUTHERN CALIFORNIA/DOSU STUDIO ARCHITECTURE
Breaking the Wall to Environmentally Responsive Architecture
Doris Sung promoted the use of thermobimetals that at various temperatures self-shade, self-ventilate, self-assemble or self-propel

PAUL VANOUSE - UNIVERSITY AT BUFFALO
Breaking the Wall Between Species
Paul Vanouse's art installation Labor re-created the scent of human exertion created by bacteria propagating in three bioreactors

GERHARD WIDMER - JOHANNES KEPLER UNIVERSITY
Breaking the Wall to Computational Expressivity in Music Performance
Gerhard Widmer demonstrated the first naturally expressive co-performance between a human and a machine, based on learned computational models of expressivity

FUTURE LEARNING
DAVID BERG – IMBLAZE, BIG PICTURE LEARNING
Breaking the Wall of Uneven Access to Social Capital
David Berg's initiative "ImBlaze" enables schools to offer equitable access to social capital & real-world learning at scale

GEORGE COWELL - RISING ACADEMY NETWORK
Breaking the Wall to Harnessing AI for Distance Learning
George Cowell created "Rori", a chatbot tutor harnessing AI and audio to deliver personalised learning to any student on any phone

REMY GAKWAYA - TECHNOLOGY LEARNING AND BUILDING SOLUTIONS (TAKENOLAB)
Breaking the Wall to Technological Education for Marginalized Communities
Remy Gakwaya's project provides STEM education to end unemployment in marginalized communities

JEAN GREYLING - NELSON MANDELA UNIVERSITY
Breaking the Wall to Teaching Coding in Developing Countries
Jean Greyling's initiative TANKS introduces students from disadvantaged areas to coding concepts without computers

TATSUYA HONDA - FUJITSU LIMITED
Breaking the Wall to Deaf Students Designing their own Sounds
Tatsuya Honda developed a user interface, which allows students at schools for the deaf design their own sound experiences

JIGYASA LABROO - SLAM OUT LOUD- ARTS FOR ALL
Breaking the Wall of Access to Art Education
Jigyasa Labrod developed educational programmes with visual and performing arts for disadvantaged children in India

CLAIRE MONGEAU - M-SHULE
Breaking the Wall to Skill-Building for Sub-Saharan Africa
Claire Mongeau founded M-Schule, the first knowledge-building platform in Africa that combines SMS with artificial intelligence

CHRIS RICHMOND NZI - MYGRANTS S.R.L. S.B.
Breaking the Wall to a Learning-Ecosystem for Migrants
Chris Richmond Szi created a web-based learning ecosystem "Magrants" for immigrants and people with refugee status

BRAD TURNER – BENETECH, BENEFICENT TECHNOLOGY INC.
Breaking the Wall of Impeding Reading Barriers
Brad Turner developed an e-book service for students with reading barriers

SUNNY YANG - INTERNATIONAL CITY WANDERER EDUCATION ASSOCIATION
Breaking the Wall to Challenge-Based Education
Sunny Yang's project "Wandering Challenge" inspires young people to step out of classroom and explore their purpose in the world

SCIENCE AND INNOVATION MANAGEMENT

ANITA SCHJØLL BREDE - IRIS.AI
Breaking the Wall of an Overload of Scientific Knowledge
Anita Schjøll Brede founded an AI researcher to help leverage exponentially growing scientific knowledge

SEBASTIEN CHARLES – POSTERLAB
Breaking the Wall to Faster Knowledge Sharing
Sebastien Charles developed an application for better scientific networking within research organisations to foster interdisciplinary collaboration

XIAOLAN FU - UNIVERSITY OF OXFORD
Breaking the Wall of Technology Valuation Bottlenecks
Xiaolan Fu created a project that makes technology valuation accessible, affordable, and objective

DAVID HART - UNIVERSITY OF MAINE
Breaking the Wall of the Ivory Tower
David Hart explored the ways of how universities can become more useful societal partners in solving sustainability problems

THOMAS LEMBERGER - EMBO
Breaking the Wall to Rapid Peer Review Processes
Thomas Lemberger founded a platform for high-quality journal-independent peer-review in the life sciences

BENJAMIN MILES - SPIN UP SCIENCE
Breaking the Wall to Connecting Researchers and Innovators
Benjamin Miles's initiative promoted intergenerational connectivity of entrepreneurial researchers to foster academic innovation ecosystems

JOHAN SCHOT - TRANSFORMATIVE INNOVATION POLICY CONSORTIUM
Breaking the Wall to Transformative Innovation Policy
Johan Schot examined current innovation frames to help solve social and economic challenges of our time

GISBERT SCHNEIDER - ETH ZURICH
Breaking the Wall of Slow and Inefficient Drug Discovery
Gisbert Schneider developed a project that integrates constructive artificial intelligence into the pharmaceutical drug discovery progress

DASHUN WANG - KELLOGG SCHOOL OF MANAGEMENT, NORTHWESTERN UNIVERSITY
Breaking the Wall of Uncertain Success Criteria for Innovation
Dashung Wang's project helped uncover fundamental principles underlying the success and/or failure of innovation using AI and large datasets

JONATHAN WAREHAM – ESADE
Breaking the Wall to Innovation through Transferring Technologies
Jonathan Wareham and his project ATTRACT bring deep tech of big science research to the market