

CV - YEVDHENIIA BABENKO, Ph.D.

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RESEARCH VISION

My research programme aims to establish Strong AI through biologically inspired architectures and to enable controlled, predictable biology via digital infrastructures. I envision a closed-loop paradigm where distributed biosensor networks feed real-time data into neuro-symbolic AI systems, which in turn model and control biological processes, from plant stress responses to animal behaviour. This vision builds on my two-decade trajectory from experimental physiology and precision agriculture to cybernetics and cognitive AI. I propose to create a distributed sensor-based digital infrastructure for biological system modelling, integrating relational representations, Cognitive Interaction Layers for Neuro-Symbolic AI, and digital organism concepts to transform biology from a descriptive science into an engineering discipline.

EDUCATION AND QUALIFICATIONS

- **Ph.D. in Agricultural Sciences (Viticulture)** – Tairov Institute of Viticulture and Winemaking, Ukraine (2009)
Recognised as equivalent to Ph.D. in Crop Science by Czech University of Life Sciences Prague (2022)
- **Master of Biology (Human and Animal Physiology)** – Odesa I.I. Mechnikov National University (2003)
Recognised as equivalent to M.Sc. in Experimental Biology by Masaryk University (2019)
- **Master of Public Administration (Cum Laude)** – Odesa Regional Institute of Public Administration (2008)
- **Professional Competence for Designing Experiments with Animal Models** – University of Veterinary Sciences Brno (2022)
- **Project Manager (EFMD Level 7)** – Brno, Czech Republic (2023)

PROFESSIONAL EXPERIENCE

Senior Research Fellow

V.M. Glushkov Institute of Cybernetics, National Academy of Sciences of Ukraine (2009 – present)

- Leading research on neuro-symbolic AI, biosensor networks, and cyber-physical systems for biological applications.
- Principal Investigator of STCU projects on distributed biosensor systems and precision agriculture.
- Supervising interdisciplinary teams at the intersection of AI, sensor technologies, and life sciences.

Scientific Laboratory Technician / Animal Behaviour Researcher

Masaryk University, Brno, Czech Republic (2022–2023)

- Designed and conducted behavioural experiments on addiction models (nicotine, methamphetamine) using AI-assisted data acquisition and analysis.

Agricultural Research Assistant

Research Institute for Fodder Crops, Troubsko, Czech Republic (2021)

- Applied sensor-based diagnostics to crop physiology and stress monitoring.

Research Scientist (Viticulture and Plant Systems)

Tairov Institute of Viticulture and Winemaking, Ukraine (2003–2009)

- Developed physiological methods for drought resistance assessment and portable fluorimetry for plant diagnostics.

KEY SCIENTIFIC CONTRIBUTIONS (10 selected)

1. **Portable Fluorometer “Floratest” for Photosynthesis Diagnostics** (2007) – Co-developed the first portable chlorophyll fluorescence device for field stress assessment in vineyards. This work established the foundation for distributed biosensing and was recognised by the NASU Prize for Young Scientists (2006).
2. **Patent: Method for Plant Species Identification** (UA 86679, 2014) – Invented a transdisciplinary cross-platform technology for electronic taxonomic identification, integrating spectral data and machine learning – a precursor to relational biological modelling.
3. **STCU Project #5219: Biosensor Systems for Precision Agriculture** (2010–2013) – As PI, led the development of wireless intelligent biosensors for large-area crop monitoring, resulting in multiple publications and patents.
4. **STCU Project #6064: Distributed Smart Biosensors for Environmental Monitoring** (2015–2017) – Led the design and field deployment of a distributed sensor network for real-time environmental and biological data acquisition – a prototype for the proposed digital infrastructure.
5. **Methodological Fundamentals of Information System Design in Crop Production** (2022) – Published a comprehensive framework for creating information systems tailored to biological data, bridging cybernetics and agronomy.
6. **Intelligent Methods in Behavioural Studies on Animal Models** (2024, CEUR-WS) – Demonstrated AI-driven analysis of rodent behavioural data, integrating pharmacology and computational modelling – extending my biological modelling approach to animal systems.
7. **Modern Tools and Market Dynamics in Behavioural Research** (2025, IJ ITA) – Provided a critical synthesis of AI and sensor technologies in behavioural science, establishing the need for standardised digital infrastructures.
8. **Cognitive Interaction Layers for Neuro-Symbolic AI** (2025, CEUR-WS) – Introduced a novel framework integrating symbolic reasoning and sub-symbolic learning, enabling interpretable and generalisable AI – a cornerstone of my Strong AI vision.
9. **The Path to Artificial General Intelligence Through the Concept of a Digital Organism** (2025, Preprints) – Proposed the digital organism as a unifying model for AGI, linking biological organisation with computational architectures – the core of my research programme.
10. **Abstract Biology: Toward a Relational Framework for Life** (2025, Preprints) – Formulated a relational, graph-theoretic representation of biological processes, providing the theoretical underpinning for controlled, predictable biology via digital twins.

AWARDS AND HONOURS

- **NASU Award for Young Scientists** (2006) – for the development of portable fluorimeter “Floratest”.
- **NASU Young Scientist Research Prize** (2013) – for contributions to intelligent sensor technologies.
- **First Prize, Sikorsky Challenge** (2013) – project “Intelligent Sensor Technologies for Express Diagnostics of Agricultural Crops”.
- **Scholarship of the Cabinet of Ministers of Ukraine** for young scientists (multiple years).
- **Scholarship of the President of Ukraine** for young scientists (multiple years).

LEADERSHIP, GRANTS, AND SERVICE

- **Principal Investigator** – STCU Projects #5219 (2010–2013) and #6064 (2015–2017) on distributed biosensor systems and precision agriculture.
- **Member of the Parliamentary Working Group on Electoral Process Digitalisation** (Verkhovna Rada of Ukraine, 2012) – provided scientific expertise on digital transformation, collaborating with the Central Election Commission and State Service of Special Communications.
- **Official Mentor and Ambassador** – AIWorks, supporting early-career researchers in AI.
- **Peer Reviewer** – for international journals in AI, biosensors, agriculture, and interdisciplinary sciences (documented via ORCID and Web of Science).

ADDITIONAL SKILLS AND EXPERTISE

- **AI & Modelling:** Neuro-symbolic AI, human-in-the-loop systems, digital twins, biologically inspired optimisation.
- **Biosensing & Data Acquisition:** Signal processing, sensor networks, fluorescence diagnostics.
- **Programming & Analysis:** R/RStudio, Python (applied), statistical modelling.
- **Languages:** Ukrainian, Russian (native); Czech (C1–C2); English (C1 reading/writing, B1 spoken).
- **Authorisation:** Licensed by the Ministry of Agriculture of the Czech Republic to design and supervise experimental projects involving animal models.

SELECTED RECENT PUBLICATIONS (2024–2026)

- Babenko Y. Trends and innovations in modern agriculture: from fluorescent sensors to decision support systems. *Academia Engineering*, 2026. <https://doi.org/10.20935/AcadEng8153>
- Babenko Y., Romanov V. Cognitive Interaction Layers for Neuro-Symbolic AI. *ProfIT AI 2025*. <https://ceur-ws.org/Vol-4164/short5.pdf>
- Babenko Y. Bioinspired Models for Metaheuristic Optimization. *TechRxiv*, 2025. DOI: [10.36227/techrxiv.175693302.22402426.v1](https://doi.org/10.36227/techrxiv.175693302.22402426.v1)
- Babenko Y. The Path to Artificial General Intelligence Through the Concept of a Digital Organism. *Preprints*, 2025. <https://doi.org/10.20944/preprints202509.1612.v1>
- Babenko Y. Abstract Biology: Toward a Relational Framework for Life. *Preprints*, 2025. <https://doi.org/10.20944/preprints202509.1958.v1>
- Babenko Y. Edge Intelligent Biosensing Systems with Dual Optimization. *ICISN 2025*. <https://doi.org/10.58190/icisna.2025.142>

(Full list of >80 publications, 6 patents, and conference proceedings available upon request.)