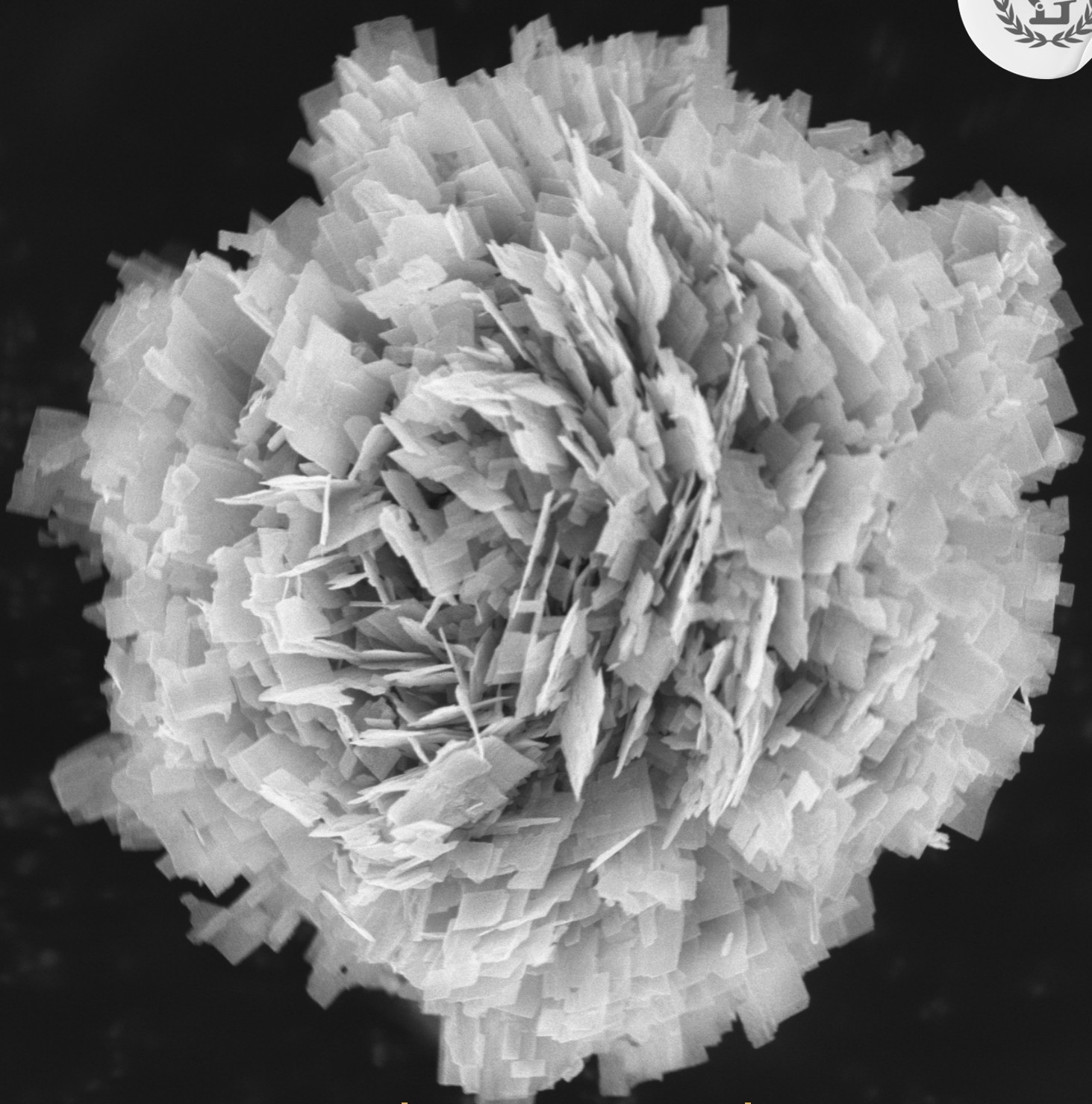
Nazarbayev University | #49 | October – December | 2025

QUARTERLY EDITION

RESEARCH NEWSLETTER



Research Features

Snapshots, success stories & voices from the lab

University Research Life

News, events & research community highlights

Opportunities & Publications

Funding calls & recent research publications

Cover Image: *SEM image of ZnO microflower prepared at the NU Advanced Nanomaterials Laboratory for photocatalytic water treatment applications.*
Author: *Timur Atabaev*

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Research highlights, people, ideas, and opportunities shaping the NU research community

RESEARCH NEWSLETTER

A Year of Research Momentum and Global Recognition

Prof. Zhumabay Bakenov
Vice Provost for Research and Innovation, Nazarbayev University

Year in Review 2025: Strengthening Research Excellence

2025 has been a year of considerable progress and growing global recognition for Nazarbayev University. The University advanced to the 401–500 band in the THE World University Rankings 2026, reflecting significant improvements across teaching, research environment, research quality, and international outlook.

Research performance continued to strengthen, with a steady increase in Q1 journal publications and international visibility. In 2025, 42 NU researchers were recognized in the

Stanford–Elsevier Top 2% of the world's most-cited scientists, underscoring the global relevance and impact of our high-quality research and scholarship.
Throughout the year, NU researchers advanced interdisciplinary work addressing key national and global challenges, including energy transition, advanced materials, artificial intelligence, healthcare technologies, water security, and sustainability. Major international and national grants, alongside the continued development of research centers and laboratories, further enhanced the NU's research recognition and impact.

Equally important has been the active engagement of students and early-career researchers, whose scholarly contributions in top quality journals and conferences, and successes in securing competitive funding reflect the strong integration of research and education at NU. These achievements are the result of the collective efforts of our faculty, researchers, students, and professional staff. I sincerely thank everyone who contributed to NU's research in 2025. Together, we continue to strengthen a research ecosystem built on quality, integrity, and global relevance and impact.

Prof. Rehan Sadiq
Provost at Nazarbayev University

Looking Ahead: Building NU's Research Future

As we build on the achievements of 2025, Nazarbayev University looks ahead with confidence and a shared sense of purpose. The progress of the past year highlights not only what we have accomplished, but also what we can achieve together.

Our future lies in research that matters and serves our community and society at large. In the years ahead, we will place greater emphasis on research quality and knowledge translation, strengthen the pathways that move ideas from discovery to innovation, guide policymaking and enhance practice. Our priority research areas include sustainability and climate change, digital transformation and artificial intelligence, advanced materials, and emerging health and biomedical technologies. These areas reflect both global challenges and national priorities.

People remain at the heart of this vision. We will continue to invest in research talent by supporting early career researchers and students, encouraging interdisciplinary collaboration, and fostering an environment where curiosity, rigor, and creativity can flourish. By deepening partnerships with leading international institutions, industry, and public sector stakeholders, NU will further extend the reach, relevance and impact of its research.

The path ahead will require commitment and collective effort. I am sincerely grateful to our faculty, researchers, students, and staff for their dedication throughout 2025. Together, we will continue to shape Nazarbayev University as a place where ideas lead to impact and research serves society, both in Kazakhstan and globally.

RESEARCH PERFORMANCE OVERVIEW (2020-2025)

7,764	3,572
Scholarly Output	Authors

Disciplinary Strengths and Impact Areas

High Impact Leaders (FWCI >2.0)

- Medicine 8.93
- Psychology 3.14
- Neuroscience 3.06
- Biochemistry 2.16

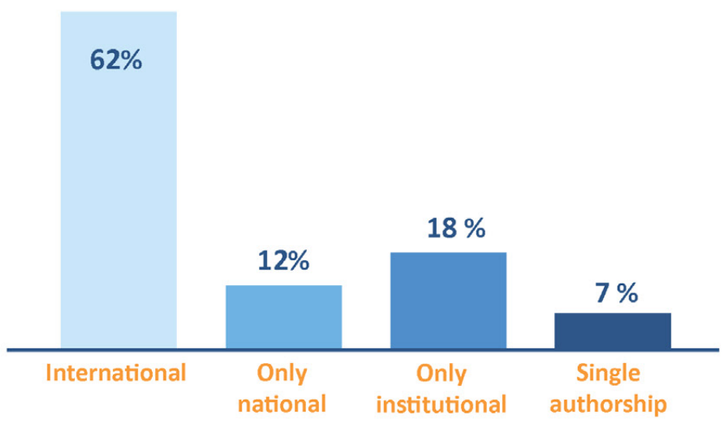
Strong Core Fields (FWCI 1.5 - 2.0)

- Social Sciences 1.83
- Arts & Humanities 2.00

High-Volume Foundation Fields (FWCI 1.0 - 1.5)

- Engineering
- Computer Science

Geographical Collaboration



75%

of NU's publications are co-authored with another institution

International FWCI 2.96

National FWCI 1.08

The university's research performance during 2020–2025 reflects a high level of global competitiveness. With a Field-Weighted Citation Impact of 2.32, publications were cited more than twice the world average within their respective disciplines.

The average of 17.6 Citations per Publication further demonstrates strong scholarly visibility.

Notably, 14.9% of outputs are positioned within the Top 10% Most Cited globally, underscoring the university's capacity to generate research of international influence and excellence.

3,987 collaborating Institutions

Global Recognition

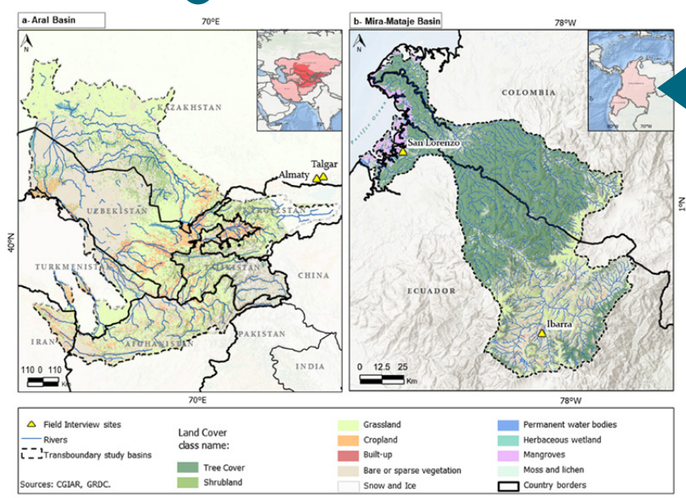
THE World University Rankings 2026 **401-500**

Strong performance in citation impact and international collaboration aligns with key indicators used in the Times Higher Education ranking methodology.

RESEARCH SNAPSHOT

Transdisciplinary research on water security: insights from Central Asia and Latin America

Aliya Assubayeva, Stefanos Xenarios, Alicia Correa, Jorge Forero



A new study led by Dr Aliya Assubayeva (Nazarbayev University; Justus Liebig University Giessen) demonstrates how translational research (TR) can connect scientific evidence, policy needs, and community perspectives in two contrasting transboundary river basins: the Aral Sea basin (Central Asia) and the Mira–Mataje basin (Colombia–Ecuador).

GRADUATE SCHOOL OF PUBLIC POLICY

Read the Full Article

Figure 1
Transboundary river basins of the study

The paper " Transdisciplinary research on water security in transboundary river basins" shows that water security one of today's major "wicked problems" cannot be addressed by engineering or policy reforms alone. Instead, it requires transdisciplinary approaches and the involvement of knowledge brokers who can bridge fragmented governance systems, competing water demands, and diverse cultural values.

KEY FINDINGS

- TR provides a structured method to translate academic analysis into policy priorities and local insights.
- Central Asia prioritizes water quantity, deteriorating irrigation systems, and infrastructure rehabilitation.
- Mira–Mataje communities emphasize water quality, pollution from extractive industries, and recognition of Indigenous and Afro-descendant rights.
- Despite their differences, both regions face aging or insufficient infrastructure, rising climate-related hazards, and weak water governance.
- Effective solutions depend on knowledge synthesizers who can connect science to action and facilitate participatory decision-making.

HOW THE RESEARCH WAS CONDUCTED:

The study applied TR in three stages:

Synthesis of scientific evidence
Review of 150 publications on the Aral basin and 30 on Mira–Mataje, identifying shared challenges across five dimensions: household/urban water security, economic uses, environmental status, hazards, and governance.

Translation to policy practice
Delphi surveys with experts (115 in Central Asia, 27 in Latin America) to determine priority issues and actionable interventions.

- Central Asia: technical and infrastructural solutions dominate.
- Mira–Mataje: governance reforms, community engagement, and environmental protection.

Translation to community realities
Fieldwork in Kazakhstan and Ecuador revealed:
Kazakhstan: concerns about scarcity, upstream dependence, and competition among sectors.
Ecuador: water seen as sacred; acute impacts from pollution, land degradation, and limited sanitation.

AUTHOR'S RESEARCH TRAJECTORY

This article synthesises work from Dr Assubayeva's PhD at Nazarbayev University (water security in Central Asia) and her postdoctoral research at JLU Giessen, which expanded the scope to Latin America through the SDGnexus Network.

The project was carried out with:

- Prof. Stefanos Xenarios – conceptualization and water security framework design
- Dr Alicia Correa – fieldwork and data analysis in Latin America
- Dr Jorge Forero – coordination of Ecuadorian field research and community engagement

WHY IT MATTERS:

More than 300 transboundary river basins globally face similar tensions over allocation, governance, and climate impacts. The study demonstrates that TR can operationalize water security by: clarifying how different actors define and prioritize water needs; revealing mismatches between scientific indicators and lived realities; enabling informed, inclusive decision-making under uncertainty.
The authors argue that future work should expand community co-design, involve more riparian countries, and deepen analysis of how professional identity shapes water security perceptions.

What Makes Young Children Happy? Listening to their voices to understand well-being in early childhood education

Daniel Hernández-Torrano, Laura Ibrayeva, Manat Sergazina, Anara Burambayeva, Aiida Kulsary, Dianne Vella-Brodrick & Patricia Eadie

The study was designed to address a major gap in early childhood research: the limited understanding of well-being from young children's own perspectives, particularly in non-WEIRD contexts. Drawing on empirical data from Kazakhstan, the authors set out to understand what well-being means to children themselves, beyond adult-defined indicators of quality and school readiness.

Read the Full Article

Figure 1
Engagement – artistic activities
Figure 2
Relationships – teacher-child

WHY IT MATTERS

Early childhood education plays a decisive role in shaping children's lifelong development. Yet, most research on well-being relies on adult-defined models and data from Western contexts. This study shifts the focus to children's own perspectives, offering rare, large-scale evidence from Kazakhstan, a non-WEIRD context.

WHAT THE STUDY DID

Participants: 316 children aged 4–7 from public and private kindergartens across Kazakhstan
Method: Draw, Write, and Tell (DWT) technique, allowing children to express what makes them happy through drawings and stories
Framework: PERMA-H (Positive Emotion, Engagement, Relationships, Meaning, Accomplishment, Health)

WHY IT'S IMPORTANT

- Amplifies children's voices in well-being research
- Provides context-specific insights from Central Asia
- Challenges adult-centric frameworks by highlighting the importance of play, place, and relationships

KEY FINDINGS

Children's well-being is grounded in everyday, "here-and-now" experiences:

Positive emotions: Linked to tangible environments playgrounds, nature, favorite toys, and cozy indoor spaces

Engagement: Dominated by play, alongside drawing, dancing, and learning activities

Relationships: Friends are central, followed by parents and kind teachers

Meaning & accomplishment: Reflected in celebrations, learning achievements, and future aspirations

Health: Associated with movement, sports, eating, and often connected to feeling strong and happy

While PERMA-H proved a useful organizing lens, the study shows that physical and natural environments play a much larger role in young children's well-being than existing models fully capture.

Takeaway: Young children define well-being not in abstract terms, but through joyful play, supportive relationships, and engaging environments. Designing early childhood education around these lived experiences is essential for fostering genuine well-being and healthy development.

How lifestyle and environment reshape the sperm epigenome

Ayazhan Akhatova, Celine Jones, Kevin Coward, Marc Yeste

SCHOOL OF MEDICINE

A new review in Clinical Epigenetics synthesises growing evidence that paternal lifestyle and environmental exposures such as diet, obesity, smoking, endocrine-disrupting chemicals, and stress alter sperm epigenetic marks (DNA methylation, histone retention, and small non-coding RNAs). These changes can influence sperm quality and fertilising ability, early embryo development, assisted reproduction outcomes, and long-term health risks in offspring. Read the article

KEY FINDINGS

Paternal factors leave epigenetic "signatures" in sperm (DNA methylation, histone modifications, sncRNAs) that accompany the genome at fertilisation.

Obesity and diet (high-fat/high-sugar or folate deficiency) are linked to altered methylation and sncRNA profiles, impaired sperm parameters, and metabolic dysfunction in offspring.

Smoking associates with differentially methylated regions in genes tied to anti-oxidation, insulin signalling, and spermatogenesis, and with reduced motility/morphology.

Endocrine-disrupting chemicals (EDCs) (e.g., BPA, phthalates) can induce transgenerational DNA methylation changes, affecting fertility and disease risk.

Stress in fathers before conception correlates with altered sperm miRNAs/piRNAs and methylation, with behavioural and metabolic effects detected across generations in animal models.

ART implications: Male BMI, diet, and alcohol intake correlate with embryo quality and ICSI outcomes; epigenetic sperm profiles show promise as biomarkers to improve ART success.

Clinical takeaway: Preconception interventions weight management, smoking cessation, balanced diet (including folate), physical activity, and reduced toxin exposure may help reverse adverse sperm epigenetic marks.

RESEARCH CONTEXT

While maternal epigenetics is well studied, this review highlights mounting evidence for paternal epigenetic influences, notes confounders (genetic background, fluctuating behaviours), and calls for longitudinal, controlled human studies using modern methylation and RNA-sequencing platforms.

WHY IT MATTERS

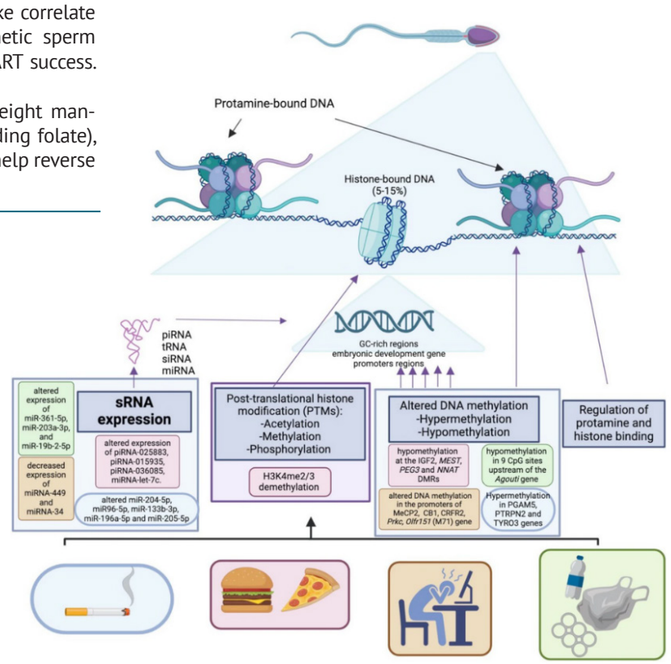
Male preconception health is a modifiable lever for improving fertility, embryo viability, and the lifelong health trajectory of children. Incorporating epigenetic screening or lifestyle programmes into fertility care could enhance ART outcomes and reduce intergenerational disease risk.

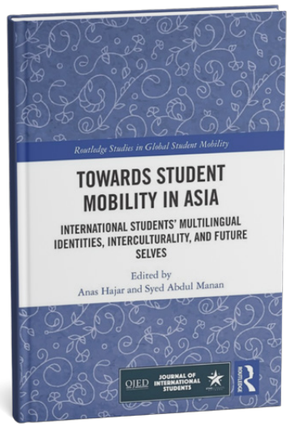
NEXT STEPS

- Large, longitudinal human cohorts to establish causality and dose response.
- Standardised epigenome assays (e.g., MethylationEPIC, small-RNA profiling) in andrology/ART workflows.
- Trials testing preconception lifestyle interventions on sperm epigenetic readouts and clinical endpoints.

Practical guidance:

- Maintain healthy weight; prioritise balanced diet with adequate folate.
- Avoid smoking, excessive alcohol, and high-fat/high-sugar patterns.
- Reduce exposure to EDCs (e.g., minimise plastics/heat, check workplace risks).
- Manage stress; support sleep and physical activity.
- Discuss preconception health with fertility specialists; consider participation in studies monitoring sperm epigenetic markers.





Towards Student Mobility in Asia: International Students' Multilingual Identities, Interculturality, and Future Selves

GRADUATE SCHOOL OF EDUCATION

Anas Hajar, Associate Professors, Graduate School of Education

an

Syed Abdul Manan, Associate Professors, Graduate School of Education

A new edited volume by **Anas Hajar** and **Syed Abdul** Manan examines international student mobility in Asia through a distinctly regional lens, challenging the long-standing Western frameworks that have shaped much of the global discourse. Bringing together empirical research from Mainland China, Hong Kong, Kazakhstan, Singapore, Malaysia, Japan, South Korea, Indonesia, Saudi Arabia, Turkey, the UAE, and Vietnam, the book explores the complex interplay of language, identity, and intercultural experience across Asia's rapidly evolving higher education landscapes.

The chapters investigate themes ranging from identity reconstruction and linguistic racism to employability, intercultural engagement, and the realities of studying at English-medium universities. The volume also highlights students' experiences of learning local languages alongside English and documents pedagogical interventions designed to support multilingual development and intercultural growth. Collectively, the contributions offer new conceptual insights into how language, culture, and power shape transnational education in Asia.

WHAT INSPIRED THE STUDY?

The project emerged from a growing concern that student mobility within Asia is frequently interpreted through theories developed primarily in Western contexts. These perspectives often focus on Anglophone destinations and treat mobility as a linguistic or academic phenomenon, leaving aside students' emotional negotiations, identity struggles, and encounters with local social and cultural dynamics.

Hajar and Manan propose an alternative: an Asian-centred, holistic approach that understands international students as "whole persons" whose academic journeys are inseparable from their social, cultural, political, and affective worlds. By drawing on cases from both established and emerging education hubs, the volume seeks to correct the underrepresentation of Asian contexts in mobility scholarship and to challenge narratives that implicitly position the West as the natural core of international education.

KEY TAKEAWAYS

The volume demonstrates that international student mobility in Asia is far from uniform. Mobility outcomes linguistic, social, or intercultural do not follow automatically from the act of studying abroad. Instead, they are shaped by local language policies, institutional practices, racialised hierarchies, and the degree to which host societies recognise international students as legiti-

Across contexts, students emerge as active agents: they negotiate belonging, participate in multiple linguistic markets, and imagine diverse future selves. By foregrounding multilingualism, interculturality, and identity formation, the book argues for more inclusive institutional policies, more equitable internationalisation strategies, and pedagogical models that value linguistic diversity and emotional well-being. It positions internationalisation in Asia not merely as a market-oriented project, but as a socially embedded and morally meaningful endeavour.

WHO WILL BENEFIT FROM THIS VOLUME?

The book will be of particular interest to:

• Scholars and postgraduate students
Working in applied linguistics, international education, sociolinguistics, and intercultural studies. The volume provides Asia-focused frameworks that support more context-sensitive and theoretically diverse research.

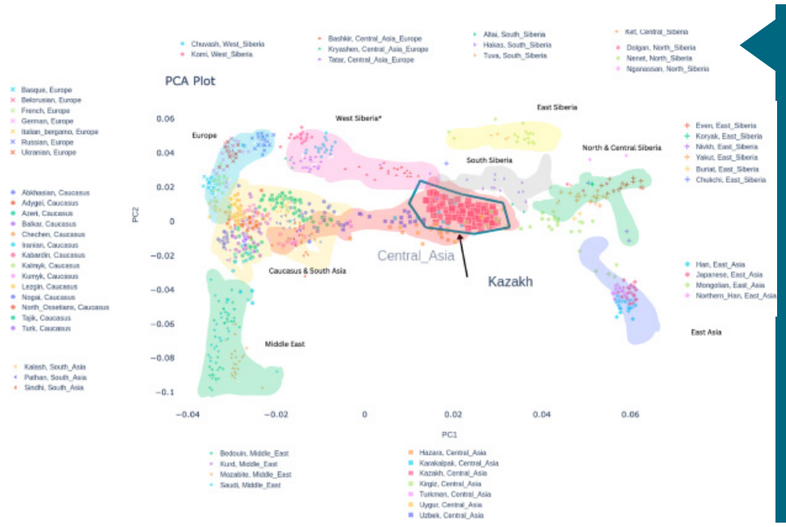
• University faculty and student-support professionals
The insights into students' linguistic, academic, and emotional experiences can inform curriculum design, advising systems, and intercultural support programmes.

• Higher education policymakers and institutional leaders
The evidence presented can guide the development of fairer, more sustainable, and more inclusive internationalisation strategies rooted in regional realities rather than imported Western models.

• Prospective international students and their families
The chapters offer a realistic portrait of the linguistic, academic, and cultural opportunities and challenges associated with studying in Asia's increasingly interconnected universities.

Kazakh Scientists Unveil the First Comprehensive Genomic Dataset of the Great Steppe

Aygerim Serikzhan, Asset Daniyarov, Askhat Molkenov, Ainur Akhmetova, Zhannur Abilova, Aigul Sharip, Dauren Yerezhepov, Saule Rakhimova, Ulan Kozhamkulov, Almagul Kushugulova, Sholpan Askarova, Dos Sarbassov, Ainur Akilzhanova, Ulykbek Kairov – Center for Life Sciences, National Laboratory Astana, NU



Researchers from Nazarbayev University's National Laboratory created the first large-scale, high-quality genotyping dataset of healthy Kazakh individuals a landmark contribution to global population genomics and biomedical research.
The study, published in Nature Scientific Data, presents a detailed analysis of genetic diversity across 224 participants representing Kazakhstan's major regions and tribal groups.

Read the Full Article

NAZARBAYEV UNIVERSITY
NATIONAL LABORATORY ASTANA

MAPPING THE GENETIC HERITAGE OF THE GREAT STEPPE

Despite the vast geographic and cultural significance of Central Asia, its populations remain largely underrepresented in global genome databases. To fill this gap, the NU team generated and analysed over 523,000 single nucleotide polymorphisms (SNPs) using the Illumina Infinium SNP Genotyping Array GSA MG v2 platform.

The resulting dataset provides an essential reference for population clustering, ancestry studies, and biomedical research revealing Kazakhstan's genetic profile as a unique bridge between East and West Eurasia.

"Our goal was to build a genomic foundation for precision medicine and population studies in Kazakhstan," says Prof. Ulykbek Kairov, the project's principal investigator. "The genetic landscape of Kazakhs reflects centuries of interaction along the Silk Road, and now we have data to explore that scientifically."

DISTINCTIVE FINDINGS WITH BIOMEDICAL RELEVANCE

The study identifies 74 population-specific variants with potential biomedical implications, particularly in genes linked to metabolism and drug response.

Among the notable examples:

- CYP4F2 (rs2108622) — a variant affecting the metabolism of anticoagulant drugs such as Warfarin, found at higher frequency in Kazakhs than in East Asians or Europeans, suggesting a need for population-tailored dosing.
- ADH7 (rs971074) — associated with alcohol metabolism and elevated risk of aerodigestive cancers, more prevalent in Kazakhs and possibly linked to national cancer statistics.
- APOE (rs7412) and CETP (rs5880) — variants influencing lipid metabolism, consistent with the historically high-fat diet of nomadic Kazakh populations.
- RREB1 (rs9379084) — linked to glucose regulation and type-2 diabetes susceptibility.

The research also found low levels of inbreeding and exceptionally low runs of homozygosity, confirming cultural practices that discourage consanguineous marriages. These genetic patterns could influence the prevalence of hereditary diseases and guide preventive health strategies in Kazakhstan.

AN OPEN RESOURCE FOR GLOBAL RESEARCH

All genotyping data are publicly available through the European Variation Archive (accession PRJEB89820) and associated code is accessible on GitHub: https://github.com/LabBandSB/KAZ-GWAS.
This open-access model invites collaboration and comparative analysis across Eurasia and beyond.

"This dataset positions Kazakhstan within the global genomic map," notes Dr. Dos Sarbassov, co-author and project supervisor. "It will help develop population-specific healthcare solutions and strengthen international cooperation in genomics."

Research was conducted by scientists from the Center for Life Sciences at National Laboratory Astana, with collaboration from L.N. Gumilyev Eurasian National University and support from international genomic databases.

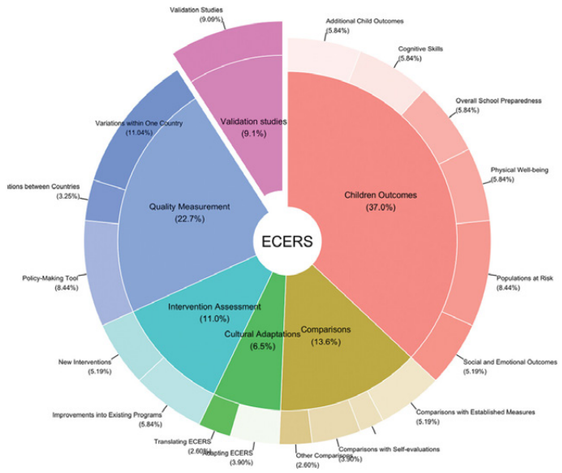
Mapping Global Evidence on ECERS: How Quality in Early Childhood Education Is Assessed Worldwide

Ainur Alpys, Central Asian Research Center for Education Innovation and Transformation (CARCEIT)
Daniel Hernández-Torrano, Graduate School of Education, Nazarbayev University

Scoping Review of the Early Childhood Environment Rating Scale (ECERS)
Published online: 12 November 2025 in Early Education and Development (Q1 journal)
Authors: Ainur Alpys, Daniel Hernández-Torrano

Read the article

GRADUATE SCHOOL OF EDUCATION



WHY THIS RESEARCH MATTERS

High-quality early childhood education and care (ECEC) is foundational for children's cognitive, social, and emotional development. The Early Childhood Environment Rating Scale (ECERS) is one of the most widely used tools worldwide for evaluating quality in preschool settings. Despite its global reach, evidence on how ECERS is applied, adapted, and validated across contexts has remained fragmented. This study provides the first comprehensive scoping review of ECERS research, systematically mapping two decades of global evidence.

WHAT WAS DONE

- Design: Scoping review following PRISMA-ScR guidelines
- Data source: Scopus-indexed journal articles
- Coverage: 154 empirical studies (2000–2023), across 40+ countries
- Focus: Applications and validation of ECERS and its major versions (ECERS, ECERS-R, ECERS-3, ECERS-E, and culturally adapted forms)

KEY FINDINGS

- Five dominant uses of ECERS emerged:
- Child outcomes research – linking classroom quality to cognitive, social-emotional, physical, and school-readiness outcomes (37%)
- Quality assessment and monitoring profiling strengths and gaps within and across countries (22.7%)
- Comparative studies – triangulating ECERS with tools such as CLASS, SSTEW, and national quality frameworks (13.6%)
- Intervention evaluation – tracking quality improvements before and after reforms or training programs (11%)
- Cultural adaptation and translation – adjusting ECERS to local pedagogical norms and languages (6.5%)
- Only 9.1% of studies focused explicitly on validation, highlighting a relative gap in standardized psychometric evidence.

WHAT THE REVIEW REVEALS

- ECERS is globally influential but used in highly diverse ways
- Research largely prioritizes academic and school-readiness outcomes, with limited attention to children's psychological well-being
- Cross-cultural use often requires adaptation, as some ECERS indicators reflect Western pedagogical assumptions
- Moderate correlations with other tools suggest ECERS captures environmental and structural quality, but not the full spectrum of relational and emotional dimensions

IMPLICATIONS FOR PRACTICE AND POLICY

For practitioners: ECERS works best when combined with complementary tools to capture interaction quality and emotional climate

For policymakers: ECERS informed profiles can guide quality improvement, but local validation and contextual calibration are essential

For researchers: There is a strong need for standardized validation protocols, measurement invariance testing, and integrated multi-tool frameworks

LOOKING AHEAD

The review calls for a shift from treating ECERS as a fixed benchmark toward using it as a flexible, context-sensitive framework. Future research should expand into children's emotional well-being, develop clearer crosswalks with national standards, and strengthen the methodological foundations of ECERS validation.

Magnetic Ring in the Milky Way Reveals Its Hidden Backbone

Dana Alina, School of Sciences and Humanities

SCHOOL OF SCIENCES AND HUMANITIES

A new study led by Dr. Dana Alina (Nazarbayev University), with key contributions from NU researchers Adel Umirbayeva, Alua Mukhash, and Danial Zhumagayir, has produced the most detailed magnetic field map of the ring-shaped molecular cloud G111, revealing that magnetic fields and shock-driven compression were crucial in shaping and maintaining its unusual structure. Read more

"We realised that if we could map the magnetic field inside and around this ring in detail, it could act like a fossil record of the forces that shaped it," *says Dr Dana Alina, lead author of the study and astrophysicist at Nazarbayev University's School of Sciences and Humanities.*

READING MAGNETISM FROM LIGHT AND MOTION

Magnetic fields in space cannot be seen directly, but they do leave fingerprints in light and in the motion of gas.

To reconstruct the plane-of-the-sky magnetic field in and around G111, the team combined several complementary tracers:

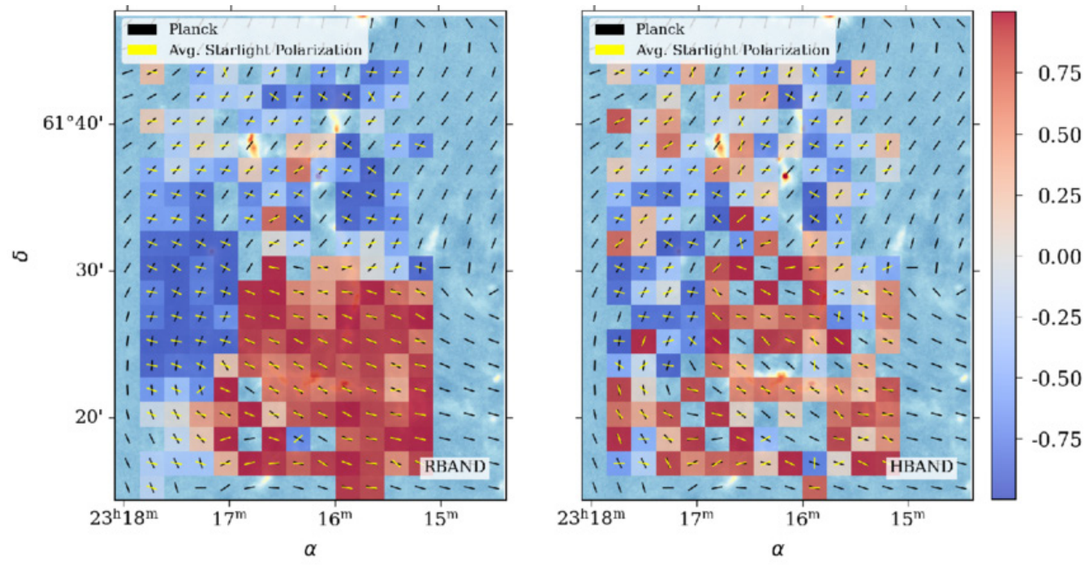
- Polarised sub-millimetre emission from interstellar dust recorded by the Planck satellite, which reveals large-scale magnetic orientations along the line of sight.
- Polarised starlight in visible and near-infrared bands from the Kanata 1.5-m telescope in Japan, combined with Gaia distances, to separate foreground dust from the magnetic field within G111 itself.
- High-sensitivity molecular gas observations of carbon monoxide isotopologues (^{12}CO, ^{13}CO, C^{18}O) from the IRAM 30-m telescope in Spain, used with a relatively new approach called the Velocity Gradients Technique (VGT).

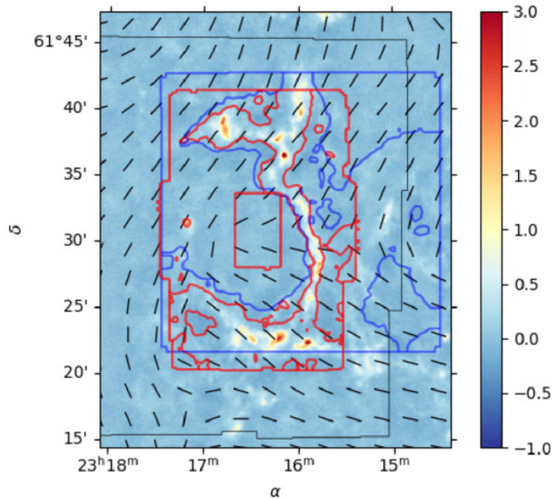
Dust grains tend to align their short axes with the local magnetic field, so their emission or the light they polarise encodes the field's orientation. The VGT, on the other hand, exploits the fact that turbulent eddies in magnetised gas are elongated along field lines. By analysing how the gas velocity changes across the cloud, the technique can infer magnetic directions in dense regions where polarisation is weak or confused.

A CURVED MAGNETIC "BACKBONE" THAT FOLLOWS THE RING

The resulting map showed something striking:
Across much of G111, the magnetic field is coherent yet curved, closely following the ring's filamentary structure rather than cutting across it.

- In the southern and eastern parts of the ring, the field lines derived from IRAM 30-m CO data bend gracefully along the dense JCMT-traced dust ridges.
- Near-infrared starlight polarisation and WISE 12 μm emission from warmer dust show the same curved pattern on slightly larger scales.





- Even in the more diffuse gas traced by ^{12}CO, the Velocity Gradients Technique reveals a consistent large-scale magnetic geometry that wraps around the ring.

This level of agreement across independent tracers and density regimes indicates that magnetic forces have remained ordered throughout the cloud's evolution, resisting the tendency of turbulence and gravity to twist and tangle the field.

"The magnetic field behaves like a flexible but resilient backbone," notes Dr Alina. "It seems to have guided the gas flows during the formation of the ring and helped preserve its symmetry over time."

A RARE LABORATORY FOR MAGNETIC FIELDS AND STAR FORMATION

This makes G111 a rare laboratory for testing theories of molecular cloud formation, feedback and magnetic regulation of star formation.

The work also showcases the power of combining:

- space-based all-sky surveys (Planck, WISE, Gaia),
- targeted ground-based polarimetry and spectroscopy (Kanata, IRAM 30-m, TRAO), and
- advanced analysis methods such as the Velocity Gradients Technique.

"Our study demonstrates that to really understand how stars form, we have to consider not only gravity and turbulence, but also magnetic fields and feedback, all at once," says Dr Alina. "G111 gives us a unique, three-dimensional case study of how these ingredients interact."

WHAT SHAPED THE RING? THE MYSTERY CONTINUES

Despite the newly revealed magnetic blueprint, the ultimate origin of the G111 ring remains open.

Was it inflated by a powerful stellar wind, carved by the expanding shell of a supernova, or assembled gradually by large-scale turbulent flows and shear? Each possibility leaves subtler signatures in the gas chemistry, shock tracers and fine-scale kinematics that current data only begin to probe.

The team's next steps include:

- using additional molecular tracers (such as SiO and CS) that are sensitive to shocks,
- running numerical magnetohydrodynamic simulations tailored to G111, and
- pursuing higher-resolution polarimetric and spectroscopic observations to zoom in on individual clumps and filaments.

By comparing these future datasets with the magnetic map presented in the new study, the researchers hope to finally reconstruct the full formation history of this enigmatic ring.

Until then, G111 stands as a striking demonstration that even in the turbulent interstellar medium, magnetic fields can impose order, quietly sculpting the clouds that will eventually collapse into new generations of stars.

FIGURE CAPTION

Magnetic field map of G111.
Segments show magnetic orientations inferred from multiple techniques overlaid on WISE 8–12 μm emission. Black contours trace cold, dense dust. Pink segments (IRAM CO + VGT) follow the cold ridge on the eastern side. Red segments (near-IR starlight polarisation) trace the magnetic field associated with warmer dust highlighted by the green contour. Together they reveal a coherent ring-like magnetic structure enveloping G111.

Nation-Building in Kazakhstan: Institutions, Identity and the Foundations of Well-being

Dina Sharipova, Associate Professor, Vice-Dean for Research, Graduate School of Public Policy, Nazarbayev University

Happiness in the steppe: exploring the connection between security and well-being in Kazakhstan

Dina Sharipova, Associate Professor, Graduate School of Public Policy
Alma Kudebayeva, Assistant Professor, Department of Economics, KIMEP

Security and wellbeing are deeply interconnected: individuals cannot experience happiness without feeling safe. In this study, the authors analyze how subjective wellbeing (SWB) defined by Veenhoven (1991) as the degree to which people evaluate the quality of their lives positively changed in Kazakhstan between 2018 and 2021, and how shifts in perceived security influenced this change.

KEY FINDINGS

Using nationally representative Household Budget Survey data, the study shows that:

- Subjective wellbeing increased in Kazakhstan during 2018–2021.
- Improved perceptions of security including protection from physical assault, violence, theft, and fraud are strongly associated with rising wellbeing.
- Security perceptions are among the strongest predictors of changes in wellbeing across the country.
- Regions that later faced the 2022 unrest already exhibited lower perceived security and lower life satisfaction, suggesting early signals of emerging social tensions.

WHY THIS MATTERS

The study underscores that security is not a background condition it is a core driver of life satisfaction, stability, and social resilience.

Fluctuations in perceived safety shape not only personal wellbeing but also:

- Trust in institutions
- Sense of fairness and future prospects
- Vulnerability to protests and instability

The findings highlight that strengthening citizens' sense of security is essential for preventing social tension and sustaining long-term societal wellbeing.

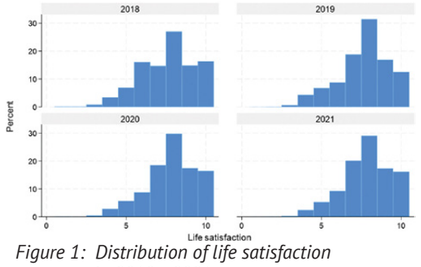


Figure 1: Distribution of life satisfaction in 2018 –2021.

Changes in Social Assistance Policies and Subjective Well-Being: Lessons from Kazakhstan

Alma Kudebayeva, Assistant Professor, Department of Economics, KIMEP
Dina Sharipova, Associate Professor, Graduate School of Public Policy
Zhongwei Xing, Food and Agriculture Organization of the United Nations

HOW POLICY SHIFTS AFFECT EVERYDAY WELLBEING

This study examines how rapid and frequent changes in Kazakhstan's targeted social assistance between 2018–2020 affected subjective wellbeing an aspect often overlooked in assessments of post-Soviet welfare reforms.

KEY FINDINGS

- Expanded social assistance temporarily improved financial conditions for low-income households.
- However, frequent and abrupt policy changes generated: Confusion; Uncertainty; Perceptions of unfairness; Lower trust in state institutions
- Satisfaction was higher among recipients who experienced stable, predictable support and clear communication.
- Wellbeing declined among those facing irregular payments, changing eligibility, or administrative barriers.

IMPLICATIONS

The study shows that social assistance policies shape much more than income they affect people's sense of: Stability; Predictability; Fairness.

These psychological factors are critical for overall wellbeing and for the perceived legitimacy of social policy.

New Political Leadership, Plus Ça Change? State–Civil Society Relations in Central Asia

Dina Sharipova, Associate Professor, Graduate School of Public Policy
Colin Knox, Adjunct Professor, Graduate School of Public Policy
Bakhytzhan Kurmanov, Associate Professor, University of Central Asia, Graduate School of Development

The article investigates whether new political leadership in Central Asia has reshaped state–civil society relations, comparing the contrasting trajectories of Kazakhstan and Kyrgyzstan.

KEY INSIGHTS

- **Kyrgyzstan:** A more pluralistic environment with higher civic autonomy, shaped by political competition and repeated regime changes.
- **Kazakhstan:** Strong vertical control maintained through state-led consultative mechanisms; civic participation remains regulated and largely symbolic.

While reform rhetoric emphasizes openness, Kazakhstan's model remains a state-managed framework, integrating NGOs within predefined boundaries.

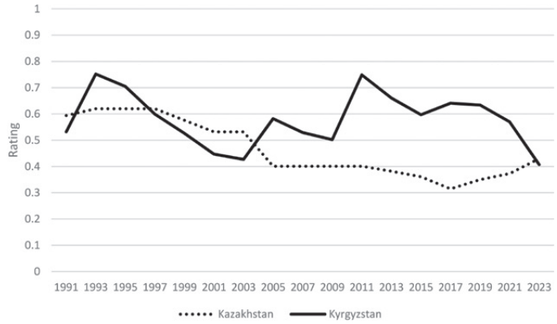


Figure 1: Core Civil Society Index trends: Kazakhstan and Kyrgyzstan
Source: Varieties of Democracies database (2024)

In Search for Kazakhstani Identity: Societal Perceptions of Kazakhstan's Nation-Building

Aigul Sadvokassova, Deputy Director of the Institute of Applied Ethno-Political Research in Astana
Aziz Burkhanov, Associate Professor, Graduate School of Public Policy
Dina Sharipova, Associate Professor, Graduate School of Public Policy

This study explores how Kazakhstanis perceive civic and ethnic identity within the context of the country's evolving nation-building agenda.

METHODOLOGY

- 4,000-respondent nationwide survey conducted in 2023
- In-depth interviews across multiple regions
- Cross-comparison with a 2016 survey (N=1,600) provides rare longitudinal insight

KEY FINDINGS

- Significant shifts have occurred in how citizens understand belonging, national identity, and the relationship between civic and ethnic elements.
- Comparative analysis reveals evolving dynamics in:
  - Civic nation-building
  - Ethnic identity markers
  - Interplay between state policies and societal perceptions

Table 9. Have you encountered discrimination for not knowing Kazakh language?

	Kazakh	Russian	Uzbek	Ukrainian	Uyghur	German	Tatar	Azeri	Korean	Tajik	Dungan	Chechen
Very often	3.4%	4.9%	1.3%	1.3%	3.1%	.6%	.6%	.6%	3.1%	1.9%	2.5%	.6%
Often	4.7%	10.3%	1.3%	2.5%	8.8%	1.3%	3.8%	.6%	8.1%	9.4%	10.0%	1.3%
Seldom	9.4%	14.5%	2.5%	7.5%	3.8%	7.5%	7.5%	.6%	16.3%	5.6%	10.6%	8.1%
Very seldom	10.3%	15.5%	8.8%	13.8%	5.0%	16.3%	13.8%	15.6%	21.9%	10.0%	17.5%	13.8%
Never	67.7%	49.8%	76.3%	72.5%	63.1%	71.9%	72.5%	66.9%	43.1%	63.8%	48.8%	74.4%
No answer	4.4%	5.0%	10.0%	2.5%	16.3%	2.5%	1.9%	15.6%	7.5%	9.4%	10.6%	1.9%

Source: Authors' original survey, *N* = 4000, 2023.

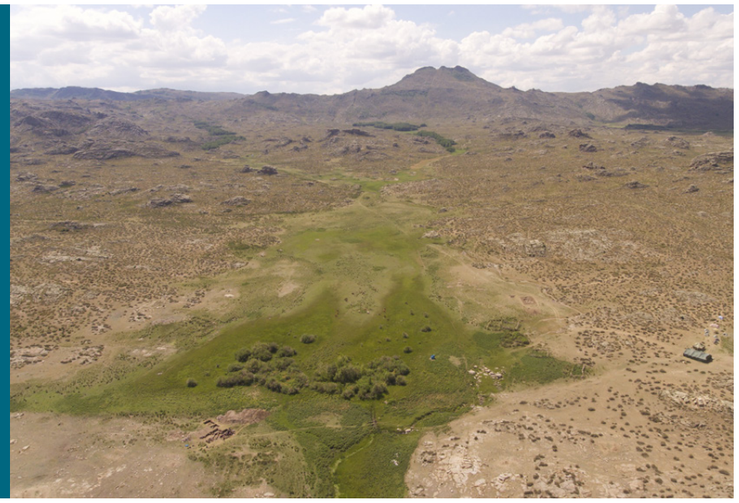
Scientists reveal 7500-year-old genetic legacy of Kazakhstan's earliest human burial

Paula Doumani Dupuy, Associate professor, School of Sciences and Humanities, Department of Sociology and Anthropology, Nazarbayev University

SCHOOL OF SCIENCES AND HUMANITIES

A groundbreaking study published in Science Advances (Scopus 96%) has revealed the oldest human genomes ever sequenced from Kazakhstan, shedding new light on the population history of prehistoric Inner Asia. Led by Associate Professor Paula Dupuy (Nazarbayev University) alongside the Max Planck Institute for Evolutionary Anthropology and an international team of collaborators, the research analyzed 21 ancient individuals from the multiperiod archaeological site of Koken in the Upper Irtysh River basin.

The results illuminate long-hidden patterns of kinship, mobility, and population structure among Inner Asian hunter-gatherers, while also uncovering the genetic legacy carried by later Bronze Age pastoralists. Read the article.



UNCOVERING A UNIQUE NEOLITHIC BURIAL: TWO RELATIVES, TWO ANCESTRIES

The early Neolithic burial at Koken contained the remains of two males, who despite being second-degree paternal relatives (uncle–nephew or half-brothers) carried distinctly different genetic profiles:

- One individual displayed higher Ancient North Eurasian (ANE) ancestry.
- The other showed stronger links to Ancient Paleo-Siberian (APS) groups.

This unexpected contrast demonstrates that even closely related hunter-gatherers in prehistoric Inner Asia formed part of a highly structured and genetically diverse population landscape.

The burial itself tells a parallel story. One individual was interred without his head, the other without his body, indicating a ritual practice of reopening graves and relocating skeletal elements possibly to honor deceased relatives or maintain symbolic kinship ties over time.

RIVERS AS GENETIC BOUNDARIES

Comparative genome-wide analyses across Siberia and northern Kazakhstan revealed four major hunter-gatherer population clusters, each associated with river systems such as the Ob, Irtysh, Ishim, and Tobol.

These findings suggest that river valleys shaped prehistoric social networks, limiting or directing movement and interaction.

Rivers acted not only as ecological corridors but also as long-lasting genetic boundaries, structuring human populations across Inner Asia for millennia.

BRONZE AGE PASTORALISTS: UNIFIED YET LOCALLY ROOTED

The team also analyzed 19 Middle–Late Bronze Age (1800–1400 BCE) pastoralists from Koken.

Most individuals show clear affinities with Andronovo-associated steppe groups, yet two stand out as genetic outliers, recording two separate admixture events:

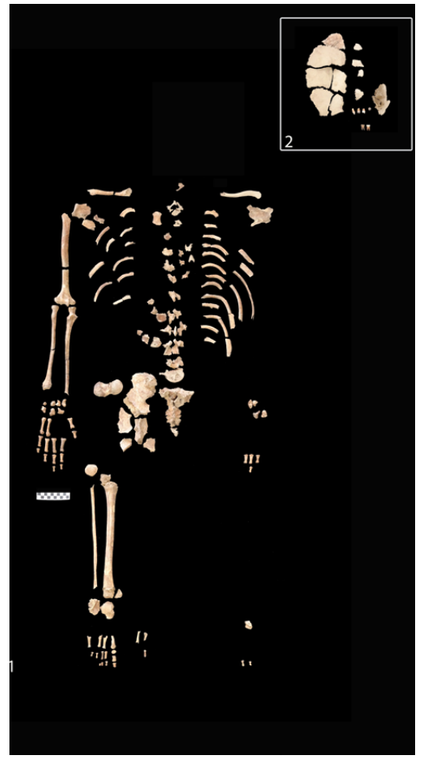
- One individual carries ancestry from Western Siberian hunter-gatherers.
- Another shows genetic influence from the Altai–Yenisei hunter-gatherer region.

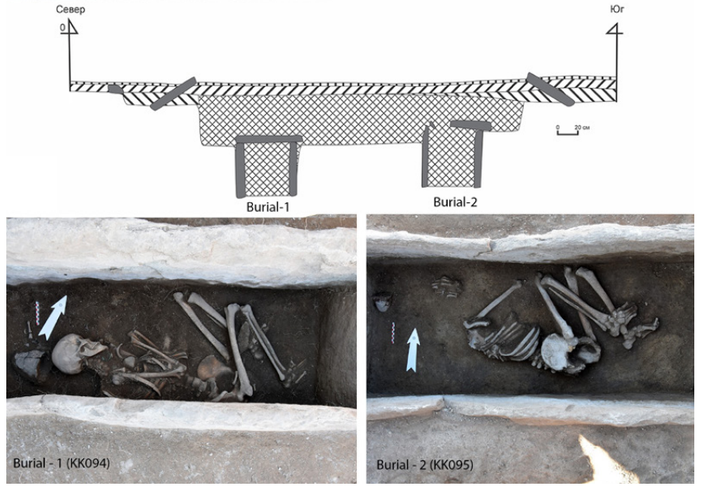
These results reveal that the spread of pastoralism across the Eurasian Steppe involved complex, small-scale integration of local forager groups, rather than straightforward population replacement.

BROADER SIGNIFICANCE: REWRITING INNER ASIA'S HUMAN STORY

The Koken genomes offer unprecedented insights into the deep population history of the Eurasian Steppe:

- Early Inner Asia hosted multiple distinct hunter-gatherer groups, each shaped by local geography and mobility patterns.
- These groups contributed genetic ancestry to later Bronze Age pastoralists.
- Diverse genetic and economic backgrounds did not prevent cultural integration or participation in steppe societies.





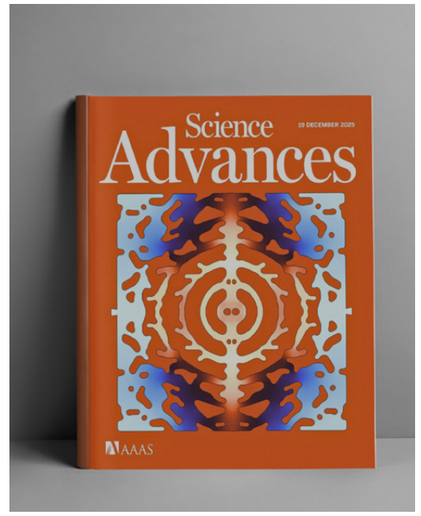


Figure Captions:
Figure 1: Aerial view of the Koken archaeological site, eastern Kazakhstan
Figure 2: Two Neolithic skeletons of paternal 2nd degree relatives from Koken
Figure 3: Bronze Age buried female with aDNA from pastoralist and hunter-gatherer admixture

Full citation

Haechan Gill, Madina Seidualy, Juhyeon Lee, Jiyoung Lee, Hyungmin Moon, Antonia Walter, Raffaela Angelina Bianco, Arman Kurmangaliev, Erbolat Rakhmankulov, Zainolla Samashev, Azat Aitkali, Galymzhan Kiyasbek, Zhuldyz Tashmanbetova, Aidyn Zhuniskhanov, Johannes Krause, Taylor Hermes, Maxat Zhabagin, Paula Doumani Dupuy, Christina Warinner, Choongwon Jeong. ***Ancient genomes from eastern Kazakhstan reveal dynamic genetic legacy of Inner Eurasian hunter-gatherers. Science Advances 11(42), eadw8219.***

"The Koken humans are exceptional components of Kazakhstani heritage with broad scientific value for studies of all humankind. Nowadays we can retrieve information about our shared history at a level of detail never thought possible by the forebearers of archaeology," the authors note.

NU Early-Career Researchers Reveal the Region's Hidden Grievances

Bimal Adhikari, Assistant Professor, School of Sciences and Humanities
Assem Bazarbek, MPP student, Graduate School of Public Policy
Madina Shakar, co-author and collaborator

Early-career researchers from Nazarbayev University examine why people in Central Asia risk protesting under authoritarian rule, showing that perceived economic injustice "relative deprivation" is the main driver of public uprisings across the region.

Post-Soviet Protests: The Causes and Consequences of Public Uprisings in Central Asia. Journal of Eurasian Studies, 16(2), 290-304.

Read the Full Article

WHY STUDY PROTESTS IN CENTRAL ASIA?

Public protests in Central Asia are relatively infrequent, yet when they erupt, they can reshape political trajectories sometimes with tragic consequences. Events such as Kazakhstan's "Bloody January" (2022), the Andijon tragedy in Uzbekistan, and clashes in Tajikistan's Gorno-Badakhshan show that uprisings can lead to rapid power shifts, human rights violations, and dramatic changes in state responses. Despite their importance, little research has examined why ordinary Central Asians take the risk of joining collective action.

Published in the Journal of Eurasian Studies, the article compiles and analyzes protest events across Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan from 1991–2020. Drawing on the Mass Mobilization Data Project, the authors examine who protested, what they demanded, and how governments responded. They connect these patterns to several leading theories of contention, including relative deprivation, framing, resource mobilization, collective action, and political opportunity structures.

KEY FINDINGS:

Relative deprivation as the dominant trigger. The study finds that perceived economic injustice frustration over unmet expectations related to income, employment, or social protection is the most consistent catalyst for protest across the region.

Key regional distinctions include:

- Kyrgyzstan: more politically oriented protests, often tied to elite competition and elections
- Kazakhstan & Uzbekistan: mobilization is more frequently rooted in everyday economic issues and broken social or economic promises
- Tajikistan & Turkmenistan: severe repression keeps protest numbers low, but discontent emerges around economic hardship, regional identity, and policing practices

Consequences and policy relevance

Most events are local and non-violent. However, when authorities use force, protests can escalate into lethal confrontations. The authors argue that addressing economic grievances early through fairer distribution, social protection, and inclusive growth can reduce the likelihood of future unrest.

Over time, policies that lessen relative deprivation may not only stabilize political systems but also create preconditions for gradual democratic deepening, in line with modernization theory.

What this means for Nazarbayev University

The project highlights NU's growing role in theory-driven, data-rich research on the politics of Central Asia. By combining global protest datasets with fine-grained regional knowledge, the authors show how cases from Central Asia can inform broader debates on inequality, authoritarian resilience, and contentious politics worldwide.

"Although these countries share a common Soviet background and similar historical and cultural roots, there remain significant discrepancies in each state's intersubjective understanding of different issues, the ways governments respond to public uprisings, and the way individuals react to those responses."

Physics-Informed AI for Subsurface Modeling: Bridging Emulsion Flooding and Carbon Storage

Omarkhan Samarkanov, School of Mining and Geosciences
Masoud Riazi, School of Mining and Geosciences
Presented at: 6th EAGE Global Energy Transition Conference & Exhibition (GET 2025), Rotterdam, Netherlands

Researchers at Nazarbayev University have developed a novel **Physics-Informed Neural Network (PINN)** framework to model complex fluid flows in porous media.

This work, presented within the «Carbon Capture & Storage» and student tracks at the prestigious EAGE GET 2025, addresses a critical bottleneck in reservoir engineering: the high computational cost of simulating multiphase flow in heterogeneous reservoirs. DOI

THE CHALLENGE

Traditional numerical simulators (such as Finite Volume methods) require dividing a reservoir into millions of grid cells to track fluid movement accurately. This approach is computationally expensive, especially when modeling complex substances like emulsions, which dynamically alter rock permeability as droplets become trapped in pores.

THE AI SOLUTION

The team, led by Prof. Masoud Riazi and Omarkhan Samarkanov, replaced the traditional grid with a mesh-free deep learning architecture that "knows" physics.

- **Physics-Embedded:** Unlike standard "black box" AI, this model embeds the physical laws of mass conservation and Darcy's law directly into the network's training process.
- **Heterogeneity Handling:** The model successfully predicts saturation profiles in both high-permeability "thief zones" and low-permeability zones, accurately capturing how emulsions divert flow to improve sweep efficiency.

KEY FINDINGS

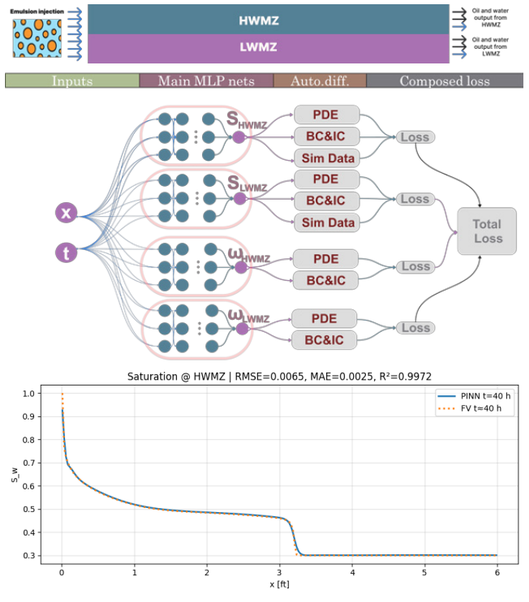
- **High Fidelity:** The PINN model successfully replicated complex Finite Volume (FV) benchmarks, proving that AI can accurately model mechanisms like pore clogging without numerical dispersion.
- **Speed & Scalability:** The differentiable nature of the model allows for rapid inference, paving the way for real-time "Digital Twins" of reservoir systems that are far faster than traditional supercomputing methods.

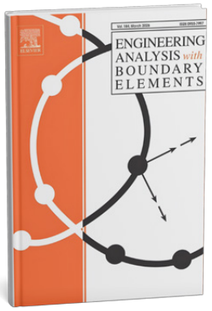
WHY IT MATTERS: FROM EOR TO CCS

While validated on Emulsion Flooding for Enhanced Oil Recovery (EOR), the team emphasizes that this technology is a bridge to green energy solutions. The underlying physics—multiphase transport, trapping mechanisms, and pressure management—are mathematically identical to those required for Carbon Capture and Storage (CCS).

Dual Application: This framework can be immediately adapted to model CO_2 plume migration and trapping in saline aquifers.

Strategic Impact: By providing fast and accurate simulation tools, this innovation supports the optimization of secure carbon sequestration sites a**nd geothermal reservoirs, contributing directly to the global energy transition.**





Designing the Future: AI, Graphene, and Electromagnetic Innovation at NU

Ravil Ashirmametov, 2nd-year Master's student, School of Engineering and Digital Sciences

Ravil Ashirmametov is a co-author of several Q1 journal publications that deliver strong, clearly measurable results in computational electromagnetics, machine-learning-enabled materials design, and graphene-based separation technologies. Below is a concise results-focused overview of each study.

1. Maximal Electromagnetic Coupling Between Arbitrary-Shaped Nanotubes

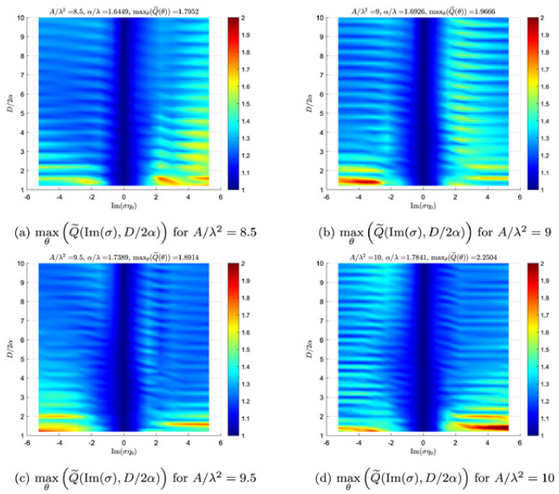
Engineering Analysis with Boundary Elements (2025). DOI

KEY RESULTS:

- Optimized nanotube cross-sections achieve electric-field enhancement exceeding 30× compared to conventional circular nanotubes.
- The enhanced coupling remains stable across a wide range of wave incidence angles and nanotube sizes, demonstrating strong robustness.
- Shape optimization proves to be a dominant design parameter, outperforming traditional tuning of excitation or material parameters.

IMPACT

The study establishes geometric optimization as a powerful route for boosting nanoscale electromagnetic performance, with direct implications for nanophotonics, sensing, electromagnetic gratings, and photonic metasurfaces.



(a) $\max_{\theta}\left(\widetilde{Q}(\mathrm{Im}(\sigma), D/2\alpha)\right)$ for $A/\lambda^2 = 8.5$ (b) $\max_{\theta}\left(\widetilde{Q}(\mathrm{Im}(\sigma), D/2\alpha)\right)$ for $A/\lambda^2 = 9$

(c) $\max_{\theta}\left(\widetilde{Q}(\mathrm{Im}(\sigma), D/2\alpha)\right)$ for $A/\lambda^2 = 9.5$ (d) $\max_{\theta}\left(\widetilde{Q}(\mathrm{Im}(\sigma), D/2\alpha)\right)$ for $A/\lambda^2 = 10$

Figure 3: Maxima of the normalized electric field concentration

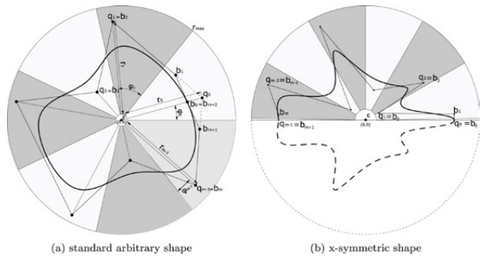
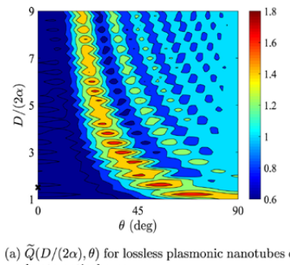
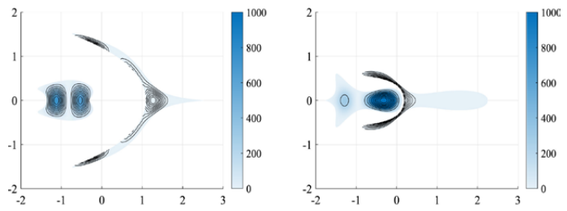


Figure 1: Parametric models employed in this work

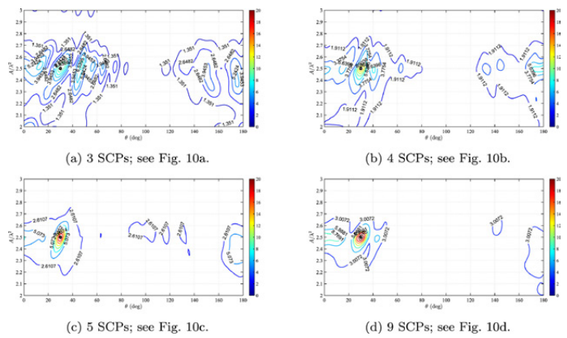


(a) $\widetilde{Q}(D/(2\alpha), \theta)$ for lossless plasmonic nanotubes of moderate optical area.



(b) 5 SCPs, $Q' = 87.56$. (c) 6 SCPs, $Q' = 182.90$.

Figure 2: Optimization results for a scenario where the respective circular nanotubes underperform



(a) 3 SCPs; see Fig. 10a. (b) 4 SCPs; see Fig. 10b.

(c) 5 SCPs; see Fig. 10c. (d) 9 SCPs; see Fig. 10d.

Figure 4: Performance robustness of optimized designs of Case II

2. Determining the Structure of Functionalized Graphene for Tailored Thermomechanical Properties Using ML

RSC Advances (2025). DOI

KEY RESULTS

- Machine-learning models predict Young's modulus, thermal conductivity, and maximum stress with high accuracy (R^2 > 0.9).
- Prediction errors remain extremely low, with MAPE below 1% in most cases.
- The ML-driven inverse design framework delivers up to 7 orders of magnitude speedup in property estimation compared to pure molecular dynamics simulations.
- Target graphene layouts with prescribed properties are identified up to 6 orders of magnitude faster, and validated through MD simulations.

IMPACT

This work demonstrates that ML can transform graphene design from a computationally prohibitive task into a fast, scalable, and accurate inverse-design process, enabling practical exploration of vast functionalization spaces.

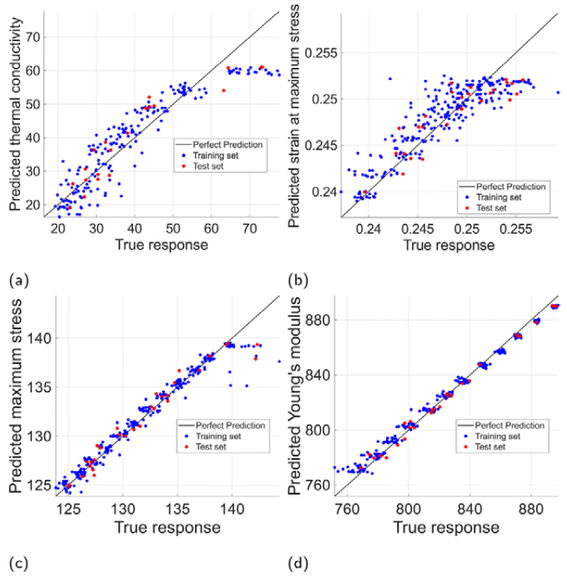


Figure 1: Optimization results for a scenario where the respective circular nanotubes underperform

3. Graphene-Based Membranes for Water Desalination and Gas Separation: MD–ML Review

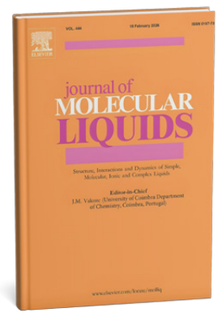
Journal of Molecular Liquids (2025). DOI

KEY RESULTS

- Provides a systematic mapping of structure–performance relationships across graphene membrane studies.
- Demonstrates how ML models complement MD simulations by accelerating property prediction and overcoming permeability–selectivity trade-offs.
- Introduces a unified MD–ML workflow linking simulation data, model training, and membrane optimization.
- Identifies emerging directions, including physics-informed ML and scalable data-driven membrane design.

IMPACT

The review offers a clear computational roadmap for advancing clean water and low-carbon gas separation technologies, positioning MD–ML integration as a cornerstone of next-generation membrane research.



OVERALL RESEARCH SIGNIFICANCE

Across these three publications, Ravil Ashirmametov's work delivers quantifiable performance gains, massive computational speedups, and transferable design frameworks, highlighting the strong contribution of NU master's students to internationally competitive, high-impact research in nanotechnology and computational engineering.

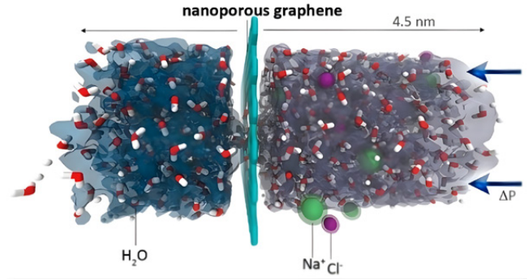


Figure 1: System configuration simulated in the work of Cohen-Tanugi and Grossman

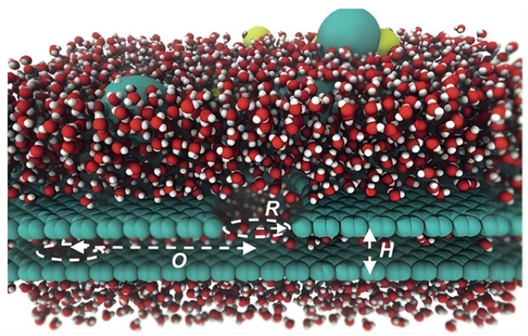


Figure 2: Multilayer graphene membrane configuration in the study of Cohen-Tanugi et al. The labeled parameters, pore radius (R), offset (O), and interlayer spacing (H), represent key geometric variables that control molecular transport, flux, and selectivity in membrane performance.

SPOTLIGHT ON SUCCESS

From NU Lab to National Recognition: Dr. Gulnur Kalimuldina and MiraiTech's Success Story

In 2025, Mirai Tech – a deep-tech startup born at Nazarbayev University received national recognition when President Kassym-Jomart Tokayev presented it with the Best Science AI Project of Kazakhstan award at the AI-SANA "Generative Nation" competition. The project stands at the intersection of advanced materials science, biomechanics, and artificial intelligence, showcasing how laboratory research at NU can transform into high-impact solutions for healthcare and sports.

DR. GULNUR KALIMULDINA
Associate Professor, Vice-Dean for Research, Graduate School of Public Policy

RESEARCH METRICS:
- 1242 citations
- h-index: 18

ACADEMIC BACKGROUND & ROLES
- PhD, Tokyo Institute of Technology (2017)
- Assistant Professor, SEDS, Nazarbayev University
- Postdoctoral Scholar, Mechanical & Aerospace Engineering, NU (2019–2022)
- Co-founder of MiraiTech, a deep-tech startup translating advanced materials research into real-world wearable and biomechanics solutions.

From Materials Research to Smart Technologies

The origins of MiraiTech trace back to Dr. Kalimuldina's pioneering work on triboelectric and piezoelectric nanogenerators materials that harvest energy from motion. Initially developed as self-powered sensors, these materials demonstrated an unexpected advantage: they provided highly sensitive biomechanical feedback.

This insight led to the development of **Mirai Smart Insoles,** a novel wearable technology that captures more than **20,000+ biomechanical data points** within minutes. Powered by nanogenerators and AI algorithms, the insoles:
- analyze gait symmetry and load distribution;
- detect early signs of injury risk;
- create individualized digital profiles;
- produce clear visual reports for coaches and clinicians.

Mirai Smart Insoles help to:
- *identify gait abnormalities and asymmetry before they become injuries;*
- *monitor rehabilitation progress over time with objective metrics;*
- *optimize training loads and technique in elite and youth sports;*
- *bring digital gait analysis into real-life settings from clinics and training centres to home use.*

"MiraiTech was born from years of scientific research at Nazarbayev University, where advanced materials science and artificial intelligence converge to create real-world impact"

— Dr. Gulnur Kalimuldina

mirai tech
Move beyond limits

Mirai Tech targets one of the key challenges in Kazakhstan and beyond: limited access to timely and objective rehabilitation diagnostics. In professional sports, injuries mean not only time away from the field, but also serious financial losses for clubs. In clinical practice, early detection of asymmetries and overload can dramatically improve recovery trajectories.

The startup has already conducted pilots with leading football clubs, including FC Astana and FC Tobol, and collaborates with rehabilitation clinics in Astana. Coaches and medical teams receive concise reports on each player's gait, load distribution, and recovery dynamics, enabling more informed decisions on training and return-to-play strategies.

DeepTech Entrepreneurship Powered by NU Ecosystem

MiraiTech's rapid growth has been catalyzed by active engagement in national and international accelerator programs:
- Winner, Founders Weekend – invitation to TechCrunch Disrupt
- Participant, Silkroad Innovation Hub Central Eurasia @ Silicon Valley
- Graduate, Silkway Accelerator by Astana Hub & Google for Startups

The startup secured:
- **USD 90,000** in early investment (Jas Ventures Limited)
- **USD 25,000** prize, Astana Hub Startup Battle
- **10 million KZT** grant, AI SANA competition

Science Behind the Startup

MIRAI TECH IS GROUNDED IN DR. KALIMULDINA'S EXTENSIVE RESEARCH PORTFOLIO:

AIoT-Enhanced Health Monitoring and Rehabilitation Using Biocompatible Triboelectric Sensors (2025–2027)
Development of flexible, biocompatible, self-powered triboelectric sensors integrated with AI to deliver real-time, personalized monitoring for advanced rehabilitation and smart healthcare.

Exchange Project between Soochow University and Nazarbayev University in New Energy Development Technology (2025–2026)
A Kazakhstan–China collaboration advancing next-generation energy technologies, supporting sustainable innovation and strengthening international research partnerships.

Integration of Self-Powered Triboelectric Phenomena in MEMS Sensors (2024–2026)
Integration of TENG principles into MEMS to create ultra-compact, self-powered vibration sensors, addressing the rising demand for autonomous, energy-efficient sensing in robotics, healthcare, and environmental monitoring.

Smart Robotic Grippers Integrated with Novel Triboelectric Sensors (2023–2025)
Creation of soft robotic grippers equipped with advanced self-charging triboelectric sensors, enabling precise object manipulation and accelerating the adoption and commercialization of smart robotics technologies in Kazakhstan.

HER EXPERTISE SPANS:
- energy harvesting materials (triboelectric and piezoelectric nanogenerators),
- self-powered sensing and self-charging systems,
- polymer and nanostructured materials, 2D materials, and energy storage,
- MEMS fabrication and microdevices for sensing and actuation.

Dr. Kalimuldina's team also holds patents on flexible wearable triboelectric and high-performance piezoelectric nanogenerators, illustrating a strong link between intellectual property and innovation-driven entrepreneurship.

Photo by DigitalBusiness.kz

From NU Innovation to Global Impact: MiraiTech and the UN Sustainable Development Goals

MIRAI TECH DIRECTLY SUPPORTS SEVERAL UN SUSTAINABLE DEVELOPMENT GOALS (SDGS) BY:

- contributing to Good Health and Well-being (SDG 3) through better rehabilitation and injury prevention;
- advancing Industry, Innovation and Infrastructure (SDG 9) via DeepTech manufacturing and AI-based diagnostics;
- supporting Partnerships for the Goals (SDG 17) through international collaborations with universities, clinics, accelerators and investors.

Looking Ahead: Toward a Global Rehabilitation Tech Platform

MIRAITECH'S NEXT STEPS REFLECT A BOLD, INTERNATIONAL VISION:

- **Expansion into Central Asia and the USA**
- **Integration into multiple professional sports, including basketball and hockey**
- **Consumer-market launch by 2026**
- **Development of a full ecosystem of wearables and AI platforms**

The long-term ambition is clear: to establish MiraiTech as a global leader in next-generation rehabilitation and sports technologies, extending NU's scientific influence far beyond Kazakhstan.

From Nanomaterials to National Impact:
The Scientific Journey of Prof. Zhumabay Bakenov

How Prof. Zhumabay Bakenov's Breakthroughs in Advanced Materials Are Shaping the Next Generation of Energy Technologies

Institute of Batteries

Zhumabay Bakenov,
PhD, Doctor of Engineering

ACADEMIC ROLES

- Founding General Director, Institute of New Materials and Energy Technologies (INMET), Nazarbayev University
- Vice Provost for Research and Innovation, Nazarbayev University
- Founder, Institute of Batteries
- Academician, National Academy of Sciences of Kazakhstan
- Honored Figure in Science and Technology of the Republic of Kazakhstan
- Professor, School of Engineering and Digital Sciences, Department of Chemical and Materials Engineering

RESEARCH METRICS:
- Citations 9041
- h-index: 48
- ORCID: Link

AWARDS & DISTINCTIONS

- Best Researcher Award, Government of Kazakhstan
- Web of Science Award "Leader of Science" (in nanotechnology)
- Scopus "Researcher of the Year"
- Springer Nature "Springer Nature Top Authors"
- State Medal of Kazakhstan "For Excellence in Labour"
- National Award for the Best Patent of the Year "Shapagat"
- Marie Curie Fellow, Medal of the Government of Kazakhstan "For Contribution to Development of Science in Kazakhstan"
- Award of Ceramic Society of Japan
- "Science Leader" by the Thomson Reuters – National Center for Scientific and Technical Information
- PI of Project from Kazakhstan at the National Pavilion at EXPO-2017
- Organizing Committee and Chairman of the INESS

National Recognition

Prof. Bakenov achieved a historic milestone: on 12 April 2025, he became the first-ever recipient of the national title "Honored Worker of Science and Technology of the Republic of Kazakhstan," awarded personally by the President Kassym-Zhomart Tokayev. This recognition marks more than three decades of scientific leadership, breakthrough discoveries in functional nanomaterials, and a sustained contribution to national research capacity.

RESEARCH LABORATORIES

Under the leadership of Professor Zhumabay Bakenov, CEAMS has grown into one of Nazarbayev University's flagship research centers in clean energy and advanced materials.:

LABORATORY OF ENERGY STORAGE SYSTEMS
LESS develops advanced materials and next-generation battery technologies, from lithium-ion and sodium-ion systems to flexible and micro-scale devices. The lab focuses on functional nanomaterials, high-energy-density storage for renewable grids and green transport, and computational modeling of electrochemical systems.

LABORATORY OF ENVIRONMENTAL SYSTEMS
ES focuses on sustainable solutions in environmental protection and energy systems, advancing research on contaminant fate, carbon capture and sequestration, water and wastewater treatment, renewable energy, and air quality management. The laboratory operates advanced testbeds for contaminant analysis, CO_2 sequestration, water treatment, renewable energy, and environmental modeling.

KEY RESEARCH AREAS:

Sustainable Water Treatment & Environmental Catalysis: Development of advanced catalysts and technologies for removing heavy metals and anionic pollutants.

CO_2 Conversion & Sequestration: Assessment of CCUS technologies, LCA protocols, and hydrogen production pathways for Kazakhstan's low-carbon transition.

Environmental Risk & Life Cycle Assessment: Evaluating environmental impacts of infrastructure and contamination to inform policy and sustainable resource management.

GLOBAL EXPERTISE

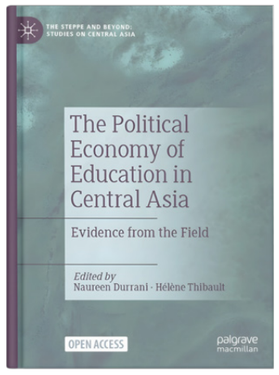
東京工業大学 Tokyo Institute of Technology
UNIVERSITY OF WATERLOO
NAZARBAYEV UNIVERSITY

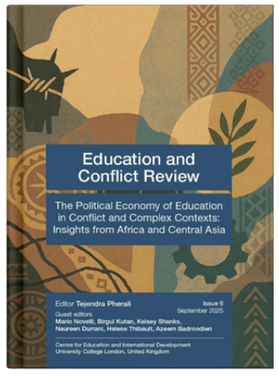
RESEARCH EXPERIENCE IN:
- Tokyo Institute of Technology (Japan)
- University of Waterloo (Canada)
- Nazarbayev University (Kazakhstan)

NU Alumni Secure British Academy–Leverhulme Research Grant

We are delighted to announce that Dr Diana Toimbek (main applicant) and Dr Fariza Tolesh (co-applicant) have been awarded a British Academy–Leverhulme Small Research Grant (SRG25\252162). Their project, Sentiments in Transition: Public Perceptions of Socio-Economic Change in Kazakhstan amid the Russia–Ukraine War, has been officially listed by the British Academy.

The British Academy





Dr Fariza Tolesh holds a PhD in Education from the Graduate School of Education (GSE) and currently works as an instructor in the Writing Centre of School of Sciences and Humanities, NU, and Dr Diana Toimbek completed her MSc in Educational Leadership, also at GSE and is currently a lecturer at the School of Applied Social and Policy Sciences, Ulster University, Belfast. The two first met as fellows of the Political Economy of Education Research (PEER) Network, a three-year initiative led by Ulster University, the University of Cape Town, Nazarbayev University, and the University of Sussex. Funded through the Global Challenges Research Fund (GCRF), the Network aimed to advance rigorous political economy analysis of education in conflict-affected contexts by fostering collaboration between academics, policymakers, and practitioners.

In 2024, NU hosted the launch of the jointly authored volume The Political Economy of Education in Central Asia: Evidence from the Field, edited by Naureen Durrani and Helen Thibault and published by Springer Nature. Book link.

Both Fariza and Diana contributed chapters to the volume:

- Tolesh, F. (2024). Access to Education and Labour Market Participation of Ethnic Minorities in Kazakhstan: The Case of Uzbeks.
- Toimbek, D. (2024). Fighting Illiteracy and Political Enlightenment: Soviet Educational Policies in the 1920s.

Following three years of collaborative work and training as PEER Network fellows, Fariza and Diana, together with fellow researchers Z. Bekzhanova and Z. Khalilova, also published a follow-up article: **Contextualizing data collection in Central Asia: insights from local researchers' experiences.**

In addition, Dr Tolesh authored another publication with colleagues from the African Hub in the special issue The Political Economy of Education in Conflict and Complex Contexts: Insights from Africa and Central Asia (UCL):
Tolesh, F. (2025). Nation-building and language policies: The perspectives of ethnic Uzbeks on the Latinisation project in Kazakhstan, Education and Conflict Review, 6, 39–46.

PEER Network
Political Economy of Education Research

We hope this new grant will open another chapter of productive, collaborative, and meaningful research for both scholars, just as impactful as the PEER project has been.

Advancing Sustainable Separation Technologies on the Global Stage

Best Poster Award at ICPCNB-2025

Zhaksylyk Suiindik, a PhD student at the MEET Lab, has been recognised for outstanding research contributions in advanced functional materials and membrane technologies.

Zhaksylyk's work on developing durable superhydrophobic textiles for efficient oil/water separation earned him the Best Poster Award at the Springer Nature / International Conference on Polymers, Composites, Nanocomposites & Biocomposites (ICPCNB-2025), held on 2–4 October 2025 at Satbayev University, Almaty.

Suiindik's award-winning poster, "**Facile Fabrication of Durable Superhydrophobic Felt Textiles Using Ionic Liquid for Efficient Oil/Water Separation,"** showcases an innovative strategy for producing robust, water-repellent textiles capable of highly efficient oil–water separation. His findings present promising pathways for advancing sustainable separation technologies with direct relevance to environmental remediation and industrial applications.

The MEET Lab, led by Professor Irshad Kammakakam, made a strong scientific impact at the conference with four oral presentations, three poster presentations, and a plenary lecture delivered by Prof. Kammakakam. The team's contributions showcased Nazarbayev University's growing expertise in advanced membrane science and ionic-mediated materials.

International Conference Presentation in Türkiye

In addition to his success in Kazakhstan, Zhaksylyk also represented Nazarbayev University on an international stage at the 8th International Symposium on Membrane Technologies and Applications (MEMTEK 2025), held in İzmir, Türkiye.

At MEMTEK 2025, he presented the same poster on superhydrophobic felt textiles, receiving considerable academic interest for its potential in oil spill recovery, wastewater treatment, and industrial separation systems. Organized by the National Research Center on Membrane Technologies (MEMTEK) at Istanbul Technical University, this symposium is Türkiye's only scientific event dedicated exclusively to membrane science and technology, drawing leading researchers and industry specialists from around the world.

BEHIND THE RESEARCH

Behavioral and Systemic Drivers of Antimicrobial Resistance in Kazakhstan

INTERVIEW WITH:
DR. YULIYA SEMENOVA,
ZHANAR KOSHEROVA,
DARIGA ZHAZYKHBAYEVA

IMPACT & SCOPUS METRICS:
Citations: 2524
h-index: 25
Accepting PhD Students

ACTIVE PROJECTS:

Antimicrobial Resistance Study in Kazakhstan: Community Antibiotic Consumption and Resistance Rates

Antimicrobial Study in Kazakhstan: Hospital Antibiotic Consumption and Resistance Rates

AMR: Evidence-Based Practice and Policy to Improve Antibiotic Stewardship and Reduce Antimicrobial Resistance in Central Asia

Dr. Yuliya Semenova, Assistant Professor, Department of Clinical Sciences, School of Medicine, Nazarbayev University

Q1. Why is antimicrobial resistance emerging as one of the most critical global health threats today?
– Antimicrobial resistance (AMR) is often described as a "silent pandemic" because it grows slowly, invisibly, and with profound long-term consequences. If current trends continue, global mortality from AMR-related infections may exceed deaths from cancer and cardiovascular diseases by 2050.

Since 1984, no new class of antibiotics has been introduced. Developing new antibiotics costs about USD 1 billion and offers little commercial return due to short treatment courses. Meanwhile, bacteria continually adapt: they transmit resistance genes both vertically and horizontally through plasmids, allowing rapid spread not only within the same species but also between different species.

This combination of slow innovation and fast bacterial evolution places modern medicine at risk. Surgeries, transplantations, chemotherapy, and treatment of common infections may become unsafe without effective antibiotics.

Q2. What makes AMR particularly urgent in Kazakhstan today?
– Kazakhstan faces a mix of behavioural, cultural, and structural factors that accelerate resistance. Antibiotics are frequently purchased without prescription, despite existing legislation. Public awareness remains low: many people still believe antibiotics are appropriate for fever, colds, headaches, or back pain *(https://doi.org/10.3390/antibiotics13080718)*.

During the COVID-19 pandemic, self-medication surged; pharmacies reported unprecedented sales of antibiotics and antiviral drugs. Parents often pressure physicians to prescribe antibiotics "just in case," even for viral infections. Doctors face heavy time constraints during outpatient visits, making it difficult to counter misconceptions *(https://doi.org/10.1038/s41598-025-91216-4)*.

These patterns mirror broader regional challenges in post-Soviet health systems. A recent multinational review confirmed that AMR surveillance in Kazakhstan is still classified as local data collection rather than standardized national surveillance, limiting the ability to generate accurate national-level resistance trends *(https://doi.org/10.3390/antibiotics13121129, https://doi.org/10.3390/antibiotics14080749)*.

Q3. What does current research reveal about antibiotic and antiviral consumption in Kazakhstan?
– Using data from Viortis and SK-Pharmacy, we looked at how antivirals and antibiotics are being used across the country and found several worrying trends.

We use WHO AWaRe (ACCESS, WATCH, RESERVE) methodology that classifies antibiotics according to their potential to develop AMR in microorganisms. WHO recommends that ≥60% of antibiotic use should come from the ACCESS group. The early findings of our team on antibiotic consumption (https://doi.org/10.3390/antibiotics13121123, https://doi.org/10.3390/antibiotics14100963) revealed that in Kazakhstan:

WATCH antibiotics remain the most widely used across the country;
ACCESS antibiotics stay far below the WHO 60% target;
RESERVE antibiotic use is low but gradually increasing;

Primary care shows the biggest imbalance, with high WATCH use and declining ACCESS use.

Our national analysis on antiviral consumption also shows several worrisome trends: A confirmation of this information is provided in the article published in Scientific Reports (2025), https://doi.org/10.1038/s41598-025-05161-3

From 2017–2023, antiviral consumption grew by +10.24% annually.

Outpatient growth (+15.93%) was nearly three times higher than in hospitals.

After the onset of COVID-19 (Q3 2020), antiviral use increased by +0.977 DDD per 1,000 inhabitants/day, with 85% of the rise coming from community self-medication.

Concerningly, the largest spikes occurred in drugs not recommended for COVID-19 (e.g., valganciclovir, oseltamivir). Meanwhile, recommended antiviral treatments showed no significant change a sign of non-guideline prescribing and widespread self-treatment.

Forecasts to 2030 show community-sector expenditures reaching USD 38.5 million, while hospital spending will stabilize near USD 21.3 million, indicating growing dependence on household-level self-medication.

Q4. What national and regional initiatives are you leading to address AMR?
–Our team at Nazarbayev University is implementing a comprehensive AMR research agenda.

1. NATIONAL ANTIBIOTIC RESISTANCE MAPPING (2018–2024)

We analyze pathogen resistance across Kazakhstan in urinary, respiratory, bloodstream, and skin-and-soft-tissue infections. Representing the first large-scale, multi-year resistance dataset in Kazakhstan, these data will serve as the foundation for the country's first interactive AMR maps, helping clinicians make more informed, evidence-based treatment decisions aligned with regional susceptibility patterns.

2. NATIONAL ANTIBIOTIC CONSUMPTION MAPPING (COMMUNITY AND HOSPITAL) (2018-2024)

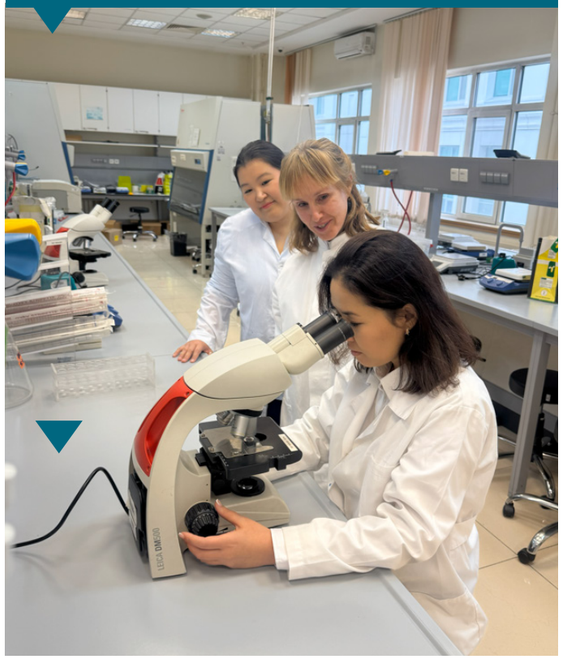
We also assess antibiotic consumption across regions of Kazakhstan at community and hospital levels, which will also be used for the interactive antimicrobial consumption maps. This map will help decision-making authorities to understand the consumption trends across regions and might be used as evidence for further policy interventions.

3.CENTRAL ASIAN COLLABORATION (KAZAKHSTAN, KYRGYZSTAN, UZBEKISTAN, TAJIKISTAN, TURKMENISTAN)

Within the framework of a joint Central Asian effort, we conducted several studies to capture the current state of AMR across Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan, and Turkmenistan. We conducted a survey among general practitioners and physician residents to assess their awareness, knowledge, and attitudes regarding antimicrobial resistance. The study covered respondents from four countries in the region (exception - Turkmenistan). With data collection finalized, the dataset is now being rigorously analysed to generate evidence that will help guide regional AMR interventions.

Also, we examined how various social and economic factors influence antibiotic consumption rates in three Central Asian countries (Kazakhstan, Kyrgyzstan, and Tajikistan) as well as in Russia. Our findings indicate that national antibiotic consumption rates are shaped not only by factors within the healthcare system but also by external determinants, including per capita GDP, consumer price inflation, and access to clean household fuels (https://doi.org/10.3390/antibiotics14050513).

We also work closely with the National Center for Public Health and the WHO Country Office to strengthen analytics, support health policy, and improve the monitoring of antimicrobial resistance.



countries, assessing the publications covering AMR awareness levels, AMR and antimicrobial consumption studies, antimicrobial stewardship practices, and national strategies to combat AMR. Our analysis showed that, despite individual initiatives, most countries face common challenges: fragmented surveillance, limited implementation of stewardship practices, and a lack of coordinated, unified regional policies.

We also work closely with the National Center for Public Health and the WHO Country Office to strengthen analytics, support health policy, and improve the monitoring of antimicrobial resistance.

4. PUBLIC ENGAGEMENT AND EDUCATION

With support from The Trinity Challenge (TTC, University of Cambridge), we run an educational campaign that includes:

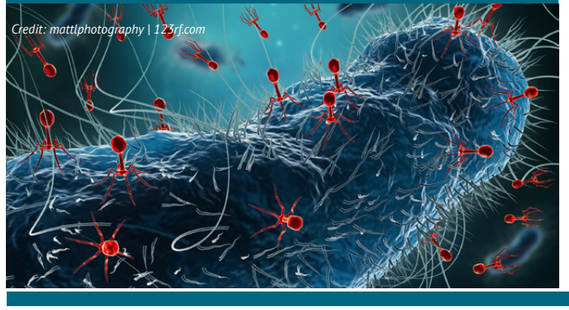
Instagram-based educational posts and videos,

TikTok and YouTube campaigns targeting parents and their kids,

A national children's art competition (ages 6–16) on AMR, WASH, and the One Health concept.
The campaign aims to raise public awareness about antimicrobial resistance using clear, accessible, and engaging communication formats.

Drawings by participants of the children's art competition "Our Health – Our Future"

Research team:
- Dr. Yuliya Semenova, Assistant Professor, Department of Clinical Sciences, School of Medicine
- Zhanar Kosherova, School of Medicine
- Dariga Zhazykhbayeva, School of Medicine,



Q5. What actions are needed from the public, healthcare workers, and policymakers to reduce AMR?

For the Public

Avoid self-medication.

Do not use antibiotics for viral infections.

Do not purchase antibiotics without a prescription.

Parents: trust evidence-based care and avoid pressuring pediatricians/physicians.

For Healthcare Providers

Prescribe using local resistance data.

Prioritize ACCESS antibiotics as first-line therapy.

Use WATCH and RESERVE antibiotics only when clinically justified.

Every unnecessary prescription accelerates AMR.

For Policymakers

Enforce prescription-only sales of antibiotics nationwide.

Strengthen AMR surveillance and reporting.

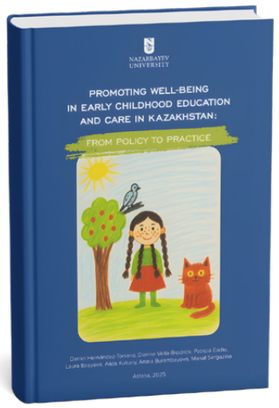
Support stewardship programmes and laboratory capacity building.

Invest in digital and clinical decision-support tools.

Conclusion

Antimicrobial resistance is not a single disease but a systemic, multisectoral challenge affecting every level of healthcare. However, through rigorous data analysis, regional collaboration, strong scientific leadership, and large-scale public engagement, Kazakhstan has the potential to become a regional hub for AMR prevention and evidence-based antibiotic stewardship.

A coordinated national effort spanning science, policy, clinical practice, and public behaviour is essential to safeguard antibiotics for future generations.



Listening to children's voices on well-being in Kazakhstan

DOWNLOAD THE BOOK | EN | KZ | RU

GLOBAL RESEARCH IMPACT:
56 peer-reviewed publications
1,402 citations
1,330 citing documents
h-index: 20

Professor Daniel Hernández-Torrano is a leading scholar in educational psychology, focusing on the role of education in promoting the health and well-being from early childhood to adolescence and university students. His work bridges cutting-edge analytical methods with a focus on equity and real-world impact, contributing to both global debates and national educational priorities.

Professor Daniel Hernández-Torrano, Professor of Educational Psychology at the Nazarbayev University, Vice Dean for Research at the Graduate School of Education

Q1. What inspired you to focus on emotional well-being and child development?

Daniel Hernández-Torrano: – I've been studying the role of education in promoting the well-being of young people in Kazakhstan for about ten years, including school-aged children, adolescents, and university students.

With this project, we intentionally turned our attention to the earliest stage of the educational trajectory: early childhood education and care (ECEC). Research shows that these early years profoundly shape children's emotional, social, and cognitive development, yet globally, and especially in non-WEIRD contexts, young children's own perspectives on well-being remain underrepresented.

So, our motivation comes from two needs:

> To build a full developmental picture of well-being across school, university, and now early childhood.

> To address a global research gap: early childhood is still one of the least explored areas, both in Kazakhstan and internationally.

Educational institutions tend to be viewed primarily as places for academic learning. While academics are important, kindergartens, schools, and universities also shape children's emotional and social development. Well-being, in our view, should be a central component of what education systems nurture.

In this project, we worked with a large and diverse sample of children aged 4-7 across multiple public and private kindergartens in Northern, Southern, and Central Kazakhstan. We used two main data collection instruments. First, the Draw, Write, and Tell (DWT) technique, an internationally recognized, developmentally appropriate method that allows young children to express their experiences through drawings, writing, and storytelling. Second, three adapted, brief questionnaires to quantitatively measure different indicators of well-being (e.g., life satisfaction, positive affect, negative affect).

Q2. If every school in Kazakhstan had to choose one well-being practice, which would you recommend?

Daniel Hernández-Torrano: – We asked over young children a simple question: "What makes you happy in kindergarten?"
From their answers, we identified 18sources of happiness, grouped into six themes.

Across our sample, one source stood out clearly: Play. Children deeply value opportunities to

Research team:
Laura Ibrayeva – Postdoctoral Researcher, Xeniya Tursunbayeva – Researcher
Daniel Hernández-Torrano – Professor, Aiida Kulsary – Research Assistant, Anara Burambayeva – Research Assistant

learn through play, joyful, hands-on, less rigid learning experiences.

Thus, if one practice were to be prioritized nationally, it should be high-quality, sustained play-based learning. This aligns with current policy directions but suggests that more intentional investment and system-wide implementation are needed. .

Q3. What significant or unexpected findings emerged from the project?
Laura Ibrayeva: – We asked over young children a simple question: "What

One of the significant findings was the global universality of children's sources of well-being. Children described well-being through:
play, friendships, belonging, caring relationships.

Another unexpected finding, at least for me personally, was how often children mentioned nature and their surrounding environments. Their responses highlighted the importance of thoughtfully integrating both indoor and outdoor spaces, including physical environments and natural elements because children consistently associated these settings with joy, exploration, and a strong sense of well-being.

Daniel Hernández-Torrano: – Another key insight from the project is that although children mention similar sources of well-being, each child reaches well-being in their own way. Using a person-centered analysis approach, we identified four distinct well-being profiles, each shaped by different indicators that contribute to their well-being:

Nature-Loving:
happiness in being outdoors, in nature, and in playful environments.

Mastery-Oriented:
happiness in achievement, learning, being recognized.

Comfort-Seeking:
happiness in safety, protection, emotional security.

Playful-Explorers:
happiness in interactive play and discovery.

This finding suggests that ECEC systems should adopt differentiated, developmentally sensitive approaches that can support this diversity among young children.

Q4. How can your research inform policy and education in Kazakhstan and beyond?
Aiida Kulsary: – Working with very young children requires methods that are ethical, engaging, and developmentally appropriate.

As mentioned earlier, we used the DWT method. Children were asked to draw what makes them happy, then share the story behind their drawings. This kept them engaged and allowed us to hear their authentic voices.

The message for policymakers is clear: Don't rely only on adults' perspectives. Include children as active contributors.

Daniel Hernández-Torrano: – Within the NU CARCEIT project Nurturing Young Minds, a practical, research-informed guide was developed to support early childhood educators and leaders in promoting young children's well-being in Kazakhstan and similar contexts.

Drawing on research evidence and the perspectives of over 300 children, the guide combines conceptual foundations with classroom-ready strategies to foster positive emotions, engagement, relationships, meaning, accomplishment, and health.

The guide is freely available free online in English, Kazakh, and Russian and is structured as a two-part resource.

OECD
BETTER POLICIES FOR BETTER LIVES

TALIS

TALIS - the Teaching and Learning International Survey - is the world's largest international survey about teachers and school leaders.

RESEARCH PROJECTS:

Professor Daniel Hernández-Torrano and his team are currently leading two major projects that together build a comprehensive view of emotional well-being across childhood and youth.

"Advancing the Conceptualization and Measurement of Emotional Well-Being through Psychological Network Analysis" — develops innovative methods to understand the structure of emotional well-being, informed by the team's broader research on psychological distress and coping among university students in Kazakhstan

"Nurturing Young Minds: Exploring the Contribution of Positive Early Childhood Experiences to the Health and Well-Being of Young Children in Kazakhstan" — focuses on the earliest developmental stage, examining how play, relationships and everyday experiences shape children's happiness and healthy growth.








Policy Brief – explaining key findings and why well-being matters. Educator Guide – filled with concrete activities based directly on children's own sources of happiness.

Q4. How can your research help teachers facing burnout or stress?
Xeniya: – During a previous school well-being project, a vice-principal asked us:

"Before studying students' well-being, will anyone study teachers' well-being?"
This question stayed with me.
Well-being is essential for teachers too. It affects their performance, work–life balance, mental health, emotional resilience.

But teachers' well-being is still under-researched in Kazakhstan and globally.
Beyond large surveys like **OECD TALIS,** we need a Kazakhstan-specific framework to **measure and support teacher well-being in context.**

Q5. If you could give one piece of advice to parents or teachers, what would it be?
Anara: – Our research in southern Kazakhstan shows that children feel happiest when they take part in real household responsibilities setting the table, helping with chores, or supporting parents in daily routines. Although these tasks may seem difficult from an adult perspective, children describe them as enjoyable and meaningful.
My advice: Allow children to participate in genuine, age-appropriate tasks. There is a developmental period when they naturally want to help, and constant restrictions can discourage this motivation. Even if the work is imperfect, children gain skills, confidence, and a stronger sense of belonging. This reflects a "Montessori-at-home" approach: follow the child's interest at the right moment.

Q6. How do collaboration and teamwork shape your research outcomes?
Daniel Hernández-Torrano: –This project brought together researchers at different stages and from different countries.
We collaborated with leading scholars from the University of Melbourne, who provided invaluable expertise on early childhood methods and well-being science.

Equally important was our local NU-trained team, whose understanding of Kazakhstan's cultural and educational context shaped every step.

Thanks to this mix of international expertise and local insight, the project has:

- *produced multiple academic publications*
- *generated practical tools for educators and policymakers*
- *engaged stakeholders such as the Ministry of Education, UNICEF, and early childhood institutes*

We recently presented at a UNICEF conference with representatives from several ministries and international researchers.

For me, this project represents a successful model of global–local collaboration, and I hope it continues to shape Kazakhstan's approach to the promotion of children's well-being.

Adaptation and Resilience of Local Communities Around the Aral Sea

AWARDS & RECOGNITIONS:
- NU Teaching Award (2021)
- JLU Early Career Researcher Grant, Germany (2022)
- OSCE Academy Research Fellowship, Kyrgyzstan (2022)
- PCMO Postdoctoral Grant, Germany (2024)
- Erasmus+ Teaching Mobility, Makerere University, Uganda (2024)
- Mentoring Hessen Program, Germany (2023–2024)

EDITORIAL & LEADERSHIP ROLES
- Associate Editor, *Central Asian Journal of Water Research*
- PI, Water Governance Cluster, SDSN Kazakhstan
- PI, SDG^{nexus} Network project funded by DAAD, BMZ, Germany

Aliya Assubayeva,
Assistant Professor,
Graduate School
of Public Policy,
Nazarbayev University

The desiccation of the Aral Sea remains one of the most striking anthropogenic environmental catastrophes on the planet. Beginning in the Soviet era, large-scale diversion of the Amu Darya and Syr Darya rivers for cotton cultivation triggered a collapse of the once-vast inland water body, which has now lost over 90% of its volume and more than 85% of its surface area since 1960. While scholars have extensively examined the hydrological, environmental, and geopolitical dimensions of this disaster, far less is understood about how local communities. Particularly those in rural areas adapt to, cope with, and attempt to rebuild their lives within this transformed landscape.

A research project led by **Dr Aliya Assubayeva**, Assistant Professor at the Graduate School of Public Policy, Nazarbayev University, addresses precisely this gap. The project investigates **mechanisms of social resilience, local knowledge systems, and adaptive practices** among communities surrounding the remaining water bodies of the Aral Sea. In 2025, fieldwork was carried out on both the Kazakhstani and Karakalpak sides, combining site observations, interviews, and stakeholder consultations.

FIELD REFLECTIONS FROM THE KAZAKHSTANI SIDE

Standing on the dry seabed of what was once one of the world's largest lakes, it is hard to believe that just a few decades ago fishing boats sailed where we drove more than 100 kilometres across what is now desert.

We began in Kyzylorda, driving about 400 kilometres toward the former port city of Aral. Along the way, we passed rice plantations, saw stark examples of soil salinisation, and glimpsed Baikonur and the Korkyt Ata monument. On arrival, the scale of change was staggering. Some port infrastructure still stands but without water. People in their 30s and 40s, born here, have never seen the sea at the port.

> *Experiencing environmental change at human scale. "The Aral Sea is a living lesson of how water policies, when poorly designed or absent reshape ecosystems, livelihoods, and generations."*
>
> *— Dr Aliya Assubayeva*

We explored two routes of the Aral Geopark:

One along the delta and its lakes, including the Kokaral Dam, and another stretching across more than 100 kilometres of dried seabed toward the remaining parts of the Small Aral. After years of reading about the Aral Sea's desiccation, seeing it in person was overwhelming and unforgettable.

We spoke with residents in fishing villages, some now abandoned, and observed the Syr Darya's levels in its delta, along with surrounding water. In Kyzylorda, we met with experts responsible for water allocation, protection, and management in the Aral–Syr Darya basin and discussed the realities of water management on the ground.

Some of our assumptions were confirmed; others were challenged insights that were only possible through fieldwork. These research visits were supported by Flexible Funds from the Centre for International Development and Environmental Research (ZEU), Justus Liebig University Giessen.

Research Seminar: "Elusive Water: the Life and Death of Central Asia's Aral Sea"

Reframing the Aral Sea through historical and human-centred lenses

In parallel to field research, the team hosted a seminar on 24 September titled "Elusive Water: the Life and Death of Central Asia's Aral Sea", featuring Dr Sarah Cameron, Associate Professor of History at the University of Maryland, College Park.

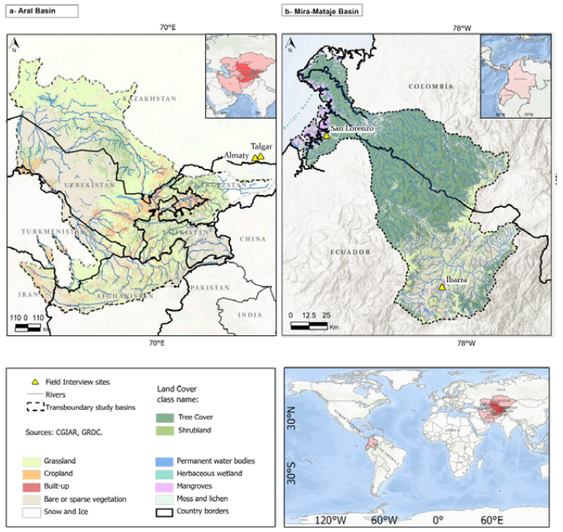
Dr Cameron is a historian of Russia and the Soviet Union whose work spans genocide, environmental history, and the societies of Central Asia. Her award-winning book The Hungry Steppe: Famine, Violence, and the Making of Soviet Kazakhstan (Cornell University Press, 2018) set a new benchmark in the field. She is currently developing a major new work examining the causes and consequences of the Aral Sea's demise research from which this talk drew.

Her seminar centred the experiences of people who lived around the sea, exploring how everyday life, mobility, and community structures were reshaped as water receded. Importantly, the lecture challenged the tendency to frame the Aral Sea solely as a "Soviet" environmental tragedy. Instead, it highlighted what this history can teach us today, especially as shrinking lakes and rivers worldwide from the Dead Sea to Lake Chad echo the Aral's warning.

WHY THIS RESEARCH MATTERS

The Aral Sea disaster is not only a historical tragedy, it is a living laboratory for understanding how environmental mismanagement intersects with governance, livelihoods, and climate change. Dr Assubayeva's work contributes to:

- **Evidence-based policy on water governance**
- **Improved understanding of community-led adaptation**
- **Regional cooperation on transboundary water management**
- **Insights relevant to SDGs 6 (Clean Water), 13 (Climate Action), and 15 (Life on Land)**



From Telecom Fibres to the Medicine of the Future

A conversation with Professor Daniele Tosi and research team members Toheeb Olalekan Oladejo and Damira Master's student, at the Laboratory of Biosensors and Bioinstruments

RESEARCH METRICS:
- 5,006 citations
- h-index: 37

CURRENT PROJECTS:
- **NextGenBCM,** where fibre-optic diagnostics are applied to predict rock mass caveability and reduce hazards in block-caving mining operations;
- **A new computational model for NP-doped optical fibres**, advancing our understanding of light propagation in complex, high-scattering media;
- **M2O-DISK**, a flagship medical-engineering initiative enabling real-time monitoring of shape, temperature, biochemical markers, and radiation dose inside the human body.

Across all these domains, Professor Tosi's work follows a unified scientific vision: leveraging fibre-optic technologies to measure, understand, and predict complex physical and biological phenomena.

Daniel Tosi, PhD,
Professor, School of Engineering and Digital Sciences, Department of Electrical and Computer Engineering, Head, Laboratory of Biosensors and Bioinstruments

Q1. What drives your choice of research topics, and why develop this work in Kazakhstan?
Prof. Daniele Tosi: – Our laboratory was founded with the strategic idea of translating optical fibre technologies traditionally used in telecommunications, structural sensing, aerospace, and imaging into biomedicine. Ten years ago, this transition was still unconventional. Optical fibres offer unique capabilities for highly precise measurements in extremely small and complex biological environments, and this scientific challenge strongly motivated us.

Kazakhstan is an ideal place to develop this research. The country aims to become a regional leader in healthcare innovation, supported by significant investment and a growing biomedical ecosystem. There is a clear national need for affordable diagnostic solutions, and fibre-optic biosensing provides exactly that: low-cost materials, high sensitivity, and scalable fabrication.

Collaboration is central to our strategy. We work closely with local clinics, the NU School of Medicine, international centres, and global academic partners. Many collaborators visit our lab, and we visit theirs. This creates a dynamic scientific ecosystem that enhances both knowledge exchange and technological impact.

Researcher Toheeb Olalekan Oladejo: – The recent NU-led publication in Optics and Lasers in Engineering (2025) further strengthens this strategic direction. The study demonstrated, for the first time, label-free multiplexed detection of diabetic retinopathy biomarkers directly in artificial tear models, validating the approach for clinical translation.

Q2. How do your fibre-optic biosensors detect biomarkers and physiological parameters with such high performance?
Prof. Daniele Tosi: – The fibres we use are fundamentally the same telecom-grade fibres deployed beneath urban infrastructure. They are not inherently biological sensors; thus, we perform specialized fabrication steps to transform them into highly responsive platforms for biomedical environments. Because these fibres originate from the telecommunications industry, they retain exceptionally high precision providing low detection limits, high sensitivity, and excellent resolution. Only sensors with **≥50 dB/RIU sensitivity** were selected for further work. Some prototypes reached ~194 dB/RIU, as shown in the calibration data of the published study.

Researcher Toheeb Olalekan Oladejo: – To detect specific proteins, we functionalize fibre tips with antibodies or aptamers. For example, anti-VEGF or anti-LCN1 antibodies bind their respective targets. This binding event changes the refractive index at the fibre surface and alters the spectral intensity.

The process involves:
- Piranha cleaning → increases surface hydroxyl groups
- APTMS silanization → provides amino functionalities
- Glutaraldehyde cross-linking → covalent immobilization
- Antibody attachment + blocking layer → high specificity

AFM imaging (page 4 in the article) confirms each modification step. Dot-blot assays verify high antibody specificity with no cross-reactivity.

Q3. What is the M2O-DISK project, and what capabilities does it enable in real-time biomedical sensing?
Prof. Daniele Tosi: – M2O-DISK (Multifunctional Medical devices based on fiber-Optic DIstributed Sensing networK) is our flagship initiative. Its ambition is to transform minimally invasive medical tools such as catheters and needles into multifunctional, real-time diagnostic platforms.

It integrates four key sensing modalities within a single fibre-based instrument:

1. Shape sensing
Real-time reconstruction of 3D geometry inside the body, improving precision in ablation, targeted therapy, and navigation of catheters.

2. Distributed temperature sensing
Temperature mapping along the tool's surface and volume critical for thermal therapies, cardiac procedures, and safety monitoring.

3. Biosensing
Rayleigh-scattering-based sensors and functional coatings enable detection of biochemical markers, refractive index changes, and analytes directly in situ.

4. Radiation dose monitoring
Fibre-integrated radiation-sensitive regions allow dose mapping during radiation therapy, minimizing side effects.

The design philosophy is scalability. By leveraging telecom fibres and nanoparticle-enhanced scattering, we can fabricate sensors in large batches.

Researcher Damira: – Nanoparticles are essential: without them, sensitivity would be impossible. Their optimization continues to push performance boundaries.

Q4. What challenges and scientific bottlenecks remain?
Prof. Daniele Tosi:

- **Reproducibility**
  Batch-to-batch variability must be minimized. The study includes repeatability tests confirming good consistency, but more work is needed.
- **Stability in biological media**
  Real tear fluid contains proteins, salts, lipids. The team showed that BSA and tear components do not interfere with the sensor signal a major achievement.
- **Fabrication complexity**
  Many competing optical sensors require fragile structures. Our SDI sensors are more robust, but scaling to mass production is a challenge.
- **Real-time dynamic sensing**
  The article demonstrates dynamic measurements in a 2 µL/min tear-flow simulation, mimicking natural tear secretion the first such demonstration globally. It proves feasibility, but clinical translation will require miniaturized interrogation hardware.

Q5. How is your laboratory structured, and what real-world applications do you expect in the near future?
Laboratory structure and mentorship
Prof. Daniele Tosi:
We do not follow a vertical hierarchy. Instead:
- Teams form thematic clusters (photonics, biochemistry, AI, microfluidics).
- Researchers from all levels work together (bachelors → postdocs).
- Each member owns a specific technical domain.
- Students are encouraged to transition from guided to independent research.

Researcher Damira: – Supervision is excellent. The professor responds very quickly, helps with analysis, method selection, and even programming choices. Access to equipment is reliable, and the team environment is highly supportive.

Current student projects
- Alpha-synuclein detection - early diagnostics of Parkinson's, Alzheimer's, and dementia.
- Progesterone sensing - planned once specific aptamers arrive.
- Diabetic retinopathy biomarkers (VEGF, LCN1) - transitioning from artificial tear models to clinical samples.

The team has IREF approval and will soon begin working with 40 patients, comparing fibre-based assays with ELISA.

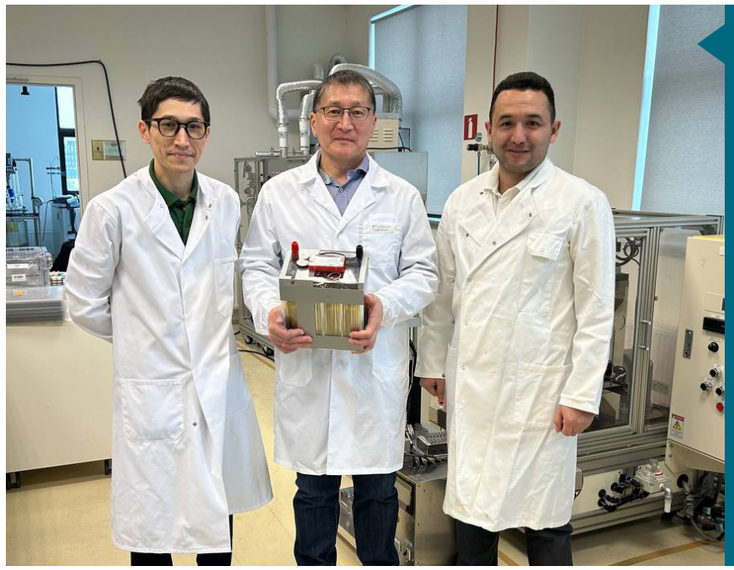
Prof. Daniele Tosi: – From Laboratory to Real-World Applications. The first practical devices expected from the laboratory are medical:
- portable platforms for analysing blood, tears, saliva, and urine,
- optimized fibre-based sensors for specific clinical environments,
- an ultra low-cost smartphone-compatible biosensor for at-home testing.

Ophthalmology is emerging as a particularly strong application area, with tear-based diagnostics showing promising clinical results.
Looking ahead, the laboratory anticipates:
- clinical trials of fibre-based diagnostic systems,
- multifunctional M2O-DISK catheters and needles,
- smart textiles for monitoring vital signs,
- home-based systems for elderly care,
- AI-enhanced interpretation of sensing data.

"Our mission is to make diagnostics precise, affordable, and accessible. The 2025 multiplexed biosensor study marks a major step toward achieving a true lab-in-the-tear platform." - Prof. Daniele Tosi

From Materials to Mobility: Pilot-Scale Manufacturing of Pouch and Prismatic Lithium-Ion Cells

Bridging Laboratory Research and Real-World Energy Systems



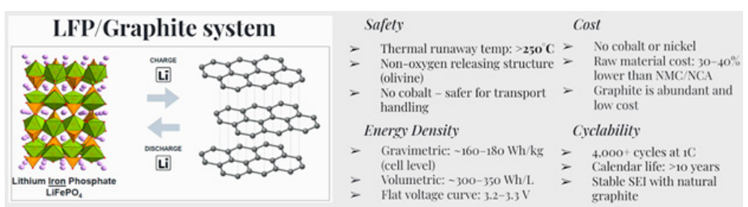
At Nazarbayev University, this challenge became the starting point for a long-term research effort led by Zhumabay Bakenov, Vice Provost for Research and Innovation and Founding General Director of the Institute of New Materials and Energy Technologies (INMET). The work is driven by a fundamental question: how can advanced battery materials be translated into reliable, scalable, and industry-ready energy storage systems?

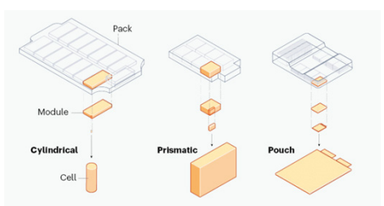
The answer led to the creation of a unique academic infrastructure built around two complementary pilot-scale facilities, designed to bridge laboratory discoveries with real-world energy applications.

How the Battery Works: The LFP–Graphite System

Lithium-ion batteries store and deliver energy through the reversible movement of lithium ions between two electrodes: a cathode and an anode. During discharge, lithium ions move internally through the electrolyte from the anode to the cathode, while electrons flow through the external circuit, powering a device. During charging, this process is reversed, storing energy back in the cell.

The pilot-line cells are based on a **lithium iron phosphate (LiFePO4, LFP) cathode** paired with a **graphite anode**, a chemistry widely adopted in electric vehicles due to its safety and durability. Although LFP offers slightly lower energy density than some nickel-rich cathodes, its exceptional safety margin, mechanical robustness, and tolerance to manufacturing variations make it ideal for pilot-scale development and real-world validation, including electric vehicle testing. The electrochemical reactions are highly reversible, enabling reliable performance over thousands of cycles when combined with well-controlled manufacturing.





Overview of the Two Pilot Lines

POUCH CELL PILOT LINE (SEMI-AUTOMATIC)

The pouch cell pilot line is designed as a flexible, semi-automatic platform optimized for research-driven development and rapid iteration. It supports:

- Fast design changes in electrode composition and cell architecture (two available sizes: 5x8 cm and 10x12 cm)
- Process parameter optimization (coating thickness, drying temperature, calendaring speed, stacking layers)
- Suitable for portable devices, consumer electronics, electric vehicles (EVs) (in large modules/packs), etc.

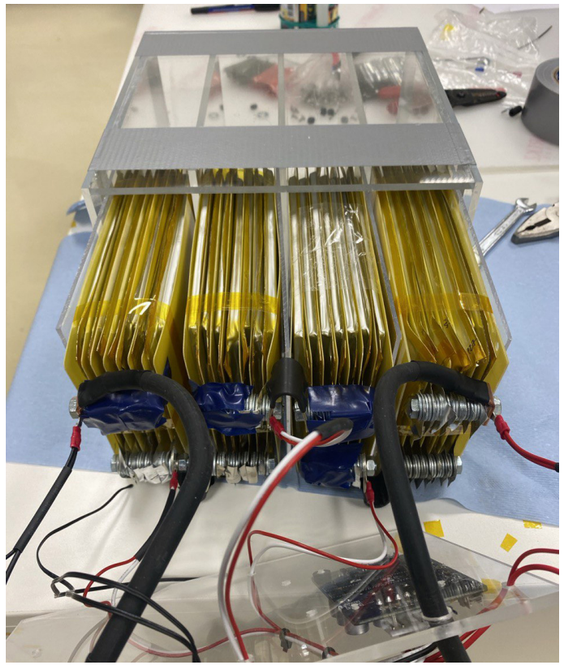
The semi-automatic nature of the line ensures tight process control while retaining the flexibility needed for experimental research.

PRISMATIC CELL PILOT LINE

The prismatic cell pilot line focuses on industrial-format cells, which are widely used in electric vehicles and stationary energy storage systems due to their mechanical robustness and high volumetric energy density.

Unlike the pouch line, this pilot line emphasizes:

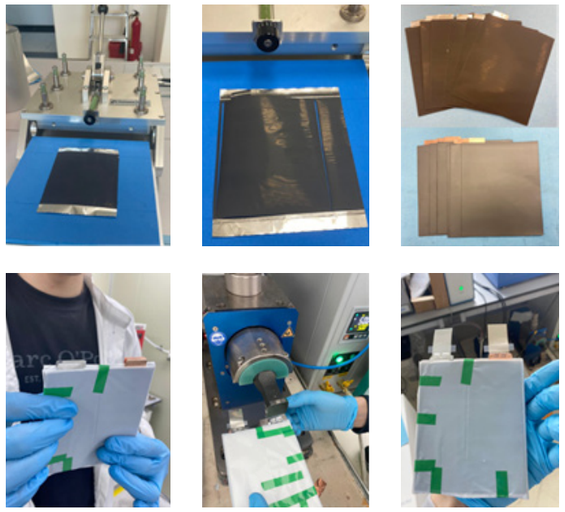
- Rigid cell housing and mechanical integrity
- Higher energy density per cell (1 prismatic cell ~ 1 module of pouch cells)
- Suitable for EVs and energy storage

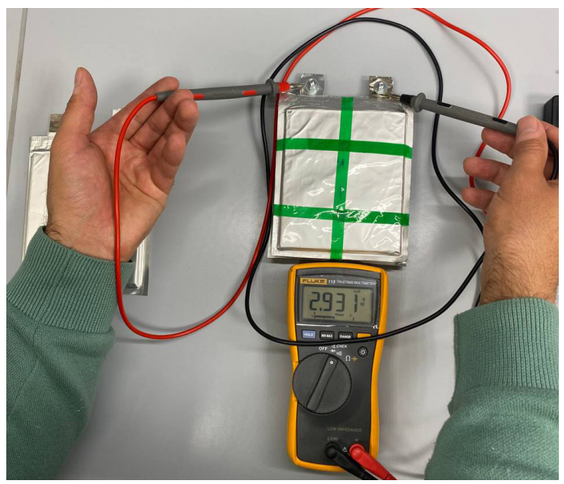


Pouch Cell Manufacturing: From Electrode to Sealed Cell

ELECTRODE PREPARATION

Electrode fabrication is the foundation of cell performance and reliability. The process begins with slurry preparation, where active materials, conductive additives, and polymer binders are dispersed in a controlled solvent system. Homogeneity at this stage is critical to ensure consistent electrochemical behavior across the electrode. The prepared slurry is applied onto metallic current collectors (Al for cathodes, Cu for anodes) using a coating process on a casting machine. Coating thickness, uniformity, and edge definition are closely monitored and controlled. Drying is performed under controlled temperature and airflow conditions to remove solvent efficiently. After drying, electrodes undergo calendaring, where controlled pressure is applied to adjust porosity and electrode density. This step directly influences ionic transport, electronic conductivity, and mechanical adhesion. Electrodes are then cut to precise dimensions, ensuring accurate alignment during cell stacking.





CELL STACKING AND ASSEMBLY

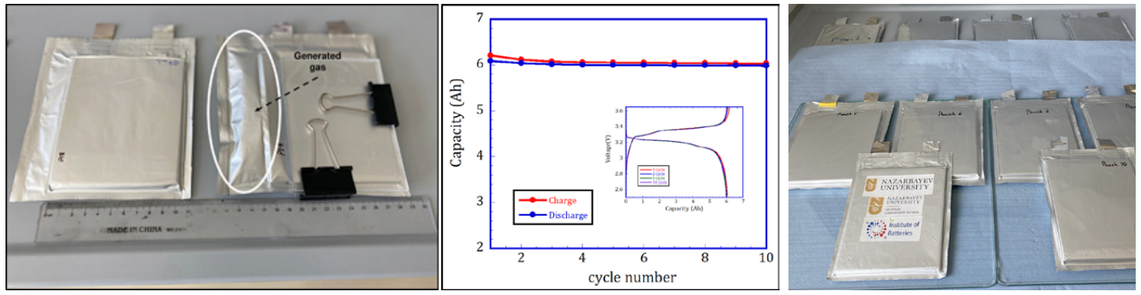
In the pouch cell architecture, electrodes and separators are stacked in an alternating sequence to form the cell core. The semi-automatic stacking system ensures precise layer alignment and minimal edge defects. The stacked assembly is inserted into a laminated aluminum pouch, followed by tab welding for current collection.

ELECTROLYTE FILLING AND SEALING

Electrolyte filling is conducted under controlled atmosphere conditions to prevent moisture contamination. The final battery has around 3500 mAh capacity with 3.2 V nominal voltage.

FORMATION AND AGING

The sealed cells undergo electrochemical formation, a process during which the solid electrolyte interphase (SEI) is formed. Carefully controlled charge–discharge cycles stabilize the cell and define its long-term performance.



Pouch cell after 1 cycle of formation (on the right) and resealed pouch after complete formation (on the left)

Prismatic Cell Pilot Line

BRIDGING LABORATORY INNOVATION AND INDUSTRIAL PRISMATIC BATTERY MANUFACTURING

To effectively scale battery materials from the laboratory to practical applications, precise mechanical design and manufacturing control are essential. The prismatic cell pilot line was established at Nazarbayev University to address this need. It provides a platform that combines research-oriented efforts with industry relevance for assembling, sealing, and formation of prismatic lithium-ion cells under controlled conditions.

WHY IT MATTERS

The pilot-scale manufacturing of prismatic cells plays a crucial role in bridging laboratory battery research with industrial applications. The results indicate that controlled, near-industrial fabrication and testing are vital for identifying manufacturing-induced failure modes and validating cell performance at scales relevant to actual applications. By facilitating the use of in-house synthesized materials in full-format prismatic cells, the pilot line enhances the connection between fundamental materials research and practical battery production. Ultimately, this infrastructure improves Kazakhstan's capacity for industry-aligned energy storage research and supports the advancement of scalable and reliable battery technologies.

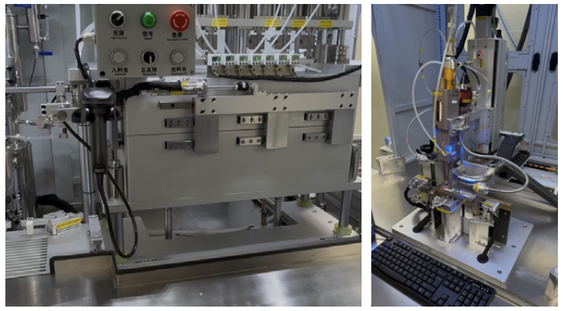
RESEARCH EQUIPMENT

Electrode Preparation – cutting, tab preparation, and moisture removal
- Electrode cutting system
- Tab cutting system
- Vacuum drying oven

Cell Assembly – multilayer electrode stacking and electrical connections inside the prismatic cell.
- Semi-automatic stacking system
- Ultrasonic tab welding system

Electrolyte Filling – controlled introduction of electrolyte to ensure uniform wetting of the electrode stack.
- Constant-pressure electrolyte filling system

Sealing – permanent sealing of the prismatic cell shell to ensure mechanical integrity and airtightness.
- Laser welding system for shell and filling port



Quality Control - inspection and safety testing to verify cell integrity and detect manufacturing defects.
- Helium leak detection system
- Short-circuit safety testing system

Formation - initial electrochemical activation of the cell under controlled temperature and pressure.
- Negative-pressure formation system

HOW IT WORKS

The development workflow for prismatic cells begins with electrode preparation on the casting machine, followed by electrode cutting and conditioning. The prepared electrodes are then assembled into precisely aligned multilayer stacks, and current collector tabs are connected through welding. These stacks are integrated into rigid aluminum shells, where electrolyte is introduced under controlled pressure to ensure uniform wetting. The cells are subsequently sealed by laser welding and inspected using leak detection methods to verify shell integrity. Finally, electrochemical formation is carried out under controlled temperature and pressure, converting laboratory-developed materials into fully functional prismatic lithium-ion cells suitable for performance, aging, and safety studies.

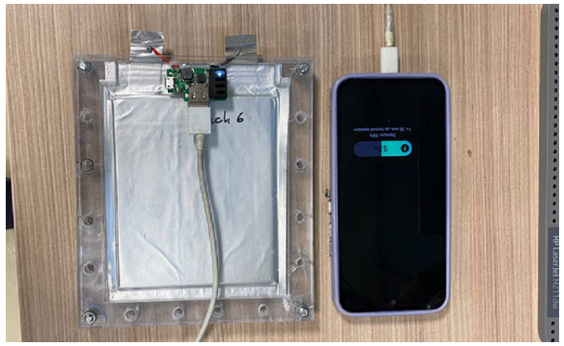
LOOKING AHEAD

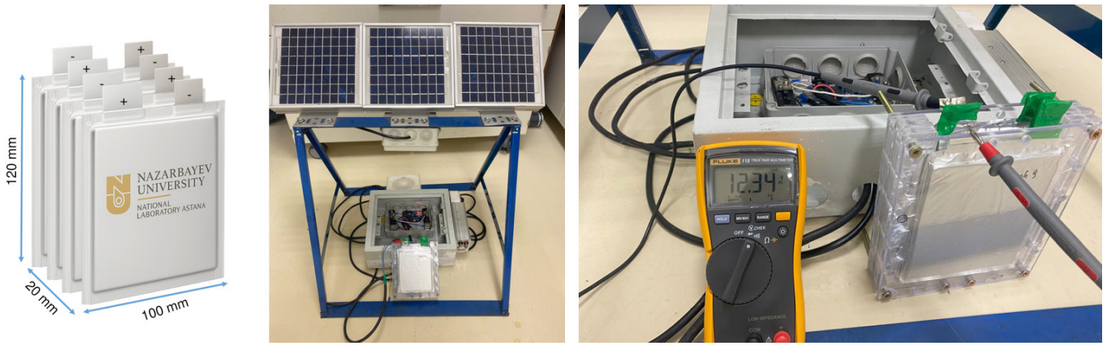
Pilot-scale validation is crucial for converting laboratory battery research into practical industrial applications. Future efforts will focus on new cell chemistries, advanced formation strategies, and optimization under near-industrial conditions. The aim is to create high-performing, reliable, and scalable prismatic lithium-ion cells for electric mobility and energy storage. By integrating materials development, manufacturing research, and pilot testing, the prismatic cell pilot line is accelerating the move from basic battery research to industry-ready production in Kazakhstan.

From Cell to Vehicle: Prototype Testing on an Electric Car

INTEGRATIONS INTO A POWER BANK AND A SOLAR ENERGY STORAGE SYSTEM

The ultimate validation of battery technology extends beyond the laboratory to real operating conditions. Within the project, prototypes of lithium-ion pouch cells (6 Ah, 3.2 V) were fabricated and tested, followed by their first integrations into portable devices (power bank) and a solar energy storage system. A 4S4P battery module with 12.8 V and 24 Ah was assembled, serving as a basis for future battery blocks for electric transport.

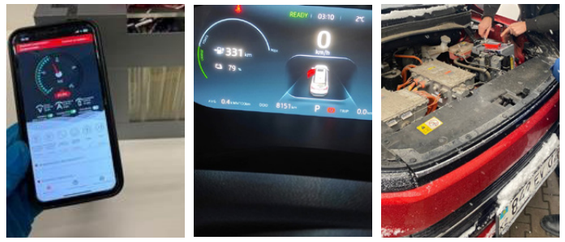




Demonstration of pouch cell integration into a solar energy storage and testing system

INTEGRATION INTO AN ELECTRIC CAR IN COLLABORATION WITH JAC KAZAKHSTAN)

A prototype 4S7P LiFePO4 battery module (12.8 V, 40 Ah), assembled from pilot-line cells, was integrated into the onboard 12-V power system of a JAC e-JS4 electric vehicle and tested at JAC Kazakhstan.



This stage evaluated electrical stability during vehicle operation, compatibility with the DC/DC converter, charge–discharge behavior, thermal response, and BMS protection functions under real-world conditions, providing critical feedback on system-level performance and reliability.
These tests provide invaluable feedback, linking cell-level design choices to vehicle-level performance and safety.

IMPACT AND OUTLOOK

The establishment of both pouch and prismatic pilot lines represents a critical step toward accelerating battery innovation. By combining flexible research-scale manufacturing with industrially relevant formats, this infrastructure enables:
- Faster translation of materials research into functional devices
- Early identification of scale-up challenges
- Training of researchers in real manufacturing environments
- Stronger collaboration between academia and industry

Future work will expand prismatic cell prototyping, integrate advanced diagnostics, and explore new chemistries and architectures tailored for electric mobility.

INESS

For 14 consecutive years, Professor Zhumabay Bakenov and his team from the Laboratory of Energy Storage Systems have played a leading role in organizing the annual International Conference on Nanomaterials and Advanced Energy Storage Systems (INESS), sustaining it as a recognized international platform for the exchange of ideas and expertise in materials science, nanotechnology, ecology, renewable energy, and advanced energy storage systems.

RESEARCH TEAM

- Dr. Dauren Batyrbekuly – Senior Researcher, Group Leader
- Dr. Batukhan Tatykayev – Senior Researcher
- Damira Rakhman – Research Assistant
- Mukagali Yegamkulov – Research Assistant
- Ilyas Mukushev – PhD Student, ENU
- Valeriya Volobuyeva – Research Assistant
- Ulan Burkit – PhD Student, NU

Natural Hydrogen: From Geological Risk to a Strategic Clean Energy Future

SCHOOL OF MINING AND GEOSCIENCES

Mahmoud Leila specializes in natural hydrogen systems, geological carbon storage, and water–rock interactions, with research focused on developing integrated exploration frameworks and advancing low-carbon geo-energy solutions.

Dr. Leila collaborates with industry partners to translate research into practical applications in hydrogen exploration and CO_2 mineralization. He supervises graduate research in natural hydrogen and subsurface geochemistry.

ORCID: Link

CITATIONS: 1095
H-INDEX: 23

Mahmoud Leila, Assistant Professor at the School of Mining and Geosciences, Department of Geological Sciences

From Industrial Product to Natural Resource

Q1. Why is natural hydrogen now considered a strategic energy resource?
Mahmoud Leila: – Hydrogen is seen as essential for decarbonization because it emits no CO_2 when used as fuel. Yet most hydrogen today is produced through carbon-intensive or costly processes, such as grey hydrogen from steam methane reforming or green hydrogen via electrolysis. This gap between rising demand and production challenges has renewed interest in naturally occurring geological hydrogen, which forms underground through geological reactions and could provide a low-carbon, scalable energy source.

Our research began in mining safety, where hydrogen accumulations pose explosion risks. Understanding how and where hydrogen forms can both improve safety and help unlock a new clean energy resource.

Fieldwork, Experiments, and Team Science

Q2. Who is involved in the project, and what happens behind the scenes?
Mahmoud Leila: – Our research is a collaborative effort. **Nazgul Assan,** a postdoctoral researcher, leads laboratory experiments simulating subsurface conditions, while **Mohammed El Sharawy**, a PhD student, focuses on natural hydrogen geology and modeling. **Nurbol Bultayev,** a master's student, and undergraduate researchers support fieldwork and data analysis. Training young scientists is central to our mission, students gain hands-on experience through sample collection and research activities. In collaboration with industry partners such as ERG, we have identified several hydrogen accumulation zones, and upcoming field campaigns will measure hydrogen flow rates and volumes.

How Integrated Science Meets Industry and Advanced Exploration Technologies

Q3. What first drew you to natural hydrogen research, and was there a moment when you realized its potential could be transformative?
Nurbol Bultayev: – My interest in natural hydrogen grew through work on alternative low-carbon energy projects and a deep dive into the science behind hydrogen generation, especially serpentinization in ultramafic rocks.

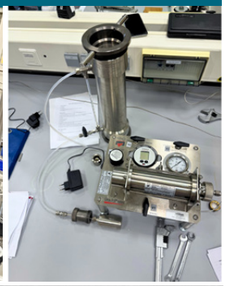
A turning point came during fieldwork in the Aktobe region at the Kempirsai massif, where we conducted hydrogen measurements. Seeing the data firsthand and discussing the results with colleagues at a conference made me realize the transformative potential of natural hydrogen as a future energy resource.

Q4: Your project combines geology, geochemistry, and advanced sensing. What makes your approach unique?
Nazgul Assan: – Natural hydrogen exploration is still emerging, with no standardized workflow. Our goal is to create an integrated strategy that guides industry from early screening to discovery.

We combine geological analysis (rock types, structures, hydrogeology) with geochemical surveys, soil-gas sampling, remote sensing, and geophysics to identify hydrogen-generating environments and map accumulation zones. A key innovation is our collaboration with Terra-A, whose non-invasive cosmic-ray sensing technology can detect subsurface gases without extensive drilling, which we are validating in Kazakhstan. Kazakhstan's ultramafic rocks make it an ideal natural laboratory: serpentinization generates hydrogen while also enabling CO_2 mineral trapping, linking exploration with climate solutions.

Impact for Kazakhstan

- *New Clean Energy Opportunities.*
- *Safer Mining Operations.*
- *Development of a High-Tech Energy Sector.*
- *Attracting International Partnerships and Investment.*
- *CO_2 Reduction Through Mineralization.*
- *Training the Next Generation of Scientists.*
- *A Natural Laboratory for Global Research.*



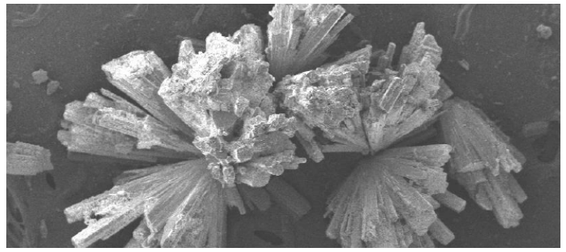


Figure 1. Fibrous Nesquehonite mineral that was formed in the laboratory during reaction between CO2-Water-ultrmafic rock from Kempirsay massif in Aktobe. It is a new technique for safe and permanent capturing and sequestration of CO2 while forming new economic materials such as Nesquehonite.

Through the integration of advanced sensing technologies, experimental research, and close industry collaboration, Nazarbayev University is shaping a new paradigm for geo-energy innovation. What started as a response to mining safety challenges has grown into a strategic exploration approach with the potential to position Kazakhstan as a key player in the global hydrogen economy.

Detecting Without Drilling

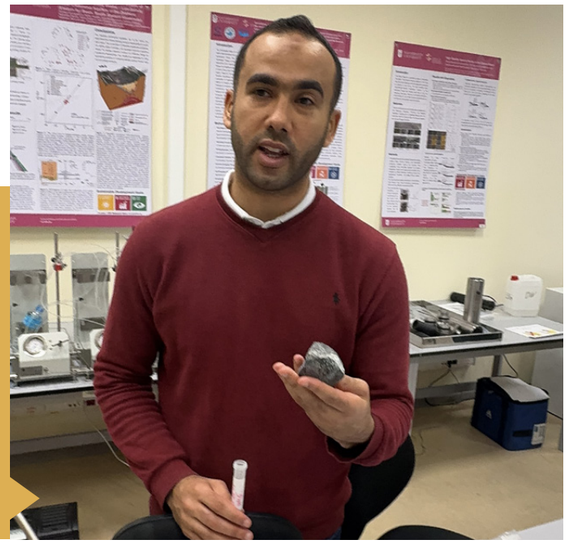
Q5. What is the most important insight from your collaboration with Terra-A?
Mahmoud Leila: – The key breakthrough is demonstrating that integrated remote sensing and geological analysis can identify hydrogen-rich zones before drilling begins. Terra-A's detection platform combines advanced radiation sensors with proprietary algorithms capable of distinguishing hydrogen, water, and minerals underground.

By calibrating this technology across multiple geological settings in Kazakhstan, we are improving predictive models and enabling industry to target exploration more efficiently. This could fundamentally change how natural hydrogen resources are discovered worldwide.

A New Energy Landscape

Q6. Where do you see natural hydrogen exploration in the next decade?
Mohammed El Sharawy: – Natural hydrogen could significantly reshape the global energy landscape. Unlike industrial hydrogen, geological hydrogen forms only in specific environments, so understanding these processes is critical.

Our experiments simulate reactions like serpentinization to evaluate hydrogen generation efficiency. These results help guide industry toward viable exploration targets while preventing unnecessary drilling in unsuitable areas. Over the next decade, natural hydrogen may become an important contributor to low-carbon energy systems.



Research Output – 2025

- *Concomitant generation of hydrogen during carbon dioxide storage in ultramafic massifs: State of the art with implications for decarbonization strategies. Link*
- *Evidence for active generation and seepage of sub-salt natural gas/condensate blend in the east offshore Nile Delta, Egypt: Integrated geochemical, petrophysical and seismic attribute approaches. Link*
- *Low-temperature carbonation and CO_2 mineral trapping in altered hydrotalcite-rich ultramafic rocks. Link*
- *Natural hydrogen favorability maps (NHFMs): a new concept for natural hydrogen exploration in different geological contexts. In: Rezaee, R., Evans, B., (eds.), Natural Hydrogen Systems Properties, Occurrences, Generation Mechanisms, Exploration, Storage and Transportation, 367-383. Link*
- *Reservoir rock typing and origin of oil in the Cretaceous post-rift mixed siliciclastic-carbonate of Abu Roash Formation, Badr El-Din 2 field, north Western Desert, Egypt. Link*

Active Projects

- ***Unlocking the Natural Hydrogen Generation Potential of Kazakhstan** (PI: M. Leila; 2025–2027, FDCRGP)*
- ***Investigating Natural H_2-Generating Rock Types in Kazakhstan** (PI: M. Leila; 2025–2027, Government)*

UNIVERSITY RESEARCH LIFE

International Research Conferences 2026

School of Sciences and Humanities

Social Sciences and Humanities: A Discourse of Public Values
Dates: 20 March
Organizing Entity: SSH
Contact Person: Gulnara Omarbekova
More info: https://ssh.nu.edu.kz/news/tpost/djg6cbror1-call-for-papers

The Universe at all Scales:
1. Phenomenology of Strong Gravity 2026 (PSG);
2. Structure and Energy in the Universe: the ISM, Star Formation and High Energy Astrophysics (SEU).
Dates: May 11–15
Organizing Entity: School of Sciences and Humanities
Contact Person: Dana Alina dana.alina@nu.edu.kz, Daniele Malafarina, daniele.malafarina@nu.edu.kz
Conference website:
https://ecl.nu.edu.kz/conference-2026/psg

Optical Fiber Sensing Systems for Diagnosis and Treatment 2026
Dates: May 26–29
Publication: Accepted abstracts in the abstract book
Organizing Entity: SEDS
Contact Person: Daniele Tosi, daniele.tosi@nu.edu.kz, Zhannat Ashikbayeva, zhashikbayeva@nu.edu.kz
Conference website: www.physics-congress.kz/ofssdt

Reimagining Archaeological Heritage and the Digital Future (7th HANSR Conference)
Dates: October 21-24
Organizing Entity: SSH
Contact Person: Paula Dupuy, paula.dupuy@nu.edu.kz
Conference website: hansr.nu.edu.kz

International Conference on Emerging Trends in Mathematical Analysis and Artificial Intelligence
Dates: TBA
Organizing Entity: SSH
Contact Person: Durvudkhan Suragan durvudkhan.suragan@nu.edu.kz

The CESS Annual Regional Conference
Dates: June 16–19
Organizing Entity: Graduate School of Public Policy
Contact Person: Dina Sharipova, dina.sharipova@nu.edu.kz
Conference website:
https://gspp.nu.edu.kz/cessconference/eng

Graduate Schools of Nazarbayev University

Eurasian Higher Education Leadership Forum (EHELF)
Dates: June 5-6
Organizing Entity: Graduate School of Education
Contact Person: Laura Ibrayeva, laura.ibrayeva@nu.edu.kz
Conference website: www.ehelf.nu.edu.kz

Voices from the Margins: Rethinking Gender, Work and Organization
Dates: June 8-10
Organizing Entity: GSE, GSB
Contact Person:
Shumaila Yousafzai, shumaila.yousafzai@nu.edu.kz
Zumrad Katayeva, zumrad.kataeva@nu.edu.kz
Laura Ibrayeva, laura.ibrayeva@nu.edu.kz
Conference website: https://event.fourwaves.com/gwo2026/pages

Firms, AI, Geopolitics and the Global Transformation of Value Creation
Dates: August/September
Organizing Entity: GSB
Contact Person: David De Remer, david.deremer@nu.edu.kz

Nazarbayev University School of Medicine

Advancing Excellence in Medical and Health Professions Education: Global Standards, Innovation and equity
Dates: October 28-29
Organizing Entity: NUSOM
Contact Person:
Gulzhanat Aimagambetova, gulzhanat.aimagambetova@nu.edu.kz, Yeltay Rakhmanov, yeltay.rakhmanov@nu.edu.kz

First International Conference on Intelligent Nutrition and Food Systems for Precision Health (NutrIX 2026)
Dates: September 17-19
Paper publication: Journal/conference proceeding/book abstract will be announced soon
Organizing Entity: NUSOM
Contact Person: Mei Yen Chan, yen.chan@nu.edu.kz
Conference website: https://nusom.nu.edu.kz/NutrIX2026

2nd Nazarbayev University International Conference on Planetary Health and Sustainable Healthcare
Dates: November 5–6
Organizing Entity: NUSOM
Contact Person: Jonas Cruz, jonas.cruz@nu.edu.kz

Antimicrobial Stewardship to Combat Antimicrobial Resistance: a One Health Perspective
Dates: November 18–24
Paper publication: Accepted abstracts will be published in a book of abstracts
Organizing Entity: NUSOM
Contact Person:
Yuliya Semenova, yuliya.semenova@nu.edu.kz

School of Engineering and Digital Sciences

2nd SEDS Annual Research Conference
Dates: April 9-10
Organizing Entity: SEDS
Contact Person: Shazim Ali Memon, shazim.memon@nu.edu.kz
Conference website: seds.nu.edu.kz/research_conference

23rd International Conference on Manufacturing Research (ICMR 2026)
Dates: September 2-4
Paper publication: Accepted papers will be published in Springer book series or journals
Organizing Entity: SEDS
Contact Person: Essam Shehab, essam.shehab@nu.edu.kz
Conference website: https://seds.nu.edu.kz/icmr2026

International Conference on Secure and Intelligent Digital Ecosystems
Dates: October 22-23
Paper publication: Accepted papers will be published in IEEE conference proceedings
Organizing Entity: SEDS
Contact Persons: Anwar Ghani Anwar, ghani@nu.edu.kz, Hari Mohan Rai, hari.rai@nu.edu.kz, Adnan Yazici Adnan.yazici@nu.edu.kz
Conference website: side.nu.edu.kz

SEDS and Partners

Physics Congress at NU
Dates: May 25–30
Publication: Accepted abstracts in the abstract book
Organizing Entity: SEDS, SSH, Kazakh Physics Society
Contact Person: Anton Desyatnikov, anton.desyatnikov@nu.edu.kz
Conference website: www. physics-congress.kz

14th International Conference on Nanomaterials and Advanced Energy Storage Systems
Dates: August 5–7
Paper publication: Accepted works will be published either in RSC Advances or Journal of Power Sources
Organizing Entity: SEDS, NLA, Institute of Batteries
Contact Person: Aishuak Konarov, aishuak.konarov@nu.edu.kz
Conference website: www.iness.kz

5th International Symposium on Emerging Materials and Devices (ISEMD 2026)
Dates: June 17-19
Organizing Entity: SEDS, NBLA, Institute of Batteries
Contact Person: Nurxat Nuraje, nurxat.nuraje@nu.edu.kz
Conference website: https://nla.nu.edu.kz/isemd2026

11th International Conference on Automation, Control and Robotics Engineering (CACRE 2026)
Dates: August 17–20
Paper publication: Accepted papers will be published in IEEE Xplore
Organizing Entity: SEDS, Hong Kong Soceity of Mechanical Engineers, Sponpored by Hong Kong University of Science and Technology, IEEE Rototics and Automation Society
Contact Person: Nurxat Nuraje, nurxat.nuraje@nu.edu.kz
Conference website: cacre.org

2nd International Conference on AI and Robotics (AIR 2026)
Dates: May 8-9
Publication: Accepted abstracts in the abstract book
Organizing Entity: SEDS, The Center of Excellence in Medical Robotics and Research
Contact Person: Aibek Niyetkaliyev, aibek.niyetkaliyev@nu.edu.kz, Prashant Jamwal, prashant.jamwal@nu.edu.kz
Conference website: https://theioes.org/air2026/

1st International Conference on AI & Digital Modelling in Energy (AIDME-2026)
Dates: July 23-26
Organizing Entity: SEDS, NLA, INMET
Contact Person: Yanwei Wang, yanwei.wang@nu.edu.kz

School of Mining and Geosciences

Rockburst and Seismicity Seminar with IMS Seismic Monitoring Training
Dates: June 17-19
Organizing Entity: School of Mining and Geosciences
Contact Person: Fidelis Suorineni, fidelis.suorineni@nu.edu.kz

Caspian Sea Conference on Regional Cooperation for Environment, Sustainability, and Climate Adaptation
Dates: June 26
Organizing Entity: School of Mining and Geosciences
Contact Person: Emil Bayramov, emil.bayramov@nu.edu.kz
Jessica Neafie, jessica.neafie@nu.edu.kz

Nazarbayev University joins GIZ's Green Skills programme in Central Asia

In November 2025, Nazarbayev University took part in the Inception Meeting of the regional GIZ project "Green Skills for a Green Economy in Central Asia (PROGRESS)", held on 17–18 November in Tashkent. The project is funded by the Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by GIZ across Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan during 2025–2028.

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Strategic focus: energy sector and skills development

The PROGRESS initiative aims to strengthen professional competencies and employment in the green economy, with renewable energy and energy efficiency identified as priority sectors during the initial implementation phase. Key discussion points included the integration of green skills into national policies, development of qualification frameworks, and modernisation of academic and professional training programmes. Working sessions emphasised the importance of sustainable collaboration between universities, vocational institutions, industry associations, and public authorities, as well as the development of a shared methodological framework for green skills across Central Asia.

Nazarbayev University's role in PROGRESS

Following the inception meeting, Nazarbayev University was designated as a key partner of the PROGRESS project for the implementation of the Green Skills programme in Kazakhstan and at the regional level. The university's recognised strengths in renewable energy research, energy efficiency, and practice-oriented education were highlighted by international and regional stakeholders. A core asset supporting this role is NU's operational renewable energy testing site, which includes solar, wind, and solar thermal installations, as well as heat pump systems. This infrastructure underpins hands-on training and pilot modules directly linked to real engineering and operational challenges, enabling the development of labour-market-relevant green skills.

Contribution to the regional green transition

Participation in PROGRESS reinforces Nazarbayev University's strategic role in building human capital for the green transition. The partnership provides a platform for long-term institutional cooperation, scaling of best practices, and harmonisation of approaches to green skills development across Central Asia.

With infrastructure ranging from a renewable energy testing site ground to advanced heating systems in townhouses, we will become a regional partner of the GIZ programme. This partnership will enable us to scale our expertise and integrate applied green skills into workforce training standards across Central Asia. By working with real equipment in production settings, students and professionals will cultivate a professional culture that links environmental responsibility with advanced engineering thinking.

Anvar Kolumbetov, NURA PI, Senior Engineer

From Sun to System: Kazakhstan's First Residential District Heating Powered by Solar Thermal Energy

In December 2025, an innovative energy infrastructure project was commissioned at the campus of Nazarbayev University, demonstrating the first practical integration in Kazakhstan of solar thermal collectors into an operational district heating system serving residential buildings.

AT A GLANCE

Buildings served: 10 duplex residential townhouses
System type: Hybrid solar - gas district heating
Status: Operational (industrial use)

The project connects a solar thermal loop directly to the central heating substation of a group of 10 residential duplex townhouses, forming a hybrid heat supply system that operates under real-life conditions. Unlike conventional local or demonstrational installations, the system functions as a load-sharing element of the centralised network, preheating the heat-transfer medium and reducing reliance on gas-fired heat sources.

Implemented by NURA (NURIS Enterprise) with support from GIZ, the project covered the full development cycle from engineering design and installation to commissioning and industrial operation.

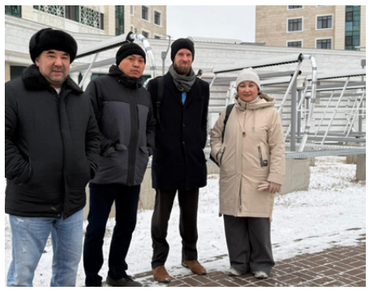
Operational data and modelling show that from May to October, solar collectors can cover up to 100% of domestic hot water demand, while in spring and autumn they compensate for up to 30% of space-heating load, significantly improving the energy efficiency of the system. The solution is particularly relevant for the climate conditions of northern Kazakhstan and demonstrates clear potential for replication in residential districts, campuses, and social infrastructure.

WHY IT MATTERS

- **First full-scale integration of solar thermal energy into residential district heating in Kazakhstan**
- **Reduces natural gas consumption and operational costs**
- **Lowers CO_2 emissions and peak thermal loads**
- **Provides a scalable model for low-carbon heating solutions**
- **Practical training and research facility**

TECHNICAL SNAPSHOT

Installed solar thermal capacity: ~50 kW
Collectors: 24 evacuated-tube panels
Total active area: 88.56 m²
Annual thermal output: ~106 Gcal
Control: Automated digital energy management system



Tour of renewable energy facilities at NU for GIZ representatives

Research Support Hub by NU Library

Nazarbayev University Library is committed to supporting the research community at every stage of the research lifecycle from publishing opportunities to accessing global resources.

Learn More and Get Help
For additional guidance and resources, visit the NU Library website or contact NU librarians directly – www.library.nu.edu.kz. **You can also visit the Library in Block 5 to ask questions in person and explore available research support services.**

NAZARBAYEV UNIVERSITY
LIBRARY

Undergraduate and graduate research avail of the Training & Consultations in group, in-person, on-site, online on the following:

- basics of research design
- developing search strategies
- selecting appropriate tools/databases for literature reviews and evidence synthesis
- citation management, data management
- strategies for staying current in your field
- navigating scholarly publishing
- bibliometics
- AI literacy

The advanced research support service will help to succeed researchers and postgraduate students, providing:

- Consultations on research visibility (guidance on ORCID, Scopus Author ID, and Web of Science ResearcherID).
- Publication strategy advising (identifying suitable journals, understanding journal impact factor, and avoiding predatory publishers).
- Support in Understanding Institutional repository policies and copyright requirements
- Depositing your work in the institutional repository

Enhancing the visibility and research impact on a global scale

Repository Overview & Content Structure

Nazarbayev University repository website - **nur.nu.edu.kz**

The NUR serves as an institutional electronic archive—built on the DSpace platform—designed for long-term preservation, aggregation, and reliable open access to the scientific outputs and intellectual property generated by the Nazarbayev University community and affiliated organizations.

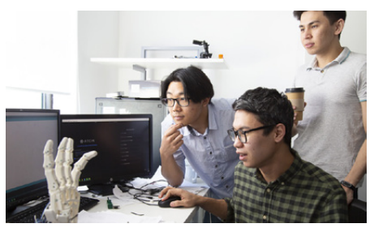
Established in 2015, it offers structured access through a variety of communities & collections, each with item counts:

Total number - 9216 items

- Theses: 2,797
  Bachelor theses - 675
  Master theses - 1913
  In open access: 858
  PhD theses - 209
  In open access: 77

- NU Schools: 2,734
- NU Research Institutes & Centres: 1,073
- NU Publications: 1775
- Forums, conferences & projects: 126

Repository Presence & Cataloging
The repository is indexed in OpenDOAR, a global directory of academic repositories, confirming its institutional status and use of DSpace software. It supports a wide range of content types, including journal articles, conference papers, theses, reports, books, chapters, learning objects, and more.



Open access publishing agreements

The agreements allow NU-affiliated authors to publish in selected gold and hybrid open access journals, with APCs covered by NU.

NU has established open access publishing agreements with: Wiley

The Transformative Agreement between NU and Wiley has been active from April 1, 2024, and is extended in April 1, 2025 and valid through March 31, 2026. This agreement aims to support the open access publishing of research articles, allowing NU authors to publish without publication fees under NU requirements set and published in the libguide and via email.

The approved requests represent a broad range of disciplines. The articles published cover journals in fields such as energy, education, environmental science, philosophy, medical research, and others. Key details of some prominent approved publications include:

British Journal of Educational Technology – ranked in Top 1% journals indexed in Scopus

Energy & Environmental Materials – ranked in Top 2 % journals indexed in Scopus

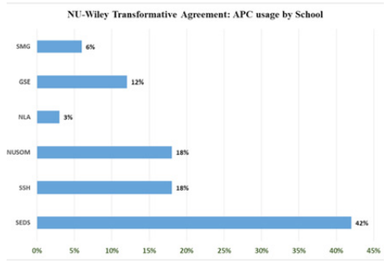
Mind & Language – ranked in Top 5 % journals indexed in Scopus

International Journal of Alzheimer's Disease – ranked in Top 5 % journals indexed in Scopus

Sedimentology – ranked in Top 5 % journals indexed in Scopus notifications to NU faculty and researchers.

Regarding the NU–Wiley Transformative Agreement, the majority of APC coverage is attributed to SEDS authors, followed by NUSOM and SSH, with additional contributions from GSE, SMG, and NLA. Consequently, all of these authors published their articles in open access, Q1-ranked journals.

In total, all approved requests are published or in the process of publication in open access. These articles contribute to the dissemination of high-impact research in a range of academic fields.



ACM – Association for Computing Machinery

Association for Computing Machinery is the world's largest computing society and a leading publisher of research in computer science and information technology. Through NU's transformative agreement with ACM, researchers can both access leading computer science research and publish their work openly.

The agreement has been signed in 2024 and still valid. There is 1 approved submission which is published in 2024 by SEDS professor. Link

Cambridge University Press

This agreement exists since 2021 and it is a "read and publish" agreement where NU acquires a whole package where funding is allocated partly for subscribed resources and partly for publishing services. NU authors also could publish using the university funding in high-quartile journals.

Oxford University Press

The agreement has been signed in June, 2025 and currently 1 submission has been approved for APC coverage.

Databases - Access to the worldwide research

Library provides access to the global research ensuring subscription to academic peer-review journals, research monographs, conference papers, theses, and other scholarly resources. The high quality credible information fosters collaboration, innovation, research connections across countries and institutions.

Reference databases - Web of Science, Scopus, Pivot, SciVal

Full text databases for interdisciplinary and subject research - A-Z databases

Interlibrary Loan

Interlibrary Loan (ILL) Document Delivery is one of the services provided by the Library through the Department to obtain resources that are not available by virtue of the partnership agreement or informal collaboration with other libraries.

Partnership agreements: University of Wisconsin–Madison, Library of Congress.

Delivery times vary depending on whether the document is owned by a Partner Institution or not.

Email library@nu.edu.kz with the full citation information of the source, or fill out the form.

Request form: https://nukz.asia.qualtrics.com/jfe/form/SV_3skawo60zFBZAnH

Libguides - Reliable research companion

The guidance in searching and locating the research materials, use of tools and basics of research processes:

- **Library Research Support Services**
- **Research Support Guide for NU undergraduates**
- **Research Support Guide for NU Staff and PhD students**
- **Nazarbayev University Repository**

- **Open Access**

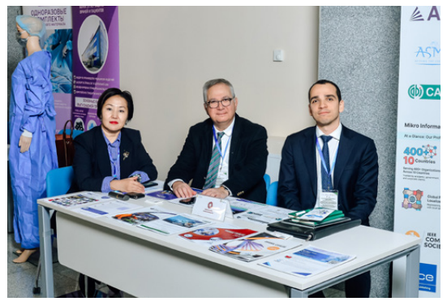
- **Open Access Publishing Agreement:** Oxford University Press
- **Open Access Publishing Agreements:** ACM
- **Open Access Publishing Agreements:** Cambridge University Press
- **Open Access Publishing Agreements:** Wiley

- **Open Educational Resources**
- **Open Research**
- **Systematic review**
- **Evidence synthesis**
- **Literature review**
- **Scholarly communication and publishing**
- **Research Impact**
- **AI tools for research and study**
- **Annotated bibliography**

1st Nazarbayev University International Conference on Planetary Health and Environmentally Sustainable Healthcare: A Milestone for Central Asia

Nazarbayev University marked a major milestone in advancing environmental sustainability in the healthcare sector with the successful conclusion of the 1st Nazarbayev University International Conference on Planetary Health and Environmentally Sustainable Healthcare, held in partnership with the University Medical Center and the Central Asian Research Centre for Educational Innovation and Transformation (CARCEIT). The two-day event brought together approximately 235 national and international participants, including leading global experts, government representatives, healthcare professionals, researchers, and students.

The conference served as a dynamic platform for sharing evidence, innovations, and solutions to the pressing environmental challenges facing healthcare systems worldwide, while also highlighting Kazakhstan's growing role in shaping regional and global sustainability agendas.



Global Leaders Share Expertise Through Keynote Presentations

The conference featured eight keynote addresses delivered by internationally renowned experts in planetary health and sustainable healthcare. These keynote speakers represented leading institutions across the world, including the University of Memphis, University of Wyoming, and University of North Carolina in the United States; the National University of Singapore; Nagasaki University in Japan; and Aga Khan University in Pakistan.

- **"Planetary Health: Expanding the Healing Mission of Medicine in the 21st Century".** A call to reframe medicine's mission to include environmental stewardship and planetary well-being.
- **"Concept for Managing All Types of Waste in the Republic of Kazakhstan for 2025–2030"**. An overview of Kazakhstan's national strategy to modernize waste management systems and strengthen environmental protection.
- **"Reimagine Public Health in the 21st Century Using the SMAART Model".** A presentation of a novel model integrating data science, systems thinking, and equity-oriented public health innovation.
- **"Sustainable Clinical and Pharmaceutical Waste Management Practices in Wyoming, USA"**. A comparative perspective highlighting effective strategies for reducing healthcare waste in clinical settings.
- **"High-quality Health Systems and Climate Leadership"**. A discussion on how strong health systems must evolve to lead climate mitigation and adaptation efforts.
- **"Leading Beyond the Clinic: Managerial Competencies for Global Health and Sustainability".** An exploration of the leadership skills required for healthcare professionals navigating global environmental challenges.
- **"Climate, Pollution, and Health Systems: Building Resilience through Research and Education in Asia".** Evidence from Asia underscoring the need to strengthen health systems through interdisciplinary research and training.
- *Virtual Keynote:* **"From Vulnerability to Preparedness: Assessing Climate-Resilient Health Systems through the WHO Framework".** A global overview of tools and indicators for evaluating climate-resilient health systems.

Their presentations examined emerging planetary health threats, the environmental footprint of healthcare systems, strategies for decarbonizing clinical services, and innovative approaches to integrating sustainability into health education and practice.

ENGAGEMENT FROM NATIONAL LEADERS

The conference welcomed high-level representatives from Kazakhstan's key governmental agencies, reflecting strong national commitment to environmental sustainability:

- Mr. Saken Kalkamanov, Chairman of the Board, International Green Technologies and Investment Projects Center, Ministry of Ecology and Natural Resources
- Dr. Eric Baizhunusov, Chairman of the Board, National Center of Public Health Care, Ministry of Health

Their remarks emphasized the importance of strengthening intersectoral collaboration, accelerating sustainability reforms in the health sector, and ensuring that Kazakhstan remains aligned with global planetary health priorities.

SHOWCASING RESEARCH FROM KAZAKHSTAN AND CENTRAL ASIA

The scientific program included two dedicated sessions focused on research from Nazarbayev University and other institutions in Kazakhstan and the Kyrgyz Republic. These sessions showcased emerging scholarship and data-driven initiatives advancing planetary health and sustainable healthcare across the region.

In total, 24 research studies from Kazakhstan and other countries were presented through oral and poster formats, reflecting the diversity and depth of ongoing work in climate–health interactions, eco-friendly health practices, and system-level sustainability efforts.

CAPACITY-BUILDING THROUGH WORKSHOPS

The conference also provided meaningful training and professional development opportunities through two interactive workshops:

- **"Public Health Diplomacy in an Era of Complexity, Uncertainty, and Unpredictability".** Delivered as a pre-conference event by Prof. Ahish Joshi of the University of Memphis, this workshop drew strong attendance from students, faculty, and healthcare practitioners seeking to understand diplomacy in global health contexts.
- **"Tools to Address and Improve Environmental Sustainability in Clinical Care".** Led on the second day by Prof. Paul Barach of the University of North Carolina, this workshop offered participants practical tools and evidence-based approaches to reducing the environmental footprint of healthcare facilities.

Both workshops were enthusiastically received and contributed to the conference's broader mission of capacity building and knowledge translation.

SPOTLIGHT ON THE QAZ GREEN HEALTH PROJECT: ADVANCING SUSTAINABLE HEALTHCARE IN KAZAKHSTAN

One of the defining features of the conference was the comprehensive dissemination of research outputs from the Qaz Green Health Project, funded by CARCEIT. The conference is one of the local impact activities and a culminating activity organized by the Gaz Green Health Team. The team, led by Associate Professors Jonas P. Cruz and Paolo C. Colet of the School of Medicine, aims to build environmental sustainability competencies among current and future healthcare professionals in Kazakhstan. Its research outcomes formed one of the most substantial scholarly contributions to the conference.

The overarching study, **"The Qaz Green Health Project: Developing the Environmental Sustainability in Healthcare Competence of the Present and Future Healthcare Workforce in Kazakhstan",** was presented during the session "Planetary Health and Sustainability Research at Nazarbayev University." This presentation synthesized the project's goals, methodology, educational innovations, and its role in building national capacity for greener and more resilient healthcare systems. Collectively, the project's research outputs provided one of the richest and most coherent bodies of evidence on environmental sustainability in healthcare ever presented in Kazakhstan.

A TRANSFORMATIVE STEP FOR CENTRAL ASIA

The 1st Nazarbayev University International Conference on Planetary Health and Environmentally Sustainable Healthcare positioned Kazakhstan and Nazarbayev University as an active contributor to global sustainability efforts. Through high-level engagement, strong regional participation, and impactful research exchange, the conference reaffirmed the university's commitment to planetary health and interdisciplinary collaboration, laying the groundwork for greener and more resilient healthcare systems in Central Asia.

SDSN Kazakhstan Highlights 2025

SDSN Kazakhstan Receives DAAD Funding as a Core Partner in the SDGnexus Network Project

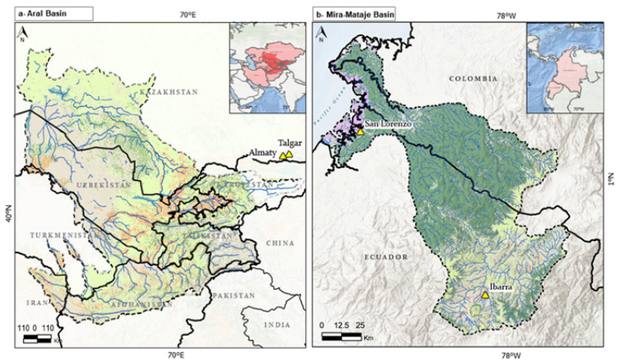
SDSN Kazakhstan at Nazarbayev University has launched the second phase of the SDGnexus Network Project in partnership with the Centre for International Development and Environmental Research (ZEU), Justus Liebig University Giessen, with funding from DAAD's Exceed programme.

The five-year initiative (2025–2029) brings together six core universities from Latin America, Central Asia, and Germany to study interactions among the SDGs, focusing on land use, water, climate, biodiversity, governance, and gender. The new phase builds on the first stage (2020–2024) and prioritizes support for early-career researchers and improved knowledge exchange. The project continues the growing collaboration between Nazarbayev University and JLU, formalized by an MoU in 2024. **Dr. Serik Orazgaliyev** and **Dr. Aliya Assubayeva** serve as co-PIs from Kazakhstan. Read more

New Publication: Sustainability and Environmental Challenges in the Caspian Sea

The SDSN Kazakhstan team Dr. Stefanos Xenarios and Dr. Serik Orazgaliyev together with colleagues from the University of Oulu, Dr. Ali Torabi Haghighi and Dr. Björn Klöve, published a Special Issue on Sustainability and Environmental Challenges in the Caspian Sea in the International Journal of Water Resources Development. The collection provides an integrated overview of the geophysical, historical, climatic, hydrological, and socioeconomic dynamics shaping the Caspian Sea. It identifies key environmental challenges and highlights national and regional policy pathways for advancing sustainable water management. Addressing these issues is essential for preserving the ecological stability of the Caspian region and informing long-term strategies for sustainable development. Read more

Transdisciplinary Research on Water Security in Transboundary River Basins

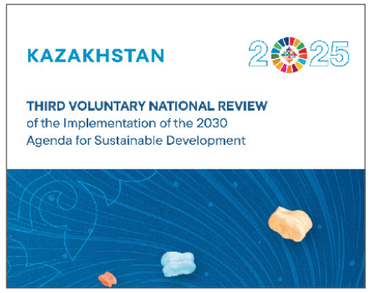


As part of the SDGnexus Network Project, SDSN Kazakhstan researchers contributed to a new article, "Transdisciplinary Research on Water Security in Transboundary River Basins," published in iScience (Cell Press). Read more

SDSN Network Managers Workshop, Malaysia

From 2–6 November 2025, SDSN Network Managers from 25 countries gathered at Sunway University (Malaysia) for a workshop dedicated to capacity-building and cross-network collaboration. SDSN Kazakhstan Manager Aida Kumarbayeva participated in sessions on SDG data gaps, net-zero campus strategies, governance models, and innovative sustainability initiatives. Read more

SDSN Kazakhstan's Contribution to the 2025 Voluntary National Review



SDSN Kazakhstan took part in shaping Kazakhstan's Voluntary National Review (VNR) 2025, the country's official report to the United Nations on progress toward the 2030 Agenda. The team contributed evidence-based insights on national priorities and SDG implementation challenges.

Among its recommendations, SDSN Kazakhstan highlighted key priorities:

- SDG 4: Quality Education
- SDG 3: Good Health and Well-Being
- followed by SDG 8, SDG 1, and SDG 16

The team also noted that public awareness of the SDGs remains low, with only 20% of respondents demonstrating a strong understanding.

This contribution underscores SDSN Kazakhstan's commitment to supporting informed policymaking and inclusive national processes. Read more

3rd SDSN Kazakhstan Conference: Partnership and Collaboration for a Sustainable Future

On 16 May 2025, SDU University hosted the 3rd SDSN Kazakhstan Conference under the theme "Partnership and Cooperation in Building Sustainability and Sustainable Development."

The conference gathered representatives from academia, government, civil society, and international organizations to discuss regional challenges related to education, healthcare, economic development, environmental protection, and social equity. The event continues to serve as a key national platform for advancing SDG implementation across Kazakhstan and Central Asia. Read more

SDSN Kazakhstan at the GBA–ASEAN Conference on Trade, Finance & Sustainable Development

On 31 October – 1 November 2025, SDSN Kazakhstan participated in the GBA–ASEAN Conference held in Hong Kong and Shenzhen. Manager Aida Kumarbayeva represented the network at this high-level event co-hosted by SDSN, the University of Hong Kong, and the Chinese University of Hong Kong.

The conference marked the launch of the GBA–ASEAN Initiative, an action-oriented programme aimed at strengthening trade, policy, and technology cooperation between China's Greater Bay Area and ASEAN. Sessions featured global leaders, including Prof. Jeffrey Sachs and senior ASEAN officials, addressing energy transitions, sustainable finance, and AI governance. Read more

Nazarbayev University and SDSN Kazakhstan at the Water Security and Climate Change Conference, Tashkent

A Nazarbayev University delegation including Dr. Serik Orazgaliyev, Dr. Aliya Assubayeva, Dr. Kamilya Yessimbet, PhD student Yelif Ulagpan, and MPA student Bauyrzhan Zhomart participated in the 9th WSCC Conference in Tashkent on 8–10 October 2025.

The team contributed poster presentations on water governance, agricultural policy, and urban water management in Kazakhstan. Their participation helped strengthen regional and international collaboration around water security, climate resilience, and sustainable development. Read more

ISSAI Momentum Showcases Kazakhstan's Homegrown AI Innovations

On December 10, ISSAI hosted its ISSAI Momentum event at the Main Hall of Nazarbayev University, attracting over 150 distinguished guests from government, academia, IT companies, non-governmental organizations, international organizations, Media and diplomatic missions. The program included live demonstrations, Q&A sessions, and showcases of real-world AI applications. ISSAI unveiled a suite of next-generation AI products designed for real-world applications:

Oylan 3 – A multimodal AI tool processing text, speech, and images in Kazakh (including Latin script), Russian, and English, featuring web search, advanced reasoning and Retrieval-Augmented Generation (RAG) for accurate, context-aware responses.

MangiSoz 3 – A comprehensive speech recognition, synthesis, Optical Character Recognition (OCR), and translation engine supporting 11 languages, including Kazakh, Russian, English, Turkish, Chinese, Arabic, French, Spanish, Kyrgyz, Uzbek, and Azerbaijani. It also features expressive voice generation.

TilSync 2 – A next-generation live translation platform for events and broadcasts, offering real-time translation via QR code, translation history, speaker introductions, macOS support, and dual subtitle streams in Kazakh, Russian and English.

Beynele 2 – A culturally grounded multilingual image generation system trained on extensive Kazakh visual datasets. The latest version supports multi-image conditioning, allowing photorealistic compositions that reflect Kazakh aesthetics and identity.

Mangitas 02 – A secure, cloud-independent AI inference server capable of hosting all ISSAI models in a closed network, ensuring confidentiality and compliance with enterprise security requirements.

ISSAI Momentum highlighted the institute's commitment to openness and collaboration and reaffirmed Kazakhstan's growing role as a hub for homegrown AI innovation.

ISSAI Showcases Advances in Multilingual AI at NLPIR 2025 Conference in Japan

ISSAI researchers presented cutting-edge work on multilingual artificial intelligence at the 9th International Natural Language Processing and Information Retrieval Conference (NLPIR 2025), held on 12–14 December at Kyushu University in Fukuoka, Japan.

Anuar Aryngazin, Data Scientist at ISSAI, delivered an oral presentation on Multi-Head Vision Transformer for Multilingual Font and Language Identification, co-authored with Huseyin Atakan Varol. The study explores advanced vision-based transformer architectures for robust multilingual font and language identification in real-world settings.

Professor Varol also presented Efficient Language Expansion for Machine Translation Using LoRA: A Case Study for Kazakh, co-authored with Saida Mussakhojayeva, demonstrating how parameter-efficient fine-tuning can accelerate the integration of low-resource languages into modern machine translation systems.

Both papers were selected for oral presentation, underscoring their scientific relevance and impact. The proceedings will be published by Springer Nature, further strengthening ISSAI's international research visibility in multilingual AI.

NU Social Club successfully launches with «The Young Researchers' Get Together» Event

The NU Social Club officially launched with its inaugural event, "The Young Researchers' Get Together," bringing together approximately 200 young researchers from Nazarbayev University Schools, Research Centers, and affiliated organizations.

Held on November 28 at Ballroom Right, Block C2, the event marked the beginning of a new initiative aimed at strengthening non-academic engagement and fostering closer connections across the university's young researcher community. The gathering provided participants with an opportunity to interact in an informal setting beyond the scope of their regular academic and research responsibilities.

The event also highlighted a growing interest in creating more platforms for peer engagement, communication, and community-building among young researchers at NU.

Supporting Community Building Across NU

In a research-intensive environment, young researchers often operate within separate teams, departments, and projects, with limited opportunities for interaction outside formal academic settings. The NU Social Club was established to address this need by creating a space for connection across disciplines and organizational units.

By encouraging non-academic interaction, the initiative supports broader networking, strengthens ties across the university, and contributes to a more inclusive and cohesive research community.

About the NU Social Club

Sponsored by the NU Impact Foundation, the NU Social Club is a newly established initiative aimed at connecting young researchers across the NU community, including its Schools, Research Centers, and affiliated organizations.

The club seeks to promote:

- non-academic interaction;
- networking;
- collaboration;
- a stronger sense of community among young researchers. It is intended to serve as a platform for building meaningful connections and supporting a more vibrant university environment.

"We established this club to break down silos and create a supportive, enjoyable atmosphere where researchers can truly connect. The attendance at our first gathering proves just how much this kind of non-academic interaction was needed."

Future Activities

Following the successful launch of its first event, the NU Social Club plans to organize further activities and gatherings to continue strengthening engagement across the young researcher community at Nazarbayev University.

How to Join

Young researchers interested in joining the NU Social Club may send a request to **nu_social_club@nu.edu.kz** Members are also encouraged to regularly check their official NU email accounts for updates on upcoming events, meetings, and announcements.

ISSAI Advances Global AI Dialogue, Innovation, and Impact

Global Leadership in Artificial Intelligence

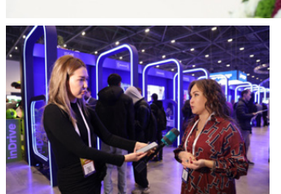
On 1 October, the Institute of Smart Systems and Artificial Intelligence (ISSAI) at Nazarbayev University hosted AI Horizons: A Conversation with Global Leaders, a high-profile academic event attended by more than 400 students, faculty members, and researchers. The discussion featured internationally renowned scholars Peter Norvig, John Hopcroft, and Merouane Debbah, and was moderated by Huseyin Atakan Varol, Founding Director of ISSAI.

The panel addressed strategic directions in AI research and education, highlighting the continued relevance of classical computer science foundations, as well as emerging priorities related to interpretability, trust, and responsibility in advanced AI systems. Particular attention was given to Kazakhstan's positioning within the global AI landscape and the importance of sustained engagement with early-career researchers and students.

ISSAI at Digital Bridge 2025: Shaping Kazakhstan's AI Future

On 2 October, the Institute of Smart Systems and Artificial Intelligence (ISSAI) at Nazarbayev University hosted a high-level panel at Digital Bridge 2025 in Astana titled Bridging Academia, Innovation, and Society: Localizing AI for Global Relevance. The discussion emphasized that Kazakhstan's AI development depends on aligning local innovation with global collaboration to become an active contributor to the international AI ecosystem.

The panel featured Sarim Aziz (Meta Platforms Inc.), Elmira Obry (Foody AI), Huseyin Atakan Varol, and Leisan Akhmadullina (Innopolis University). During the forum, ISSAI signed Memoranda of Understanding with Kyrgyz State Technical University and SHAI.PRO and showcased its technologies at the IT exhibition through live demonstrations and stakeholder engagement.



ISSAI Launches Qolda:
Compact Open-Source Multimodal AI for Everyday Devices

On November 14, ISSAI announced the launch of Qolda, a new open-source, compact language-vision model designed to make advanced intelligence truly accessible to everyone.

Today, state-of-the-art generative AI models such as DeepSeek, KazLLM, and Oylan typically require supercomputing-scale infrastructure, placing them out of reach for most users. Qolda changes that equation. With 4 billion parameters, Qolda delivers powerful multimodal reasoning while remaining lightweight enough to run on smaller, affordable devices such as laptop computers. ISSAI Qolda is firmly committed to upholding safety and ethical standards. It promotes responsible use of technology, avoids offensive or inappropriate language, and refuses to respond to prompts that compromise security. On benchmark evaluations, Qolda, operating in reasoning mode with 4B parameters, demonstrates competitive performance matching the KazLLM-70B on Kazakh and Russian. Qolda communicates fluently in Kazakh, Russian, and English, and handles both text and image inputs with remarkable efficiency. Whether you are a researcher, developer, student, or a small business owner, Qolda is built to support real-world tasks, empower new ideas, and inspire innovation.

ISSAI Hosts AI & Circular Construction Conference at Nazarbayev University

On 28 November, the Institute of Smart Systems and Artificial Intelligence (ISSAI) at Nazarbayev University hosted the conference AI and the Circular Economy: Shaping the Future of Construction Policy and Practice, examining how artificial intelligence and circularity can transform the built environment. Organized by Huseyin Atakan Varol and Ferhat Karaca in collaboration with the ACI Student Chapter, the event brought together around 120 participants from academia, policy, industry, and the NU Civil Engineering community.

The conference highlighted the role of digital innovation, data analytics, and AI-driven indicators in advancing sustainable, resource-efficient construction and urban development. Invited speakers included Luís Bragança (University of Minho), representatives of the Astana Center of Urbanism and the Kazakhstan Green Building Council, United Nations Development Programme experts, and Nazarbayev University doctoral researchers, offering multidisciplinary perspectives on the future of circular construction.

CARCEIT NEWS

NAZARBAYEV UNIVERSITY
CENTRAL ASIAN RESEARCH CENTRE FOR EDUCATIONAL INNOVATION AND TRANSFORMATION (CARCEIT)

The Central Asian Research Centre for Educational Innovation and Transformation (CARCEIT) is dedicated to advancing education research and innovation in Central Asia. As part of the Graduate School of Education at Nazarbayev University, CARCEIT aims to shape global knowledge, influence education policy and leadership, and build a robust regional research community. CARCEIT is dedicated to driving innovation and transformation of educational practices across the region.

CONFERENCES

Emerging Insights on Young Children's Happiness and Well-Being in Kazakhstan

Conference Highlights | Early Childhood Education (ECEC)

At the National Conference *"The Best Start in Life for All Children in Kazakhstan"* (30–31 October 2025), Professor Daniel Hernández-Torrano (NU GSE) presented early findings from the CARCEIT-funded project *"Nurturing Young Minds."* The study draws on data from 316 children in public and private kindergartens nationwide.

WHAT MAKES CHILDREN HAPPY

- Play and toys
- Friendships and caring relationships
- Creative activities and learning
- Nature experiences and physical movement

PATHWAYS TO WELL-BEING

The research identifies distinct pathways through which children flourish, including comfort-seeking, nature-oriented, mastery-focused, and playful profiles highlighting diverse sources of joy, engagement, and connection in everyday kindergarten life.

POLICY & PRACTICE IMPLICATIONS

Findings underscore the importance of recognizing children as competent social actors and systematically integrating their perspectives into ECEC policy and practice.

COLLABORATION

The project is conducted in close partnership with the University of Melbourne, reinforcing Kazakhstan's commitment to prioritizing children's well-being in early education.

KNOWLEDGE EXCHANGE

Promoting Well-Being in Early Childhood Education

As part of the CARCEIT-funded project Nurturing Young Minds, the research team developed two major outputs a Policy Brief and an Educator Guide focused on promoting children's well-being in early childhood settings. Informed by research with over 300 children in public and private kindergartens, and refined through consultations with educators and policymakers, these resources translate evidence into practical strategies for system-level improvement and everyday pedagogical practice.

Parental Engagement and Early Intervention

CARCEIT-supported researcher Assem Tazhiyeva presented findings on how sociodemographic factors influence early intervention within families. The study highlights the role of education level, employment, and access to information in shaping parental engagement particularly among families of children with special educational needs. The presentation also introduced Ozim Academy, an inclusive education ecosystem supporting parents and in-service teachers, and emphasized the importance of collaboration between families, schools, and social services.

EMERGING RESEARCH

Ethics and Culture in Research with Young Children

The CARCEIT team produced a collaborative autoethnographic study exploring the ethical, methodological, and cultural dimensions of conducting research with young children in Kazakhstan. Drawing on researchers' reflections and field experiences, the study underscores the importance of culturally sensitive and reflexive approaches when working with young and vulnerable participants, offering guidance for early childhood and education researchers in emerging research contexts.

RECOGNITION

Research Excellence Award 2025

CARCEIT Director Professor Naureen Durrani was honoured with the Outstanding Career Achievement Research Excellence Award 2025, recognising her sustained scholarly impact and leadership in education research.

OTHER NEWS

CARCEIT Announces Winners of Five Major Educational Innovation Grants

Central Asian Research Centre for Educational Innovation and Transformation (CARCEIT) has announced the winners of five competitive grants supporting cutting-edge research aimed at transforming education policy and practice in Kazakhstan and the wider Central Asian region. The selected projects span higher education reform, teacher education, gender and climate change, and the future of learning in the AI era.

EXPLORING INNOVATIVE MODELS OF UNIVERSITIES IN TRANSITIONING ECONOMIES

Principal Investigator: Aida Sagintayeva

This project examines how new and accelerated university models emerge and evolve in transitioning economies. Through comparative case studies, the research explores leadership, governance, faculty development, and student experience, offering insights into how national priorities and global influences shape modern universities.

ICEP Grant

HYBRID FUTURES: WESTERN-STYLE UNIVERSITIES, LOCAL EPISTEMOLOGIES, AND

HIGHER EDUCATION HUBS

Winner: Munyaradzi Hwami

Duration: 27 months

This international collaborative project challenges one-way models of global education by positioning Kazakhstan and Uzbekistan as creators of higher education futures. By foregrounding local knowledge systems, the study redefines how higher education hubs develop in the region.

EITP Grants

GENDER, CLIMATE CHANGE, AND HIGHER EDUCATION TRANSFORMATION

Winner: Zumrad Kataeva

Duration: 27 months

Focusing on four Central Asian countries, this project investigates how universities integrate gender equality into climate and sustainability initiatives across governance, curricula, and research, advancing scholarship on gender-responsive climate action in higher education.

BUILDING INCLUSIVE TEACHING CAPACITY IN KAZAKHSTAN

Winner: Janet Helmer

Duration: 27 months

This study explores how inclusive pedagogy is embedded in Initial Teacher Education (ITE) programs and how future teachers are prepared to support diverse learners, directly contributing to SDG 4 on inclusive and equitable education.

TRANSFORMING INITIAL TEACHER EDUCATION IN THE ERA OF AI

Winner: Gulmira Qanay

Duration: 27 months

By integrating Lesson Study with AI-enabled tools, this project rethinks practice-oriented teacher preparation. It aims to strengthen reflective teaching, classroom inquiry, and sustainable development competencies for future educators in Kazakhstan.

OPPORTUNITIES & PUBLICATIONS

List of external research funding opportunities

We are pleased to share a curated list of international research funding opportunities that may be of interest to you. All listed opportunities have been pre-checked by Pre-award Operations Office of NURA and are open to applications from Nazarbayev University.

Pre-Award Operations Office Contacts:

Phone: +7 (7172) 69-48-27, 69-45-38, 69-47-19
Office Location: Block C4, 2nd floor, Office 265

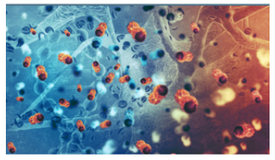
General

Research Grants *€100,000 - €250,000 – More details*	31/08/2026	Merck KGaA
EREF research grants *$15,000 - $500,000 More details*	01/05/2026	Environmental Research & Education Foundation
Small Research Grants on Education *$50,000 – More details*	25/11/2025	Spencer Foundation
Wellcome Discovery Awards *£3.5 million – More details*	31/03/2026	Wellcome Trust
Open call research grants *up to £50,000 – More details*	22/05/2026	Froebel Trust Charter for Inclusive Practice
FID - Call for Proposals *€50,000 - €6,250,000 – More details*	Rolling basis	Fund for Innovation in Development

Economy and policy

Core Research Grants: Future of Work *$75,000 - $200,000 – More details*	11/03/2026	Russell Sage Foundation
Thematic Research Programme and Regular Research Programme *$-not stated – More details*	31/03/2026	Hong Kong Institute for Monetary Research (HKIMR)

Medicine



ACS GCI Pharmaceutical Roundtable Research Grant *$40,000-$80,000 – More details*	15/05/2026	ACS
Therapeutic catalyst *up to £250,000– More details*	29/05/2026 25/09/2026	Cancer Research UK (CRUK)
Joint IASD/DreamScienceTM foundation *$5,000 – More details*	15/10/2026	The International Association for the Study of Dreams
Focused Ultrasound Foundation Research Awards *$-not stated – More details*	Rolling basis	Focused Ultrasound Foundation

Renewable energy

Grant application *More details*	Rolling basis	Energy Foundation

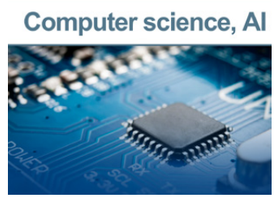
Engineering

IDEA Programs (Innovations Deserving Exploratory Analysis): Rail Safety IDEA *Up to $130,000 for both Type 1 and Type 2 projects – More details*	15/05/2026	Transportation Research Board (TRB) National Academies of Sciences, Engineering, and Medicine (NASEM)
Research and development enabling fund *£25,000-£50,000 – More details*	Rolling basis	Institution of Civil Engineers (ICE)

STEM

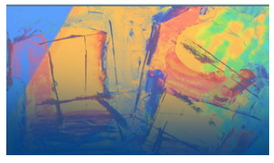
Targeted Grants in MPS *$-not stated – More details*	Rolling basis	Simons Foundation
Research Ireland Discover Programme – Opportunistic Funding Mechanism *More details*	Rolling basis	The Science Foundation Ireland

Computer science, AI



Scaling Trust *£100,000–£3,000,000 – More details*	24/03/2026	Advanced Research+Invention Agency (ARIA)
Comcast Innovation Fund *$3,000 - $150,000 – More details*	Rolling basis	Comcast
Internet Freedom Fund *$10,000-$900,000 – More details*	Rolling basis	Open Technology Fund (OTF)

Science, art, culture



Environmental Sustainability *$-not stated – More details*	Rolling basis	National Science Foundation
Grants *More details*	Rolling basis	Jane and Aatos Erkko Foundation

EREF Environmental Research & Education Foundation

We are pleased to invite you to apply for an exciting opportunity — the Research Grants offered by the Environmental Research & Education Foundation (EREF). These grants support innovative research projects focused on sustainable solid waste management and circular economy solutions.

Key Research Priority Areas:
- Climate Change & GHG Emissions
- Landfill methane emissions research
- Waste-to-energy impact studies
- Emission monitoring technologies

Objective of the Grant
- Advance scientific research in waste management
- Develop sustainable materials management practices
- Improve understanding of waste streams
- Promote circular economy solutions

Who Can Apply?
- Universities & academic researchers
- Environmental research organizations
- Institutions working on waste & sustainability research

Application Deadline:
01 May 2026
For more details, please visit the website: erefdn.org

New Research Publications Indexed by Scopus

The publications indexed in Scopus for **OCTOBER–DECEMBER 2025** represent a broad spectrum of disciplines, underscoring the diversity and interdisciplinary character of contemporary research. For ease of navigation and reader accessibility, the articles are organized according to the Scopus subject areas (Elsevier Support).

1. Physical Sciences

Fundamental research in Chemistry, Earth, Planetary Sciences, Mathematics, Physics and Astronomy.

- **CO2 storage capacity of coal seams: a screening and geological review of carboniferous coal formations of Kazakhstan**
  Asif, M.| Junussov, M.| Longinos, S.| Hazlett, R.| Satibekova, S.
  10.1007/s40789-025-00750-z

- **Dualistic role of ZEB1 and ZEB2 in tumor progression**
  Parfenyev, S.E.| Daks, A.A.| Shuvalov, O.Y.| Fedorova, O.A.| Pestov, N.B.| Korneenko, T.V.| Barlev, N.A.
  10.1186/s13062-025-00604-3

- **Tracheal tuft cells release ATP and link innate to adaptive immunity in pneumonia**
  Abdel Wadood, N.| Hollenhorst, M.I.| Elhawy, M.I.| Zhao, N.| Englisch, C.| Evers, S.B.| Sabachvili, M.| Maxeiner, S.| Wyatt, A.| Herr, C.| Burkhart, A.-K.| Krause, E.| Yildiz, D.| Beckmann, A.| Kusumakshi, S.| Riethmacher, D.| Bischoff, M.| Iden, S.| Becker, S.L.| Canning, B.J.| Flockerzi, V.| Gudermann, T.| Chubanov, V.| Bals, R.| Meier, C.| Boehm, U.| Krasteva-Christ, G.
  10.1038/s41467-025-55936-5

- **Hydrogen sensors based on polyaniline and its hybrid materials: a mini review**
  Askar, P.| Kanzhigitova, D.| Tapkharov, A.| Umbetova, K.| Duisenbekov, S.| Adilov, S.| Nuraje, N.
  10.1186/s11671-025-04231-9

- **Cryogenic fracturing of coal with LN2 treatment: A sustainable approach for enhancing coalbed methane extraction in water-scarce regions**
  Longinos, S.N.| Begaliyev, D.| Asif, M.| Tuleugaliyev, M.
  10.1016/j.jgsce.2025.205686

- **Piezoelectric-Triboelectric Hybrid Nanogenerator for Energy Harvesting and Self-Powered Sensing Applications**
  Hussain, S.Z.| Singh, V.P.| Sadeque, M.S.B.| Yavari, S.| Kalimuldina, G.| Ordu, M.
  10.1002/smll.202504626

- **High-performance Na3V2(PO4)3/C cathode for efficient low-temperature lithium-ion batteries**
  Mukushev, I.| Tyan, Y.| Kalimuldina, G.| Mukanova, A.| Jakupova, Z.| Kim, S.-S.| Bakenov, Z.| Nurpeissova, A.
  10.1038/s41427-025-00591-x

- **LN2 cryo-fracturing stimulation for future geothermal energy production from a depleted oil field: A case study of LN2 immersion in heated granite subsurface core specimens from Southwestern Kazakhstan**
  Longinos, S.N.| den Brok, B.| Hazlett, R.
  10.1016/j.energy.2025.137287

- **Performance evaluation of developed controllers for unmanned aerial vehicles with reference camera**
  Tassanbi, A.| Ali Khan, A.| Kashkynbayev, A.| Shehab, E.| Duc Do, T.| Ali, M.H.
  10.1177/00202940241270863

- **Parallel fiber-optic semi-distributed biosensor for detection of IL-6 and IL-8 cancer biomarkers in saliva at femtomolar limit**
  Zhakypbekova, A.| Bekmurzayeva, A.| Blanc, W.| Tosi, D.
  10.1016/j.optlastec.2025.113139

- **Sensitive detection of kidney injury biomarker (KIM1) in urine samples using an optical fiber semi-distributed interferometer biosensor**
  Seitkamal, K.| Afroz, A.| Tleuzhanova, A.| Makhmajanov, Z.| Kumar, S.| Gaipov, A.| Blanc, W.| Tosi, D.| Bekmurzayeva, A.
  10.1016/j.talanta.2025.128348

- **Enhanced oil/water separation using electrospun sandwich-like fibrous membranes of PCL/PMMA@PCL/PCL**
  Wang, Y.| Zhang, W.| Karamergenova, A.| Lin, L.
  10.1016/j.seppur.2025.134114

- **Hydrogen-bond-modulated flowable weak gel for EOR in ultra-high temperature and ultra-high salinity fracture-cavity ordinary heavy oil reservoirs**
  Xue, M.| Chen, L.| Chen, H.| Fu, L.| Bai, Y.| Lv, W.| Hou, B.| Riazi, M.
  10.1016/j.colsurfa.2025.137537

- **DYNAMICS OF NONLINEAR ANOMALOUS REACTION-DIFFUSION MODELS: GLOBAL EXISTENCE AND BLOW-UP OF SOLUTIONS**
  Jabbarkhanov, K.| Suragan, D.
  10.3934/eect.2025028

- **Insight Into the Role of Fiber Diameter on Electrospun Polysulfone Mats**
  Khezri, Z.| Pirsalami, S.| Avaji, S.| Mousavi, S.H.| Riazi, M.
  10.1002/pol.20240343

- **Analysis of dynamic pull-in for lumped MEMS model of atomic force microscope with constant magnetic excitation**
  Skrzypacz, P.S.| Putek, P.A.| Pruchnik, B.C.| Turganov, A.| Ellis, G.A.| Gotszalk, T.P.
  10.1016/j.jsv.2025.119215

- **Ag3PO4-based composites as next-generation antibacterial nanomaterials: A review of light induced synergistic effects**
  Tugelbay, S.| Yergaliuly, G.| Abilkhan, A.| Khan, N.| Tatykayev, B.
  10.1016/j.cej.2025.167818

- **Accurate and Fast Load Estimation Under Detuned Operation of IPT Systems**
  Savaedi, H.| Yazdi, S.| Bagheri, M.| Namadmalan, A.
  10.1002/cta.4497

- **Investigation of natural surfactant for oil recovery potential**
  Tukhfatova, A.| Abbas, A.H.| Irawan, S.| Pourafshary, P.
  10.1016/j.petlm.2025.09.001

- **Integrated seismic stratigraphic, sedimentological and petrophysical approaches for characterizing the Cenomanian reservoirs in transitional highs of north Western Desert intra-cratonic rift basins, Egypt**
  Awadalla, A.| Farag, A.| Moscariello, A.| Leila, M.
  10.1016/j.marpetgeo.2025.107581

- **A Short Review of Density Functional Theory Studies into Hydrogen Storage in Metal-Organic Frameworks**
  Soltan, R.| Amankeldiyeva, A.| Akilbekov, B.| Kalibek, M.| Sarsenova, S.| Kerimkulov, Z.| Abutalip, M.| Magazov, Y.| Almas, N.| Nuraje, N.| Karibayev, M.
  10.30919/es1828

- **Graphene-based conductometric monitoring of hydrogen purity (Proof of Concept)**
  Turlybekuly, A.| Shynybekov, Y.| Sagidolda, N.| Tebenova, A.| Myrzakhmetov, B.| Wang, Y.| Sultanov, F.| Razanau, I.| Novikau, U.| Mentbayeva, A.
  10.1016/j.ceja.2025.100871

- **Savinase-functionalised oxidative drug-loaded nanocarriers enhance the treatment of solid colorectal tumours in a 3D cell culture model**
  Mun, A.G.| Nurlankyzy, N.| Kalmagambetova, S.| Baumuratov, A.| Sarbassov, D.| Paunov, V.N.| Burska, A.N.
  10.1039/d5tb01882j

- **Optimizing reduced graphene oxide/MXene composites as sulfur hosts for lithium-sulfur batteries: A systematic investigation**
  Kenzhebek, M.| Mentbayeva, A.| Supiyeva, Z.| Kabyshev, A.| Sultanov, F.
  10.1016/j.matlet.2025.138773

- **Advances in hydrogel-based solar-driven interfacial evaporation systems: The pivotal factors and design strategies from photothermal engineering to energy management**
  Huang, X.| Cui, Y.| Kumar, N.| Sun, J.| Lin, Y.| Nuraje, N.| Wang, C.
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- **ERO1α as a Potential Drug Target for Breast Cancer: A Systematic Review of Current Evidence**
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  10.1016/j.jacc.2025.08.015

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  Akhatova, A.| Jones, C.| Coward, K.| Yeste, M.
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- **Partisan attitudes and the motivation behind the spread of misleading information**
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- **Multidimensional Visualization and AI-Driven Prediction Using Clinical and Biochemical Biomarkers in Premature Cardiovascular Aging**
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- **A qualitative study on the perspectives of doctors, nurses and residents about artificial intelligence and its application in healthcare: Implications to education**
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5. Social Sciences and Humanities

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- **Mapping the Field: A Scoping Review of Initial Teacher Education Research in Central Asia**
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- **Performance-Based Evaluation of Supplementary Cementitious Material Synthesized with Basic Oxygen Furnace Slag and Ground Granulated Blast Furnace Slag**
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- **Genomic landscape of the Great Steppe: Genetic variants in healthy Kazakh individuals**
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- **Dominant sources of PM2.5 in Kazakhstan's urban cities: A PMF and HYSPLIT-based study for air quality management in Central Asia**
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- **Hyperspectral Imaging for Quality Assessment of Processed Foods: A Case Study on Sugar Content in Apple Jam**
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- **Middle and early Upper Paleolithic settlement of the Georgian caucasus: A general perspective**
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- **Two founders, two leadership styles: QNP, Kazakhstan**
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- **Stone tool knapping quality and raw material selection behaviour in the Inner Asian Mountain Corridor**
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- **A qualitative study on the perspectives of doctors, nurses and residents about artificial intelligence and its application in healthcare: Implications to education**
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- **Environmental backsliders, repeat offenders and capital markets: Evidence from India**
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- **Effects of positive psychological interventions on young children's mental health and well-being: A systematic review protocol**
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- **A bibliometric performance analysis of publication productivity within pedagogy, andragogy, and heutagogy continuum: Outcomes of SciVal analytics**
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- **A Novel Methodology for Identifying the Top 1% Scientists Using a Composite Performance Index**
  Remizov, A.| Memon, S.A.| Sadykova, S.
  10.3390/publications13040055

6. Environmental Sciences

Research focused on sustainability and environmental challenges.

- **LN2 cryo-fracturing stimulation for future geothermal energy production from a depleted oil field: A case study of LN2 immersion in heated granite subsurface core specimens from Southwestern Kazakhstan**
  Longinos, S.N.| den Brok, B.| Hazlett, R.
  10.1016/j.energy.2025.137287

- **Enhanced photocatalytic antibacterial Ag3PO4/AgCl nanocomposites for water purification from organic and microbial contaminants**
  Tugelbay, S.| Shalabayev, Z.| Khan, N.| Mukhanbetzhanov, N.| Jumagaziyeva, A.| Sultanov, F.| Kozhakhmetov, S.| Kushugulova, A.| Shevelkov, A.V.| Mucsi, G.| Tatykayeva, U.| Daniyeva, N.| Burkitbayev, M.| Tatykayev, B.
  10.1016/j.jece.2025.118753

- **Ag3PO4-based composites as next-generation antibacterial nanomaterials: A review of light induced synergistic effects**
  Tugelbay, S.| Yergaliuly, G.| Abilkhan, A.| Khan, N.| Tatykayev, B.
  10.1016/j.cej.2025.167818

- **Graphene-based conductometric monitoring of hydrogen purity (Proof of Concept)**
  Turlybekuly, A.| Shynybekov, Y.| Sagidolda, N.| Tebenova, A.| Myrzakhmetov, B.| Wang, Y.| Sultanov, F.| Razanau, I.| Novikau, U.| Mentbayeva, A.
  10.1016/j.ceja.2025.100871

- **Long-term performance of air quality networks: implications in health and environmental management**
  Galán-Madruga, D.| de Lourdes Berríos Cintrón, M.| Broomandi, P.| Oleniacz, R.| Cáceres, J.O.
  10.1007/s13762-025-06526-x

- **A mixed method exploration of job morale of physicians working in public healthcare settings in Kazakhstan during the COVID-19 pandemic**
  Kuandyk, A.| Dmitriyeva, M.| Toleukhanova, N.| Conneely, M.| Suleimenov, T.| Sarssenov, D.| Mamytkhan, R.| Sakhayev, M.| Tleubergenov, A.| Toleubayev, M.
  10.1186/s41043-024-00732-y

- **Machine learning models for predicting surfactant-enhanced oil removal from contaminated soil**
  Hajibolouri, E.| Bekbau, B.| Omirbekov, S.| Ranjbaran, M.| Turalina, D.| Riazi, M.
  10.1016/j.jhazmat.2025.140141

- **Thiol functionalized kaolin pellets: Development and optimization for mercury ion removal from aqueous solutions**
  Abdulsalam, A.A.| Pirman, M.| Begenova, D.| Kyzas, G.Z.| Xia, D.| Pham, T.T.| Golman, B.| Poulopoulos, S.G.
  10.1016/j.clay.2025.107983

- **Performance-Based Evaluation of Supplementary Cementitious Material Synthesized with Basic Oxygen Furnace Slag and Ground Granulated Blast Furnace Slag**
  Sandybay, S.| Shon, C.-S.| Zhang, D.| Kim, J.R.| Chung, C.-W.
  10.3390/su172210326

- **CO2utilization and sequestration potential in deep coal seams: A case study on Carboniferous coals from the Karaganda Basin, Kazakhstan**
  Safaei-Farouji, M.| Misch, D.| Sachsenhofer, R.F.| Kostoglou, N.| Gaus, G.| Bauersachs, T.| Junussov, M.| Fustic, M.
  10.1016/j.jcou.2025.103204

- **Next-Generation Cu-MOF-based electrocatalysts for CO2reduction: Bridging mechanistic insights and rational design**
  Abid, H.M.W.| Balanay, M.P.
  10.1016/j.ccst.2025.100521

- **Dominant sources of PM2.5 in Kazakhstan's urban cities: A PMF and HYSPLIT-based study for air quality management in Central Asia**
  Tursun, K.| Omarova, A.| Ibragimova, O.P.| Bukenov, B.| Tursumbayeva, M.| Mukhtarov, R.| Radelyuk, I.| Yenisoy, S.| Karakaş, D.| Ergin, H.| Karaca, F.| Baimatova, N.
  10.1016/j.uclim.2025.102706

- **Towards Sustainable Air Quality in Coal-Heated Cities: A Case Study from Astana, Kazakhstan**
  Agibayeva, A.| Kumisbek, A.| Nauyryzbay, A.| Avcu, E.| Zhalgasbayev, K.| Karaca, F.| Guney, M.
  10.3390/su172210214

- **Visible-light-responsive Ag3PO4-based photocatalysts for water treatment and wastewater remediation: Advances, challenges, and future directions**
  Tugelbay, S.| Bakbolat, B.
  10.1016/j.jece.2025.120339

- **Seamless metamaterial integration into slotted resonators for compact high-performance near-field wireless power transfer system design**
  Dautov, K.| Jarndal, A.| Almajali, E.| Majzoub, S.| Mahmoud, S.A.| Bonny, T.| Hashmi, M.
  10.1007/s44444-025-00026-6

- **Carbon Neutrality of Central Asia: Technological Prospects and Challenges**
  Lee, W.
  10.1021/acsestengg.5c00870

- **Research on the application of metal oxide buffer layers in perovskite solar cells**
  Li, S.| Li, X.| Dai, C.| He, W.| Shabdan, Y.| Guli, M.
  10.1016/j.cej.2025.166935

- **A Bibliometric Analysis of the HCV Drug-Resistant Majority and Minority Variants**
  Immanuel, O.M.| Fabiyi, O.T.| Oshakbayev, K.P.| Abuova, G.| Konysbekova, A.| Vattipally, S.B.| Ali, S.| Abidi, S.H.
  10.3390/ijerph22111670

- **Middle and early Upper Paleolithic settlement of the Georgian caucasus: A general perspective**
  Tsikaridze, N.| Mgeladze, A.| Aghapishvili, T.| Tielidze, L.| Coil, R.| Chagelishvili, R.| Kvavadze, E.| Tskvitinidze, N.| Kopaliani, G.| Vanishvili, N.| Dvali, G.| Khachapuridze, A.| Prat, S.| Péan, S.| Puaud, S.| Bonilauri, S.| Jaillet, S.| Messager, E.| Moncel, M.-H.| Patou-Mathis, M.| Panchulidze, S.| Bidzinashvili, G.| Nioradze, G.
  10.1016/j.quascirev.2025.109556

- **Estimating Demolition Waste Recoverable Fractions in Rapidly Transforming Urban Zones**
  Nauyryzbay, A.| Kumisbek, A.| Amangeldiyeva, A.| Kim, J.R.| Guney, M.
  10.3390/su17219686

- **Precipitation dynamics in southern central Asia during marine isotope stage 5: Implications for early modern human dispersal**
  Li, Y.| Song, Y.| Fitzsimmons, K.E.| Dave, A.K.| Zeeden, C.| Nie, J.| Yang, S.| Aminov, J.
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- **Structure and dynamics of Biela Skala deep-seated gravitational slope deformation in central Slovakia volcanic field**
  Toločka, A.
  10.1007/s11069-025-07691-5

- **Experimental and numerical study of non-spherical particles in moving bed heat exchangers**
  Boribayeva, A.| Musahanov, A.| Baigarina, A.| Lukmanov, I.| Sultaniyar, S.| Patkhollayev, A.| Govender, N.| Golman, B.
  10.1016/j.ceja.2025.100859

- **First assessment of PM10-bound polychlorinated biphenyls in a paired outdoor and indoor urban site**
  Galán-Madruga, D.| Cárdenas-Escudero, J.| Broomandi, P.| Cáceres, J.O.| Tarazona, J.V.| Carmen-González, M.D.
  10.1007/s11869-025-01817-1

- **Severe health risks from ambient volatile organic compounds (VOCs) in a Central Asian city: Source attribution and probabilistic risk assessment**
  Alibekov, A.| Bahetnur, Y.| Yessenbayeva, K.| Baimatova, N.| Lee, W.
  10.1016/j.aeaoa.2025.100378

- **Inequality in the Distribution and Utilization of Healthcare Resources in Kazakhstan (2002–2023): A Spatiotemporal Analysis**
  Shaltynov, A.| Abenova, M.| Baibussinova, A.| Semenova, Y.| Omarov, N.| Tanatarova, G.| Sepbossynova, A.| Rocha, J.
  10.3390/ijerph22111762

7. Multidisciplinary Research

Cross-disciplinary work addressing complex global questions.

- **Enhancing the stability and efficiency of eye-sensitized solar cells with MIL-125 metal-organic framework as an**

electrolyte additive
Ibrayeva, A.| Imanbekova, Z.| Abibulla, U.| Tashenov, Y.| Baptayev, B.| Balanay, M.P.
10.1038/s41598-025-89913-1

- **Quantifying the impact of surface roughness on contact angle dynamics under varying conditions**
Razavifar, M.| Abdi, A.| Nikooee, E.| Aghili, O.| Riazi, M.
10.1038/s41598-025-01127-7

- **Database of soil properties incorporating organic content from roots and soil organisms for regional slope stabilisation**
Li, Y.| Rangarajan, S.| Rahardjo, H.| Shen, Y.| Hamdany, A.H.| Satyanaga, A.| Leong, E.C.| Wong, S.K.| Wang, C.L.| Kew, H.| Htoo Naing, T.| Poh, C.H.| Ghosh, S.
10.1038/s41598-025-85250-5

- **Structural, surface, and theoretical investigation of hydrophobic-modified nanodiamond powders**
Kydyrbay, N.| Zhazitov, M.| Abdullah, M.| Duisebayev, T.| Tezekbay, Y.| Aldongarov, A.| Karibayev, M.| Nuraje, N.| Toktarbaiuly, O.
10.1038/s41598-025-10027-9

- **Random forest-based prediction of shallow slope stability considering spatiotemporal variations in unsaturated soil moisture**
Li, Y.| Rangarajan, S.| Cheng, Y.| Rahardjo, H.| Satyanaga, A.
10.1038/s41598-025-92739-6

- **All-cause hospital admissions and incidence of asthma in children in Kazakhstan: a population-based retrospective cohort study**
Syssoyev, D.| Mussina, K.| Poddighe, D.| Gaipov, A.| Galiyeva, D.
10.1038/s41598-025-94066-2

- **An innovative modelling technique for bimodal soil water characteristic curve under wetting process**
Bello, N.| Satyanaga, A.| Irawan, S.| Zhai, Q.| Gofar, N.| Kim, J.
10.1038/s41598-025-93987-2

- **Emotional labor and empathic concern as predictors of exhaustion and disengagement in college teachers**
Zhai, X.| Rehman, S.| Addas, A.| Liu, Q.| Rehman, E.| Khan, M.N.
10.1038/s41598-025-11304-3

- **A comparative analysis of alpha olefin sulfonate and dodecyl sulfate in aphronic fluid containing xanthan gum in a wide range of temperatures**
Riazi, M.| Hemmati-Sarapardeh, A.| Schaffie, M.| Zabihi, R.| Riazi, M.
10.1038/s41598-024-80475-2

- **The burden of COVID-19 in primary care of Almaty, Kazakhstan, 2021–2022**
Kozhekenova, N.| Moiynbayeva, S.| Jeremic, D.| Dinic, M.| Semenov, P.| Nurgaliyeva, Z.| Tolekova, S.| Miller, A.| Smasheva, A.| Milicevic, M.S.
10.1038/s41598-025-89707-5

- **Improved food image recognition by leveraging deep learning and data-driven methods with an application to Central Asian Food Scene**
Karabay, A.| Varol, H.A.| Chan, M.Y.
10.1038/s41598-025-95770-9

- **Efficient template free polymerization of continuously porous hybrid conducting polymers for highly stable flexible micro pseudocapacitors**
Zhigerbayeva, G.| Aliyev, A.| Magazov, Y.| Kudryashov, V.| Adilov, S.| Nuraje, N.
10.1038/s41598-025-93663-5

- **A comprehensive analysis of the impacts of Image Resolution and Scanning Times on the quality of MPI-reconstructed images**
Do, T.D.| Mukhatov, A.| Tolebay, A.| Le, T.-A.| Pham, T.T.
10.1038/s41598-025-89296-3

- **Robust super-twisting algorithm-based single-phase sliding mode frequency controller in power systems integrating wind turbines and energy storage systems**
Huynh, V.V.| Naqvi, S.| Nguyen, B.L.-H.| Tran, A.-T.| Shim, J.W.| Do, T.D.
10.1038/s41598-025-01407-2

- **National trends in Azithromycin consumption during 2017–2023 in Kazakhstan: impact of the COVID-19 pandemic and the imperative for enhanced clinical guidelines**
Kassym, L.| Kussainova, A.| Semenov, D.| Aimurziyeva, A.| Uzbekova, S.| Semenova, Y.
10.1038/s41598-025-91216-4

- **Novel synthesis method of multi walled carbon nanotube-silica Janus nanostructures**
Namdar, H.| Manteghian, M.| Jafari, A.| Riazi, M.
10.1038/s41598-025-03164-8

- **Stability of colloidal gas aphrons based on polymer-surfactant formulations and molecular dynamics insights**
Amankeldiyeva, A.| Kaumbekova, S.| Khalidulliyeva, A.| Salimova, Z.| Ibrayeva, A.| Cochennec, M.| Colombano, S.| Amanbek, Y.| Wang, Y.| Omirbekov, S.
10.1038/s41598-025-08100-4

- **Data-driven total organic carbon prediction using feature selection methods incorporated in an automated machine learning framework**
Macêdo, B.D.S.| Wayo, D.D.K.| Campos, D.| De Santis, R.B.| Martinho, A.D.| Yaseen, Z.M.| Saporetti, C.M.| Goliatt, L.
10.1038/s41598-025-91224-4

- **Effect of work schedule flexibility as a moderator in the relationship between job stress and wellbeing in pharmacy practice**
Rehman, E.| Alotaibi, K.A.| Rehman, S.| Ahmad, M.
10.1038/s41598-025-10523-y

- **Low temperature carbonation and CO2 mineral trapping in altered hydrotalcite-rich ultrmafic rocks**
Leila, M.| Hazlett, R.| George, P.-M.| Šegvić, B.| Fustic, M.
10.1038/s41598-025-16025-1

- **Investigation and prediction of fatigue performance of SLM 316 L stainless steel based on small build orientation variations and heat treatment effects**
Yankin, A.| Perveen, A.| Talamona, D.

10.1038/s41598-025-89003-2

- **A novel algorithm for modeling gas–oil dynamic interfacial tension (IFT) and component exchange mechanisms**
Safaei, A.| Riazi, M.
10.1038/s41598-025-03372-2

- **Strength characterization of limestone lithofacies under different moisture states**
Gad, A.| Arman, H.| Yagiz, S.| Abdelghany, O.| Amin, B.M.| Ahmed, A.| Paramban, S.| Saima, M.A.
10.1038/s41598-025-22699-4

- **Genetic landscape and phenotypic spectrum of osteogenesis imperfecta in the Kazakhstani pediatric population**
Bayanova, M.| Abilova, A.| Rakhimzhanova, M.| Bazenova, A.| Nazarova, L.| Malik, D.| Tanko, N.M.| Altaeva, N.| Bolatov, A.
10.1038/s41598-025-95877-z

- **Experimental and DEM based characterization of flowability of non-spherical and spherical bauxite particles**
Boribayeva, A.| Baigarina, A.| Gvozdeva, X.| Musahanov, A.| Golman, B.
10.1038/s41598-025-04138-6

- **Phytochemical profiling and various biological activities of Phlomis tuberosa L.**
Azhikhanova, Z.| Duru, M.E.| Kucukaydin, S.| Megbenu, H.K.| Tas Kucukaydin, M.| Baisalova, G.| Shaimardan, M.| Nuraje, N.| Özler, M.A.
10.1038/s41598-024-80456-5

- **Effect of ultrasonic atomization parameters on AlSi12 aluminum powder characteristics for additive manufacturing**
Yankin, A.| Murtaza, H.A.| Golman, B.| Perveen, A.| Talamona, D.
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- **Systemic antiviral consumption in Kazakhstan**
Semenova, Y.| Kussainova, A.| Kassym, L.| Aimurziyeva, A.| Semenov, D.| Makalkina, L.| Aldiyarova, N.| Avdeyev, A.| Lim, L.
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- **Fabrication of well-defined magnetic microporous polymeric monoliths using simple non-aqueous emulsification technique**
Karrar, A.A.| Taha, F.| Essawy, H.A.| Dyab, A.K.F.| El-Mageed, A.I.A.A.
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- **Computerised analysis of non-conjugate spiral bevel gear mesh using an advanced and fast-converging tooth contact model**
Temirkhan, M.| Amrin, A.
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- **Machine learning based prediction modeling of micro-EDM of Ti–29Nb–13Ta–4.6Zr (TNTZ)**
Ali, S.| Talamona, D.| Perveen, A.
10.1038/s41598-025-05118-6

- **Glaucoma screening in Kazakhstan**
Urazhanova, M.| Kadraliyeva, E.| Dautbayeva, Z.| Semenova, Y.
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- **Sensor-driven control strategies for post-stroke shoulder rehabilitation exoskeletons: A systematic review**
Karasheva, M.| Saudanbekova, A.| Utepbergen, A.| Akkulova, S.| Niyetkaliyev, A.| Ozhikenov, K.| Ozhiken, A.| Alimbayev, C.| Shylmyrza, U.| Aimukhanbetov, Y.
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- **Thermal, hardness, and tribological assessment of PEEK/CoCr composites**
Sariyev, B.| Amrin, A.| Mergenbay, A.| Rao, H.J.| Khabdulayeva, A.| Spitas, C.| Golman, B.
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- **Deep eutectic solvent assisted oil - water interfacial behavior on polystyrene surfaces: a computational study**
Bexeitova, K.| Ardakkyzy, A.| Soltan, R.| Baisalova, G.| Nurgalieva, D.| Karibayev, M.| Toktarbay, Z.
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- **Generalized analysis of dynamic pull-in for singular mag-MEMS and MEMS oscillators**
Skrzypacz, P.| Ellis, G.| Pruchnik, B.| Putek, P.
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- **The buffering effects of mindfulness and organizational support on the mental health of hospital pharmacists in high-workload environments**
Rehman, S.| Alotaibi, K.A.| Rehman, E.| Khan, M.N.| Rahman, M.A.| Yaqoob, B.
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- **Glial reactivity and cognitive decline follow chronic heterochromatin loss in neurons**
Newman, A.G.| Sharif, J.| Bessa, P.| Zaqout, S.| Brown, J.P.| Richter, D.| Dannenberg, R.| Nakayama, M.| Mueller, S.| Schaub, T.| Manickaraj, S.| Boehm-Sturm, P.| Ohara, O.| Koseki, H.| Singh, P.B.| Tarabykin, V.
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- **An approach for unplanned dilution assessment in open stope with consideration of the stope shape irregularity**
Alipov, A.| Adoko, A.C.
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- **HAttFFNN: Hybridized attention mechanism-based feedforward neural network deep learning model for the plastic material classification of three stage materials on spectroscopic data**
Alimbekova, N.| Rai, H.M.| Turymbetov, T.| Zhumadillayeva, A.
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- **Human occupations at the Alpysbaev Cave (western Tian Shan): Bioarchaeological insights from the Iron Age burial cluster**
Namen, A.| Hernandez Burgos, S.C.| Varis, A.| Coco, E.| Kalisher, R.| Gaul, E.| Gnecchi-Ruscone, G.A.| Spyrou, M.A.| Posth, C.| Lindauer, S.| Naumann, D.| Williams, S.A.| Taimagambetov, Z.| Iovita, R.
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- **Machine learning model to predicting synergy of ultrasonication and solvation impacts on crude oil viscosity**

Khan, N.| Razavifar, M.| Ahmad, Q.A.| Siyar, M.| Riazi, M.| Khan, W.| Qajar, J.
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- **Ancient genomes from eastern Kazakhstan reveal dynamic genetic legacy of Inner Eurasian hunter-gatherers**
Gill, H.| Seidualy, M.| Lee, J.| Lee, J.| Moon, H.| Walter, A.| Bianco, R.A.| Kurmangaliev, A.| Rakhmankulov, E.| Samashev, Z.| Aitkali, A.| Kiyasbek, G.| Tashmanbetova, Z.| Zhuniskhanov, A.| Krause, J.| Hermes, T.| Zhabagin, M.| Dupuy, P.D.| Warinner, C.| Jeong, C.
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- **Corrigendum to "method for assessing the content of molybdenum enzymes in the internal organs of fish" [MethodsX Volume 12 (2024) 1–9/102576] (MethodsX (2024) 12, (S221501612400030X), (10.1016/j.mex.2024.102576))**
Satkanov, M.| Tazhibay, D.| Zhumabekova, B.| Assylbekova, G.| Abdukarimov, N.| Nurbekova, Z.| Kulatayeva, M.| Aubakirova, K.| Alikulov, Z.
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- **Self-supervised learning with BYOL for anterior cruciate ligament tear detection from knee MRI**
Aidarkhan, A.| Mukhamediya, A.| Askhatova, A.| Beisembekova, R.| Alimbayeva, Z.| Ozhikenova, A.| Ozhikenov, K.| Jamwal, P.K.
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- **Integrated petrophysical and seal characterization of the heterogeneous jurassic plover formation for CO2 storage assessment in Northwest Australia**
Yahia, M.| Szabó, I.| Badawi, M.| Radwan, A.A.| Kiss, K.| Leila, M.| Szabó, N.P.
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- **Fosl1 is a transcriptional effector of BRAFV600E-driven intestinal tumorigenesis**
Alam, Z.| Nightingale, R.| Lesmana, A.| Liu, C.| Jenkins, L.J.| Richardson, M.F.| Croft, L.| Luk, I.Y.| Reehorst, C.M.| Chionh, F.| Vukelic, N.| Basheer, F.| Tulchinsky, E.| Badshah, J.| Dumenil, T.| Bakiri, L.| Wagner, E.F.| Tebbutt, N.C.| Whitehall, V.| Mariadason, J.M.| Dhillon, A.S.
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- **Transdisciplinary research on water security in transboundary river basins**
Assubayeva, A.| Xenarios, S.| Correa, A.| Forero, J.
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- **Tailored manganese oxide and nickel sulfide composites with MWCNTs as platinum-free electrodes for solar energy conversion**
Suleimenova, D.| Tashenov, Y.| Ibrayeva, A.| O'Reilly, R.J.| Baptayev, B.| Balanay, M.P.
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- **The Escalating Threat of Heatwaves in Central Asia: Climate Change Impacts and Public Health Risks**
Broomandi, P.| Bagheri, M.| Fard, A.M.| Hadei, M.| Abdoli, M.| Roshani, A.| Fathian, A.| Shafiei, S.| Leuchner, M.| Kumar, P.| Kim, J.R.
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- **Machine learning-enhanced fully coupled fluid–solid interaction models for proppant dynamics in hydraulic fractures**
Wayo, D.D.K.| Irawan, S.| Wang, L.| Goliatt, L.
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- **Impact of changes in the wind regime on the Caspian sea level fluctuation and its relationship with SOI and NAO**
Safarov, E.| Bayramov, E.| Safarov, S.| Neafie, J.| Hedjazi, A.
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- **AI-enhanced clustering of mine tailings using Geostatistical data augmentation and Gaussian mixture models**
Madani, N.| Sabanov, S.
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- **Effect of acid etching of stainless-steel foils in aqueous rechargeable lithium-ion batteries**
Maratova, K.| Myrzakhmetov, B.| Rakhman, D.| Toleuova, A.| Dauletbay, A.| Bakenov, Z.| Konarov, A.
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- **Past, current status, and future trends of the rural healthcare network in the Republic of Kazakhstan**
Jobalayeva, B.| Glushkova, N.| Khismetova, Z.| Tanatarova, G.| Zhagiparova, Z.| Semenova, Y.
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- **A highly efficient triple band metasurface enabled absorber for 5G/6G millimeter wave applications**
Younis, F.| Khan, O.| Ahmad, J.| Qasim, M.J.| Luo, H.| Wang, S.
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- **Incident-aware smart prioritization framework for penetration testing and prevention of URL-based cybersecurity attacks in industry 4.0 IoT networks**
Nurlan, Z.| Gabdullayev, D.| Mukhametzhanova, B.| Zhakiyev, N.| Sonny, I.| Ala'anzy, M.A.| Ahmad, Z.| Amirgaliyev, B.
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- **Comparison of left ventricular hemodynamic forces measured by transthoracic echocardiography and cardiac magnetic resonance imaging in healthy adults**
Zhankorazova, A.| Tonti, G.| Khamitova, Z.| Toktarbay, B.| Jumadilova, D.| Bekbossynova, M.| Khissamutdinov, N.| Dautov, T.| Salustri, A.
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- **The mediating role of cognitive arousal in the relationship between impulsivity and sleep quality among college students: a random intercept cross-lagged panel analysis**
Rehman, E.| Kenzhebayeva, F.| Jahangir, M.| Sharif, K.| Ahmed, J.| Khan, A.
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- **Political participation and grassroots governance: A social work perspective based on CGSS 2021 data**
Zhang, X.| Burkhanova, D.| Yang, Y.| Tian, J.
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- **Multi-stage sliding mode control design with optimal state estimator for load frequency regulation in hybrid-source power systems**
Tran, A.-T.| Van Huynh, V.| Nguyen, B.L.-H.| Shim, J.W.| Do, T.D.
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- **All-cause hospital admissions and incidence of type 2 diabetes among adolescents in Kazakhstan**
Atageldiyeva, K.| Syssoyev, D.| Mussina, K.| Poddighe, D.| Gaipov, A.| Galiyeva, D.
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- **Experimental and numerical simulation studies of the zwitterionic polymers for enhanced oil recovery**
Karimov, D.| Imekova, G.| Toktarbay, Z.| Nuraje, N.
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- **A highly efficient hybrid fiber optic laser using a cesium atom vapor cell as an optical gain medium**
Kim, S.| Lee, M.| Song, S.| Hong, S.| Nilsson, J.| Oh, K.
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- **The sobol sensitivity analysis of the pressure, stresses, and displacement arising from poroelastic modelling of hard mechanical systems**
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Dear NU Researchers,
We are always proud to share your achievements and news. If you have a story to tell, we warmly invite you to submit it for publication in a future issue of the newsletter.

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