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TSYBENKO I. O.
State Scientific and Technical Library of Ukraine (Kyiv, Ukraine),
e-mail: tsyb2012@ukr.net, ORCID 0000-0002-6408-9011

ZHEREBCHUK S. V.
State Scientific and Technical Library of Ukraine (Kyiv, Ukraine),
e-mail: zerebcuksofia@gmail.com, ORCID 0000-0002-0212-7107

MARÍN-ARRAIZA P.
Vienna University of Technology (Vienna, Austria), ORCID (Bethesda, USA),
e-mail: p.arraiza@orcid.org, ORCID 0000-0001-7460-7794

KUDAS D. I.
Military Academy (Odessa, Ukraine), e-mail: kudasdmitriy@gmail.com,
ORCID 0009-0002-0687-4182

# Analysis of Ukrainian Scientists' Migration Using Analytical Tools of the National Electronic Research Information System and the ORCID Identifier

**Objective.** This study investigates trends in academic migration among Ukrainian scientists in the context of war-induced displacement. **Methods.** To analyze mobility patterns, a comprehensive approach was employed using the "Scientist" module – an analytical tool based on ORCID identifiers – which enables the detailed tracking of affiliations, publications, and international collaborations. Scientists' profiles were filtered by country of affiliation and further verified through manual analysis of publication timelines and profile updates. **Results.** The year of first foreign affiliation was estimated despite challenges arising from irregular profile updates. The findings reveal a clear trend of relocation and growing collaboration with foreign institutions, although many researchers still maintain ties with Ukrainian universities. The study highlights both the potential and limitations of relying on digital researcher profiles to assess migration. **Conclusions.** The integration of ORCID with complementary data sources significantly improves the accuracy of mobility analysis and offers a foundation for developing targeted support mechanisms for displaced scientists, ensuring continuity and resilience within the Ukrainian research ecosystem.

*Keywords:* academic mobility; ORCID; URIS; international collaboration; war impact; digital transformation; State Scientific and Technical Library of Ukraine

## Introduction

*Problem statement.* Scientific migration has become one of the defining features of modern science. Researchers and academics regularly cross borders in search of better working conditions, access to resources, and opportunities for international collaboration. However, when migration is driven not by professional choice but by war, it creates a very different situation. The war in Ukraine has forced thousands of scientists to leave their institutions, interrupt their projects, and adapt to new research environments abroad. This not only disrupts their individual careers but also weakens Ukraine's scientific capacity, leading to the risk of long-term brain drain.

*Relevance.* The issue is particularly important now because science plays a vital role in the country's recovery and international integration. Losing qualified personnel at such a critical time could have lasting consequences for decades. At the same time, forced mobility may also create new opportunities: displaced scientists establish international networks, access new resources, and join projects that were previously out of reach. Understanding both the losses and


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the new possibilities is essential for shaping effective policies to support Ukrainian science during and after the war.

*Brief mention of prior studies.* Previous research has explored scientific mobility and brain drain using international bibliometric databases such as Scopus or Web of Science. These studies provided useful insights into migration trends, collaboration networks, and publication patterns. Some scholars have also pointed to the potential of persistent identifiers such as ORCID (Open Researcher and Contributor ID) as tools for tracking scientific activity across borders. However, the use of ORCID to analyze wartime displacement of scientists has been discussed only in passing, and there is still no established methodology for applying it systematically in this context.

*Research gap.* The main unresolved problem is the absence of comprehensive tools for analyzing the academic mobility of Ukrainian scientists under conditions of war. ORCID is widely used to identify scientists and track their publications, but it is not designed as an analytical platform. It lacks functions for aggregating, structuring, and interpreting data at the national level. On the other hand, the Ukrainian Research Information System (URIS), developed by the State Scientific and Technical Library of Ukraine, provides advanced analytical capabilities, but its integration with ORCID data for migration analysis has not yet been fully utilized. This leaves a clear gap in understanding how war-driven displacement reshapes Ukrainian science.

*Purpose of the work.* This paper aims to examine how data from ORCID and URIS can be combined to study the academic mobility of Ukrainian scientists during the war. The objectives are to explore changes in institutional affiliations, to trace publication activity and collaboration patterns, and to identify the countries and institutions that have become key destinations for displaced scientists. The study also seeks to demonstrate the added value of URIS as a national analytical tool for monitoring these processes and to provide recommendations for policies that support displaced scientists, preserve Ukraine’s research potential, and foster reintegration after the war.

**Literature Review.** The utilization of ORCID (Open Researcher and Contributor ID) metadata has been the subject of various scholarly investigations, focusing on its potential to enhance research analytics. These studies explore how ORCID's structured metadata can improve author identification, track research outputs, and facilitate data sharing practices.

One significant study by Kim and Owen-Smith (2021) demonstrates the use of ORCID-linked labeled data to evaluate author name disambiguation at scale. By linking ORCID profiles to bibliographic data, the authors created a large-scale labeled dataset that aids in assessing the performance of name disambiguation algorithms, thereby enhancing the accuracy of author identification in scholarly databases.

Another notable research by Sixto-Costoya, Robinson-Garcia, van Leeuwen, & Costas (2021) investigates the relevance of ORCID as a source for studying data-sharing activities at the individual level. The study analyzes how scientists report datasets in their ORCID profiles, providing insights into data-sharing practices across different disciplines and countries. This methodological discussion highlights ORCID's potential as a valuable resource for understanding and promoting open science practices.

Additionally, Spinellis (2023) presents a framework for open, reproducible publication research, utilizing ORCID metadata alongside other open datasets. The study showcases how integrating ORCID data can facilitate the analysis of publication trends, scientific collaborations, and bibliometric measures, contributing to more transparent and reproducible research analytics.


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The development of the URIS in Ukraine has been a significant step toward integrating the country's research infrastructure into global open science initiatives. Several studies have analyzed its role, challenges, and prospects in supporting Ukraine's state open science policy, research infrastructure (RI) mapping, and the unification of scientific registers.

Zharinova, Zharinov, & Rybalko (2024) explore URIS as a fundamental component for implementing Ukraine's open science policy. The study highlights how the system facilitates the accessibility and dissemination of scientific information, aligning Ukraine with European and global open science standards. The authors emphasize URIS 's role in improving research transparency, increasing collaboration, and ensuring compliance with FAIR (Findable, Accessible, Interoperable, Reusable) principles. They also address challenges such as data standardization, interoperability with international platforms, and the need for legislative support.

In another study, Zharinov, Zendulková, Tsybenko, & Zherebchuk (2024) discuss the significance of mapping research infrastructures (RI) in Ukraine and draw comparisons with the Slovak case. The authors argue that a comprehensive RI mapping strategy is essential for optimizing resource allocation, enhancing collaboration, and increasing Ukraine's participation in European research initiatives. They provide insights into how URIS can support the identification and categorization of research facilities, ultimately strengthening the national research ecosystem.

Zharinov, Vasylenko, Krasovskyi, & Rybalko (2024) also examine the role of URIS in unifying scientific registers using a Current Research Information System (CRIS). The study illustrates how integrating multiple scientific databases into a single, structured CRIS framework can enhance research visibility, prevent duplication of efforts, and improve data accuracy. The authors propose a model for the technical and organizational aspects of this integration, highlighting best practices from other countries.

The reviewed literature underscores URIS's crucial role in modernizing Ukraine's research infrastructure and aligning it with open science principles. While the system presents numerous opportunities, challenges such as interoperability, data governance, and institutional adoption remain. Future research should focus on addressing these challenges to maximize the system's effectiveness in supporting Ukraine's scientific community.

The issue of scientific migration, particularly in the context of Ukraine, has gained significant attention in recent years due to the ongoing war and its impact on research mobility. Various studies analyze the migration patterns of Ukrainian scientists, the factors influencing their mobility, and the consequences of this phenomenon on the national and global scientific landscape.

Kostenko, Kopanieva, Hryhorevska, Zhabin, & Kubko (2024) explore the current state of scientific migration in Ukraine, utilizing scientometric approaches to assess scientist mobility. The study highlights the increasing trend of Ukrainian scientists relocating abroad due to war-related challenges, institutional instability, and economic factors. The research emphasizes the need for systematic monitoring tools, such as ORCID and national research databases, to track migration flows and analyze their long-term effects on Ukraine's research ecosystem. Kostenko et al. (2024) also underscores the importance of policy measures to retain and reintegrate displaced scientists, suggesting that strategic governmental support and international collaborations could mitigate brain drain.

Mulska (2021) focuses on the monitoring of migration mobility and the information-analytical frameworks used to assess its impact on human capital. Their study provides a


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methodological approach to analyzing migration trends, considering both voluntary and forced relocations. The authors argue that digital tracking systems, including bibliometric databases and research profiling platforms, play a crucial role in understanding migration-driven shifts in scientific productivity and collaboration networks. They also highlight that war-induced migration leads to the redistribution of scientific expertise across different regions, which can both challenge and enhance international research cooperation.

Ratha, Mohapatra, & Scheja (2011) investigate the broader economic and business implications of migration, including its influence on the development of national economies. While their research is not solely focused on scientific mobility, it provides valuable insights into how workforce migration, including highly skilled professionals, affects innovation and economic stability. The study suggests that countries receiving Ukrainian scientists benefit from increased knowledge exchange and academic productivity, whereas Ukraine faces a loss of intellectual capital. However, the authors argue that fostering international cooperation and maintaining active networks with expatriate scientists could facilitate knowledge transfer and potential reintegration efforts in the future.

Overall, the reviewed literature highlights the complexity of scientific migration and underscores the need for robust analytical tools to effectively monitor its effects. The integration of national research information systems (such as URIS) with global platforms (such as ORCID) is presented as a crucial strategy for tracking scientist mobility and supporting policy development. Additionally, these studies highlight the dual nature of migration: while it poses risks to Ukraine's research sector, it also creates opportunities for increased international collaboration and potential reintegration strategies post-conflict.

## Methods

*Methodology for research and use of the "Scientist" module tools.* This study applies a mixed-method approach combining elements of quantitative bibliometric analysis and qualitative case study research. The overall aim was to examine academic migration patterns among Ukrainian researchers and to evaluate the extent to which they establish, maintain, or shift affiliations to foreign institutions. The methodological design consisted of three main stages: (1) data collection from verified sources, (2) manual validation and triangulation, and (3) analytical categorization and interpretation.

The choice of a case study-oriented approach was determined by the nature of the research problem. Academic migration is not easily captured by large-scale statistics alone, as researchers may hold multiple affiliations, maintain temporary positions abroad, or continue formal ties to Ukrainian institutions. Therefore, in-depth case-oriented analysis was necessary to complement quantitative trends and provide a nuanced understanding of mobility trajectories. Two complementary platforms were used as primary sources of researcher data:

- ORCID (Open Researcher and Contributor ID), which provides self-reported information entered by researchers, including personal data, institutional affiliations, publications, and collaborations. Although the data are global in scope and allow identification of cross-border activities, they are not always independently verified, which may limit their reliability;
- URIS (Ukrainian Research Information System) that relies on institutional input and verification. Universities and research organizations validate and approve researcher records before submission, which ensures greater accuracy for official affiliations,


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positions, and memberships. However, URIS data may lag behind in capturing temporary appointments or rapidly changing international collaborations.

The combination of ORCID and URIS was chosen to balance the openness and international coverage of ORCID with the institutional reliability of URIS. Together, they provide a complementary picture of migration dynamics.

Given the limitations of both systems, a manual validation procedure was implemented for each identified researcher with a potential foreign affiliation. This process included:

1. Reviewing publication timelines to establish the approximate onset of collaboration with foreign institutions.
2. Checking for simultaneous affiliations with Ukrainian and foreign organizations.
3. Cross-referencing additional evidence from project participation, grant records, and publication acknowledgements to confirm active engagement abroad.

This triangulation ensured greater accuracy, allowing us to distinguish between short-term collaborations and long-term academic migration.

Validated data were systematized and analyzed through two complementary strategies:

- quantitative categorization or grouping of researchers by type of affiliation (exclusive foreign, dual Ukrainian-foreign, temporary foreign);
- qualitative interpretation (case studies) – selected individual trajectories were examined in detail to illustrate broader patterns, highlight exceptions, and contextualize trends.

The case studies, therefore, do not serve as the sole method but as an analytical tool applied after quantitative categorization. They provide concrete illustrations of general patterns, enhancing the explanatory value of the findings.

Despite triangulation, several methodological challenges remain:

- ORCID profiles may be incomplete, outdated, or inconsistent;
- multiple affiliations complicate the identification of a primary workplace;
- URIS, while institutionally verified, may omit temporary international positions.

These limitations are explicitly considered in the interpretation of results. The approach remains replicable and transparent, enabling future researchers to refine or extend the analysis by integrating additional databases and automated tracking mechanisms.

## Results and Discussion

As of the current period, the URIS system contains profiles for 35,707 Ukrainian scientists. Most of these profiles include at least basic information, with 26,263 being fully or partially completed, while 1,325 profiles remain incomplete. These figures indicate that URIS is actively used by the scientific community, although further engagement is needed to ensure profiles are filled. For comparison, ORCID currently hosts approximately 15,000 to 20,000 profiles of Ukrainian researchers. Considering that Ukraine has an estimated total of around 150,000 scientists according to the State Statistics Service, it can be seen that roughly one quarter of researchers are registered in URIS, highlighting both the system’s potential and the need to increase coverage.

It is important to clarify how data are entered into URIS and ORCID, as this directly affects the validity of the analysis. ORCID profiles are primarily self-reported by researchers, meaning the accuracy of the data depends on individuals maintaining and updating their own information. While some ORCID profiles are linked to institutional systems, verification is limited, and missing or outdated information may affect the reliability of analyses. In contrast,


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URIS receives data mainly through institutions, such as universities and research centers, which verify affiliations and academic positions. Although URIS imports some information from ORCID, it does not rely solely on it. This combination of self-reported and institution-verified data provides a more reliable foundation for analyzing academic mobility, although limitations remain. For example, researchers with dual affiliations, ongoing collaborations abroad, or irregular updates to their profiles may still require additional manual verification to ensure the accuracy of conclusions. Acknowledging these limitations is essential when interpreting patterns of academic migration, as some uncertainty remains regarding the precise number of scientists working abroad versus maintaining partial ties to Ukrainian institutions.

Analysis of URIS data shows that most Ukrainian scientists received their higher education in Ukraine, reflecting the traditional strength of the national higher education system. Nonetheless, a notable portion pursued studies abroad, especially in countries with leading scientific institutions such as Germany, the United States, the United Kingdom, Poland, France, and Canada. These international educational experiences contribute to professional development and underpin global research collaborations. Regarding current employment, the majority of scientists continue to work in Ukraine, yet a significant outflow to countries including the United States, Germany, Poland, Canada, France, and the United Kingdom is evident. These patterns illustrate substantial academic migration, which has accelerated following the 2014 conflict and further intensified after the full-scale invasion in 2022.

The drivers of academic migration in Ukraine are complex and interrelated. Chronic underfunding of research and higher education has long undermined the stability of scientific careers, limiting access to research grants, laboratory modernization, and competitive career paths. The ongoing war has exacerbated these challenges, destroying infrastructure in occupied and frontline territories and forcing scholars to relocate for safety and continuity of research. Additionally, the absence of clear institutional mechanisms for career advancement, combined with bureaucratic inertia, has prompted many early-career scientists to seek opportunities abroad. Attractive international programs, such as the Marie Skłodowska-Curie Actions, DAAD, Fulbright, and Horizon Europe grants, have further facilitated this outflow by providing funding, access to infrastructure, mentorship, and global networks. Although these programs are often designed for temporary exchanges, they frequently become pathways to long-term relocation.

The consequences of this migration for Ukrainian science are substantial. The departure of experienced researchers and promising early-career scientists weakens the national research base, reduces universities' capacity to provide high-quality education, and limits mentorship opportunities for future generations. Academic migration also affects the international visibility of Ukrainian institutions, as researchers increasingly publish under foreign affiliations, which impacts institutional citation metrics and global rankings. However, the growing Ukrainian academic diaspora can also play a positive role, maintaining collaborations with home institutions, co-authoring publications, mentoring students, and initiating bilateral research projects. Such transnational linkages may support knowledge circulation rather than permanent loss, potentially facilitating return migration or continued collaboration.

When comparing these findings with other studies, the results are largely consistent. Previous analyses have noted the incompleteness of national research databases, and trends of education abroad and migration to Europe and North America align with documented patterns of international academic mobility. Reports on war-driven displacement of Ukrainian scientists also corroborate the observed post-2022 acceleration of migration. Despite limitations inherent in using self-reported and institution-verified data, the combination of URIS and ORCID provides a


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valuable empirical foundation for understanding academic mobility, enabling the development of policies aimed at retaining talent, promoting return, and strengthening international collaboration.

Overall, while URIS and ORCID data offer a powerful tool for mapping academic migration, it is important to treat the results as indicative rather than definitive. The self-reported nature of ORCID profiles, the partial verification in URIS, and occasional delays in updating affiliations mean that conclusions must be contextualized and interpreted carefully. Integrating these datasets with additional sources, such as publication records, participation in international projects, and grant data, can enhance the accuracy of analyses. This nuanced approach ensures that policy recommendations based on these findings are grounded in the most reliable evidence available while acknowledging the inherent uncertainties.

*Case studies on academic mobility of Ukrainian scholars in the context of war and global research trends.* The ORCID profiles of Ukrainian scholars provide unique insights into patterns of academic mobility, especially when viewed through the lens of the ongoing war in Ukraine. By analyzing selected individual profiles, one can better understand the varied trajectories of scientists: from temporary affiliations abroad to full-scale migration, while still maintaining ties to Ukrainian institutions. This section presents four illustrative case studies–Oleksandr Kovalchuk, Danylo Bazylevych, Yurii Pelekh, and Fedir Ivashchyshyn–that exemplify different mobility scenarios and challenges in classifying them solely through digital infrastructure like ORCID or URIS.

*Analysis of scientist Oleh Romanko's profile in the URIS system.* To illustrate the current limitations and potential of the Ukrainian Research Information System (URIS) in tracking academic mobility, it is useful to examine the individual case of a specific scientist. The profile of Dr. Oleh Romanko, a prominent Ukrainian historian, offers a valuable example of both the strengths and the existing gaps in the system's capacity to reflect a scholar's professional trajectory and international engagement.

URIS presents a structured profile of Dr. Romanko, including his full name, biographical details, academic affiliations, educational background, scientific achievements, a list of publications, and an associated ORCID identifier. However, despite the presence of key information, the profile is noticeably incomplete in several critical areas. Notably, there is no data available regarding his academic degrees or titles, nor any records of research projects he may have participated in. This lack of completeness stems from the way URIS operates: the system does not collect data directly from scientists or institutions, but instead relies exclusively on information made publicly available through the scientist's ORCID profile. Consequently, any data not uploaded or maintained within ORCID will not appear in URIS.

Dr. Romanko's educational background reflects a strong academic foundation. He graduated from the Faculty of History at Simferopol State University in 1998, later earning a Candidate of Sciences degree (Ph.D. equivalent) from V. N. Karazin Kharkiv National University in 2002, followed by a Doctor of Sciences degree in 2010 at the same institution. His academic career has been largely focused on historical research, particularly related to Crimea, and has included teaching positions at the Crimean State Medical University and the Crimean Federal University.

However, this well-documented academic trajectory is only partially reflected in the URIS system. The profile contains only a single entry related to education, which significantly underrepresents the full scope of Dr. Romanko's qualifications. Given his biography, the system


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should include at least two additional educational milestones. This discrepancy once again highlights the limitations caused by incomplete ORCID entries.

In terms of research output, Dr. Romanko demonstrates a high level of scholarly productivity. The URIS profile includes 92 publication records, which suggests robust academic engagement. Nonetheless, according to publicly available information and institutional sources, Dr. Romanko has authored over 150 scholarly articles and 15 monographs. This discrepancy is not a technical shortcoming of URIS itself but a consequence of data incompleteness in the source system – ORCID. Since URIS automatically imports metadata from ORCID through an API, the quantity and accuracy of bibliometric data are fully dependent on how actively and comprehensively the scientist curates their ORCID profile.

The analysis becomes even more constrained when attempting to assess Dr. Romanko's international experience and mobility. His biography notes several international research internships and fellowships in countries such as Germany, the Netherlands, Poland, Russia, and Serbia. Despite this, URIS does not currently provide tools to analyze academic mobility in a structured, automated manner. The profile contains only one education entry and two affiliations under employment history, which are insufficient to form a complete picture of his international engagements. Furthermore, the absence of project-related entries in the profile presents a major analytical blind spot, as participation in international research projects is a vital indicator of scientific cooperation and mobility.

The integration of ORCID into the URIS infrastructure is a crucial step toward establishing a centralized, transparent, and machine-readable research information ecosystem in Ukraine. Dr. Romanko's ORCID ID (0000-0001-9898-8560) is linked to his URIS profile, enabling automatic data synchronization. However, while ORCID offers a standardized framework for identifying scientists and capturing key career events, it does not offer built-in tools for advanced analytics or mobility tracking. The effectiveness of the URIS-ORCID integration, therefore, depends not only on the existence of this technical link but also on the active participation of scientists in maintaining up-to-date and comprehensive records. The lack of fields or structured metadata concerning project participation, grants, or types of international cooperation further limits the analytical power of the system.

This case study underscores several broader conclusions. First, while URIS provides a foundational profile of a scientist, its utility for in-depth analysis is severely constrained when data is incomplete or inconsistently maintained. In Dr. Romanko's case, the profile lacks records of his academic degrees, comprehensive employment history, and project involvement, which are essential for evaluating his academic mobility and collaborative activities.

Second, the absence of structured data on international projects and partnerships points to the need for a more robust metadata schema within URIS. Enhancing the system's analytical capabilities would require not only improved API integration and data harvesting from ORCID but also the introduction of additional data fields to capture detailed information on mobility, collaborations, and participation in funded research.

In conclusion, the example of Oleh Romanko's profile illustrates both the progress made in developing Ukraine's national research information infrastructure and the critical areas in need of further development. URIS, when supported by accurate and regularly updated ORCID profiles, holds great potential for tracking academic mobility. However, realizing this potential will require systemic improvements–ranging from scientist education and incentives for profile maintenance, to technical upgrades in data models and analytic tools. Expanding the system's ability to process and visualize data on international cooperation and mobility will be essential


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for assessing brain drain, supporting policy decisions, and enhancing the visibility of Ukrainian science in the global research landscape.

*Dual institutional engagement and strategic use of cross-border academic mobility*. Oleksandr Kovalchuk's academic profile offers a compelling example of dual professional engagement across borders (Fig. 1). Since September 2023, he has held the position of Associate Professor at the Department of Biology and Methods of Teaching Biology at Sumy State University (Sumy, Ukraine). This recent affiliation underscores his continued commitment to Ukrainian academia and highlights the resilience of national institutions amidst wartime disruption.

Simultaneously, Kovalchuk has maintained a long-standing affiliation with the University of Wrocław (Poland), where he has served as an adjunct in the field of palaeozoology since 2020. His involvement in a European institution predates the full-scale invasion but continued through it, positioning him as a scientist navigating complex geopolitical realities while building a transnational career.

In addition to these roles, Kovalchuk has been a leading scientist at the National Museum of Natural History of the National Academy of Sciences of Ukraine (Kyiv) since 2012, further reinforcing his high-level integration into Ukraine's scientific ecosystem.

Kovalchuk's profile exemplifies the "mobile yet rooted" scientist–physically or institutionally present in multiple countries, but still academically anchored in Ukraine. His ongoing affiliations indicate strategic mobility rather than complete migration. This case highlights a key challenge in automated mobility analysis: while systems like ORCID record institutional ties, they lack context about residency, travel frequency, or intensity of engagement. Thus, Kovalchuk may be physically based in Poland but intellectually and professionally active in Ukraine, a reality that traditional data-driven assessments may misinterpret without manual validation.

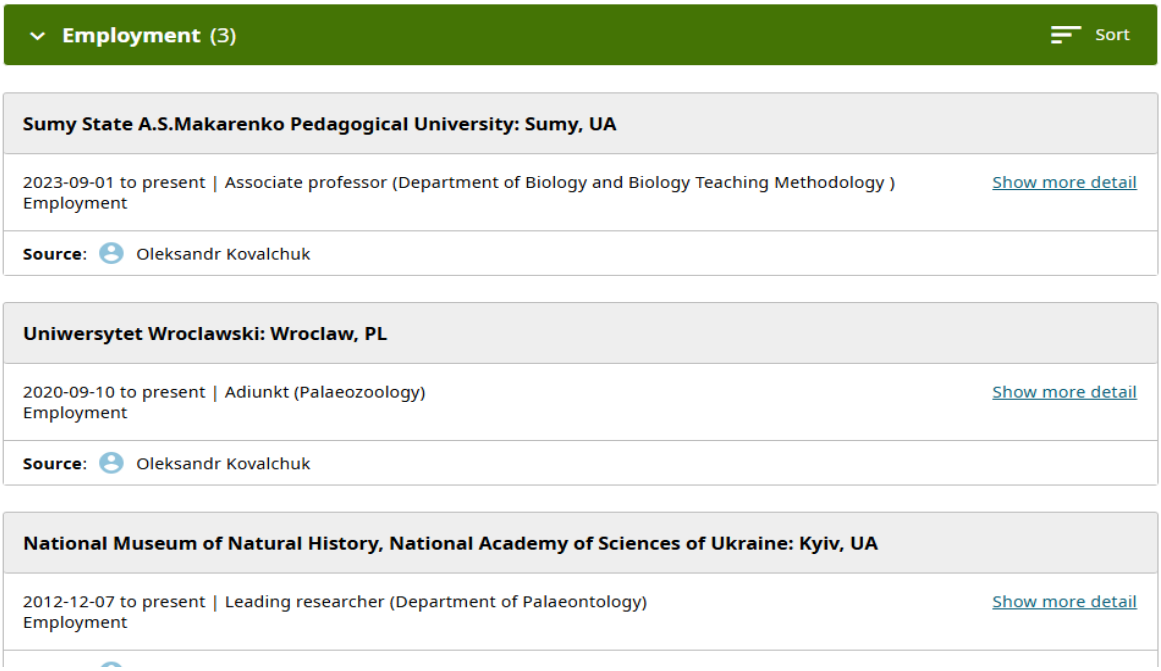


Fig. 1. Oleksandr Kovalchuk's profile


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*Implementation of the Visiting Scholar Model as a form of temporary academic mobility*. Danylo Bazylevych presents another distinct model of mobility (Fig. 2). Since December 2023, he has served as Professor and Head of the Department of Propaedeutics of Internal Medicine at Danylo Halytsky Lviv National Medical University (Lviv, Ukraine). His leadership role confirms his centrality in Ukrainian academic life and the functioning of medical education amid war.

However, Bazylevych also holds an international appointment as a visiting professor at the Stanisław Wojciechowski University in Kalisz, Poland, a position he has held since April 2021. This role likely involves periodic lectures or collaborative research, rather than permanent relocation.

Bazylevych's dual affiliation supports a nuanced understanding of academic mobility in times of crisis. His visiting professorship indicates a form of academic diplomacy – maintaining a presence abroad without severing local roots. It is a common pattern for Ukrainian scholars who, in response to conflict, seek professional continuity abroad while remaining engaged in national education and science.

The visiting professor model also reveals the interpretative limitations of ORCID. While the platform accurately displays concurrent affiliations, it does not clarify the duration, intensity, or nature of the international role – whether it involves full relocation or short-term visits. Thus, without manual verification or supplementary data, scientists risk misclassifying these forms of mobility as permanent emigration.

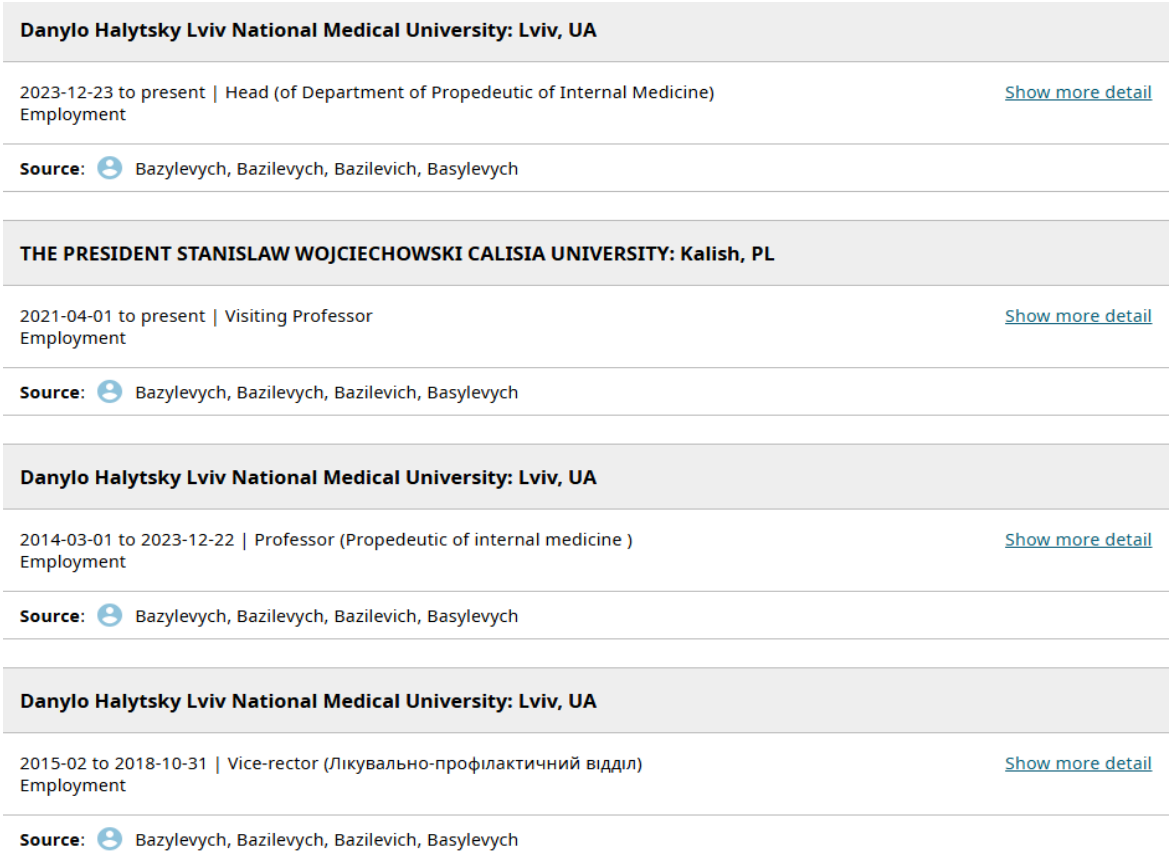


Fig. 2. Danylo Bazylevych's profile


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*A distinct case of forced academic displacement due to armed conflict*. The academic trajectory of Yurii Pelekh is a more straightforward case of research migration. His affiliation with the University of Rzeszów (Poland) reflects a significant institutional and geographic shift, presumably caused by the war. Unlike other scholars who maintain simultaneous roles in Ukraine, Pelekh appears to have fully transitioned his academic activity to a foreign institution (Fig. 3).

Pelekh's case illustrates the type of mobility that data infrastructures are better suited to detect. His profile indicates a clear break from Ukrainian affiliations and a sustained commitment to research abroad. This example represents a broader phenomenon of war-driven scientific diaspora, where scholars seek stability and resources abroad, often unable to maintain formal ties to institutions under siege or suffering from resource attrition.

His case reaffirms the value of ORCID as a tool for detecting such transitions but also points to the need for complementary metadata – such as reasons for mobility or departure from prior roles – to fully capture the context of academic migration.

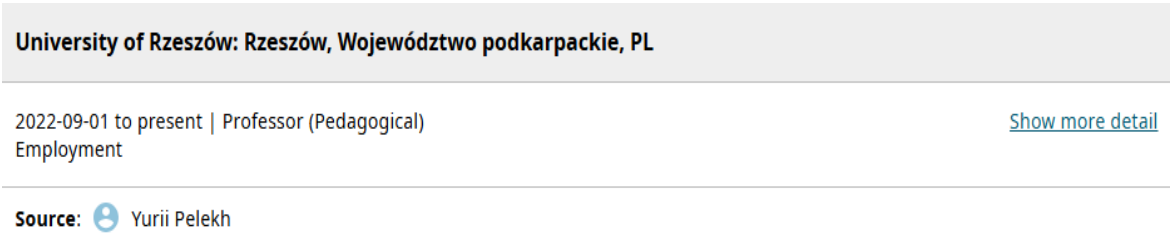


Fig. 3. Yurii Pelekh's profile

*Patterns of pre-war internationalization and long-term academic integration abroad.* Fedir Ivashchyshyn stands out as a scientist whose international mobility began well before the current war. Since December 2018, he has worked as an adjunct at the Faculty of Electrical Engineering at the Częstochowa University of Technology (Poland). His relocation predates the full-scale Russian invasion, which suggests that his academic migration was primarily driven by career development and not by displacement (Fig. 4).

Nevertheless, Ivashchyshyn has retained a continuous academic presence in Ukraine. Since 2007, he has worked at Lviv Polytechnic National University in the Department of Applied Physics and Nanomaterials Science.

Ivashchyshyn's profile exemplifies proactive mobility, characterized by voluntary transition toward international collaboration and institutional diversification. His case emphasizes that not all Ukrainian scientists abroad are part of the post-2022 migration wave. It also illustrates that international careers often begin through a proactive search for opportunity, long before political upheaval necessitates such decisions.

From a data perspective, however, the presence of long-term dual affiliations in ORCID can blur the line between strategic internationalization and reactive displacement. This makes clear that date stamps, role descriptions, and supplementary qualitative narratives are essential for interpreting academic mobility data.

*Synthesis and cross-case conclusions.* Taken together, these four profiles reveal the diversity and complexity of academic mobility among Ukrainian scientists. They illustrate a spectrum of mobility types:


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- **strategic dual affiliation** (Kovalchuk);
- **visiting appointments with limited physical relocation** (Bazylevych);
- **clear displacement and migration** (Pelekh);
- **pre-war internationalization** (Ivashchyshyn).

Each case reflects different motivations – career advancement, geopolitical disruption, or institutional partnerships – and highlights the ongoing connection many scholars maintain with Ukrainian science. They also underscore the value of tools like ORCID and URIS in mapping these affiliations, while pointing to their current limitations in assessing the *depth* and *nature* of mobility.

To strengthen the analytical capacity of these platforms, future enhancements could include:

- more precise date tracking of affiliations;
- geolocation metadata;
- indicators for type of engagement (full-time, part-time, visiting, remote);
- integration of migration-related self-declarations.

Such improvements would significantly enhance our understanding of the "academic diaspora" and support national science policy in addressing brain drain while facilitating global engagement.

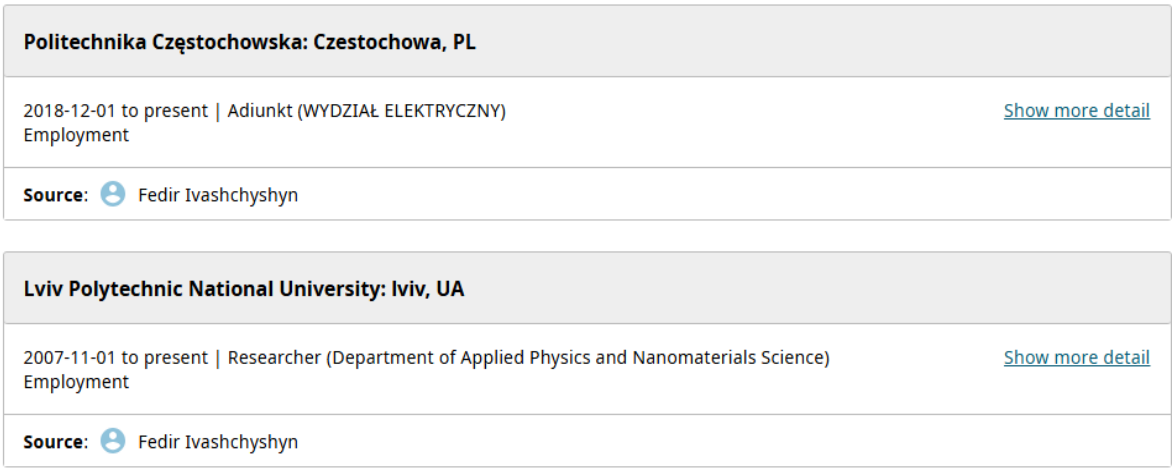


Fig. 4. Fedir Ivashchyshyn's profile

The comparative analysis of URIS and ORCID highlights the complementary strengths and weaknesses of these infrastructures. URIS, with its institutional verification and integration into the national research governance system, provides higher reliability when it comes to the formal affiliations of Ukrainian researchers. However, the system remains heavily dependent on the completeness of imported data, especially from ORCID. Conversely, ORCID offers a global platform where researchers can register multiple affiliations, record international collaborations, and link outputs such as publications and projects. Yet, because ORCID is largely self-reported and voluntary, the level of completeness varies greatly between profiles.

The integration of these systems illustrates both opportunities and risks. On the one hand, URIS-ORCID interoperability strengthens the visibility of Ukrainian research and allows for the detection of transnational academic ties. On the other hand, gaps in ORCID maintenance by individual researchers translate directly into missing or underrepresented data in URIS. This


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limitation was visible in the case study of Oleh Romanko, where significant parts of his academic career, including degrees and project activities, were absent.

Thus, while URIS can serve as a foundation for national-level monitoring of the academic workforce, it requires both technical upgrades (expanded metadata fields, time-stamped affiliations, structured project information) and behavioral incentives (encouraging scientists to maintain their ORCID profiles). Without such improvements, analyses of mobility risk being partial or biased.

The results reveal a spectrum of academic mobility among Ukrainian scholars:

- strategic dual affiliation (e.g., Oleksandr Kovalchuk);
- temporary or visiting appointments (e.g., Danylo Bazylevych);
- forced displacement due to war (e.g., Yurii Pelekh);
- pre-war proactive internationalization (e.g., Fedir Ivashchyshyn).

This typology underscores that academic mobility is not monolithic; it is shaped by diverse personal, institutional, and geopolitical factors. The war in particular has acted as a catalyst, accelerating long-standing mobility drivers such as underfunding and limited career opportunities, while simultaneously creating conditions of forced migration.

Importantly, mobility does not always equate to brain drain. Many scholars maintain links with Ukrainian institutions even while affiliated abroad. This phenomenon aligns with the concept of *"circulating brains"*, where diaspora engagement contributes to sustaining domestic research capacity. However, the balance between permanent loss and knowledge circulation remains fragile, especially given the prolonged instability in Ukraine.

The study also demonstrates the inherent constraints of relying solely on digital infrastructures for mobility analysis. ORCID and URIS record institutional ties but lack the granularity to capture critical aspects such as:

- whether the affiliation is physical or remote;
- whether the position is primary or secondary;
- the duration and intensity of engagement;
- the motivation for relocation (professional opportunity vs. forced displacement).

Without these contextual elements, affiliation data can easily be misinterpreted. For example, a dual-affiliated professor may appear in statistics as a migrant, whereas in reality, their main employment and residence remain in Ukraine. Conversely, a displaced scientist who no longer maintains ties with Ukrainian institutions may be undercounted if their profile is incomplete.

Therefore, quantitative mobility tracking must be triangulated with *qualitative sources* such as project databases, grant participation records, institutional websites, and interviews or surveys of researchers themselves. Only this combination can provide a robust picture of the scale and nature of academic migration.

The patterns revealed carry important implications for Ukraine's science and higher education policy. A dual approach is required:

1. Retention and Support of Domestic Researchers. Addressing chronic underfunding, modernizing infrastructure, and simplifying career advancement pathways remain essential to reducing the push factors that drive scientists abroad.
2. Leveraging the Academic Diaspora. Rather than viewing all mobility as a loss, policymakers should actively foster collaboration with Ukrainian scientists abroad. Mechanisms may include: programs for joint supervision of Ph.D. students, digital


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platforms for remote teaching and mentoring, incentives for co-authorship and co-grant applications, and schemes facilitating temporary or permanent return.

3. Enhancing Data Infrastructure**.** URIS should evolve into a comprehensive research information system capable not only of aggregating affiliations but also of tracking international collaboration, project participation, and geographic mobility. This requires expanded metadata schemas (e.g., type of position, duration, geolocation) and continuous synchronization with ORCID and global bibliometric databases.

From a broader perspective, Ukraine's case contributes to global debates on the resilience of science systems under conditions of crisis. The war has exposed vulnerabilities such as reliance on underfunded infrastructure, but also demonstrated adaptive strategies, including rapid integration into European research frameworks and the resilience of scholars who maintain dual roles.

The Ukrainian experience illustrates that academic mobility is simultaneously a *challenge* (loss of human capital, weakening of universities) and an *opportunity* (creation of transnational networks, increased visibility in global science). Recognizing and managing this duality will be central to shaping Ukraine's post-war reconstruction of science and higher education.

## Conclusions

The URIS system has proven to be an essential instrument for analyzing academic mobility among Ukrainian scholars. By integrating ORCID data and offering comprehensive analytical fields, URIS enables the tracking of trends in education, employment, and international collaboration, providing a nuanced understanding of scientists' trajectories over time. This is particularly critical during periods of disruption, such as the 2014 escalation of conflict and the 2022 full-scale invasion, which have significantly affected the national scientific landscape.

Analysis of URIS data reveals that the mobility of Ukrainian scientists has not been uniform but shows distinct temporal patterns. Following the events of 2014, there was a measurable increase in international engagement, primarily through short-term research fellowships and collaborations with institutions in Europe and North America. After 2022, these trends intensified, with a notable rise in scholars formally affiliating with foreign institutions. For instance, several mid-career researchers who maintained dual affiliations prior to 2022 shifted to primary affiliations abroad following the escalation of the war, reflecting both professional adaptation and safety considerations. These shifts in affiliation over time highlight both the vulnerability of Ukrainian science to external shocks and the adaptive strategies employed by researchers to maintain their professional activity.

Despite this significant outflow, the majority of Ukrainian scientists continue to live and work in Ukraine, maintaining robust links with national institutions. This reflects the resilience of the academic community and underscores a continued commitment to advancing Ukrainian science under challenging circumstances. Importantly, these patterns demonstrate that academic mobility should not be interpreted solely as a loss. Many scholars abroad continue collaborations, co-author publications, and mentor students in Ukraine, supporting knowledge circulation and sustaining institutional connections.

The findings suggest that Ukrainian science policy should adopt a dual approach to mobility: mitigating the negative effects of brain drain while leveraging international experience


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to strengthen domestic research capacity. Practical measures could include maintaining institutional ties with scientists abroad, offering incentives for return migration, supporting remote collaboration, and integrating international expertise into local projects. Such strategies would transform challenges of mobility into strategic advantages, enhancing the resilience and global integration of Ukrainian science.

In conclusion, this study demonstrates that combining ORCID and URIS data provides a robust and complementary framework for analyzing the academic mobility of Ukrainian scientists during wartime. ORCID contributes international coverage and transparency of researchers' profiles, while URIS ensures reliability through institutional verification and advanced analytical tools. Together, these systems make it possible to track shifts in institutional affiliations, detect the rise of dual or foreign appointments, and contextualize patterns of international collaboration that intensified after 2014 and especially after 2022.

The integration of these data sources highlights that academic mobility under conditions of war cannot be understood solely as a quantitative change in affiliations. It also reflects broader processes of adaptation, resilience, and the preservation of professional ties across borders. By documenting how Ukrainian scientists either relocate, maintain dual affiliations, or sustain collaboration from abroad, the study provides an evidence base for policy measures aimed at mitigating brain drain and leveraging international networks for the recovery of Ukrainian science.

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TSYBENKO I. O.
Державна науково-технічна бібліотека України (ДНТБ України) (Київ, Україна),
e-mail: tsyb2012@ukr.net, ORCID 0000-0002-6408-9011

ZHEREBCHUK S. V.
Державна науково-технічна бібліотека України (ДНТБ України) (Київ, Україна),
e-mail: zerebcuksofia@gmail.com, ORCID 0000-0002-0212-7107

MARÍN-ARRAIZA P.
Віденський технічний університет (Відень, Австрія), ORCID (Бетесда, США),
e-mail: p.arraiza@orcid.org, ORCID 0000-0001-7460-7794

KUDAS D. I.
Військова академія (Одеса, Україна), e-mail: kudasdmitriy@gmail.com,
ORCID 0009-0002-0687-4182

# Аналіз міграції українських вчених за допомогою аналітичних інструментів Національної електронної системи наукової інформації та ідентифікатора ORCID

**Мета.** Це дослідження присвячене вивченню тенденцій академічної міграції українських вчених у контексті вимушеного переселення внаслідок війни. **Методика.** Для аналізу моделей мобільності було застосовано комплексний підхід із використанням модуля «Вчений» – аналітичного інструменту на основі ідентифікаторів ORCID, який дозволяє детально відстежувати афіліації, публікації та міжнародні співпраці. Профілі вчених було відфільтровано за країною афіліації та додатково перевірено шляхом ручного аналізу хронології публікацій та оновлень профілів. **Результати.** Рік першої іноземної афіліації було оцінено попри труднощі, пов’язані з нерегулярним оновленням профілів. Результати показують чітку тенденцію до переїзду та зростання співпраці з іноземними установами, хоча багато дослідників зберігають зв'язки з українськими університетами. Дослідження підкреслює як потенціал, так і обмеження використання цифрових профілів дослідників для оцінки міграції. **Висновки.** Інтеграція ORCID із додатковими джерелами даних значно покращує точність аналізу мобільності та створює основу для розробки цільових механізмів підтримки переміщених вчених, забезпечуючи безперервність та стійкість української дослідницької екосистеми.

*Ключові слова:* академічна мобільність; ORCID; URIS; міжнародна співпраця; вплив війни; цифрова трансформація; Державна науково-технічна бібліотека України

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