

The Final Report of the Programme EXCELES (LX) Project 2022-2025	
Project ID:	LX22NPO5104
R&D&I Priority Area:	metabolic and cardiovascular diseases
Project (by IS VaVal):	National Institute for Research on Cardiovascular Diseases Related to Metabolic Diseases of Diabetes and Obesity
Project Acronym:	CarDia
Beneficiary:	Institute for Clinical and Experimental Medicine
Acronym of the national scientific authority (NSA)	CarDia
Principal investigator:	prof. MUDr. Martin Haluzík, DrSc.
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Co-investigator:	prof. MUDr. Jan Škrha, DrSc., MBA
4. Other project participant:	Masaryk University
Co-investigator:	prof. MUDr. Tomáš Freiburger, Ph.D.

Date and Signature of the principal investigator:

Final evaluation of the project implementation in 2022-2025

This section of the final report (ZZP) contains summary information on the progress achieved in the selected priority area of R&D&I. The fulfilment of the set objectives is evaluated in relation to the initial state defined by the beneficiary in the project proposal in 2022. This report contains information only on the most significant results and outputs of the project illustrating the fulfilment of the objectives, as all research results generated by this project are mandatorily registered at the national level and information about them is made available to the public through the Register of Research and Development Results (RIV), which is part of the Research, Development and Innovation Information System (IS VaVal). This system includes not only information on the results but also on the project finances. The information is made available under the project ID in the Central Project Register (CEP) - see ([LX22NPO5104](#)).

A) General information about the established national scientific authority ("CarDia")

A1. CarDia research portfolio

Specification of the areas of CarDia research in the supported priority research area, and a clear identification of the research topics

The CarDia project (National Institute for Research on Metabolic and Cardiovascular Diseases) is a large-scale national biomedical research initiative focused on tackling major chronic diseases that have a high burden on public health, healthcare systems, and society — especially cardiovascular diseases (CVD), type 2 diabetes mellitus (T2DM), and obesity.

In this priority area, CarDia integrates experimental, preclinical, translational, and clinical research to improve the prevention, diagnosis, and treatment of these conditions, while also strengthening Czech participation in international research and fostering scientific innovation.

Specification of CarDia Research Focus Areas:

1. Cardiovascular Diseases (CVD)

- Investigating mechanisms underlying heart and vascular diseases.
- Translational and clinical studies aiming to improve patient outcomes and preventive strategies.
- Advanced imaging and functional studies of high-risk cardiac conditions

2. Type 2 Diabetes Mellitus (T2DM)

- Elucidation of metabolic dysfunctions and their link to chronic complications (e.g., microvascular and macrovascular disease).
- Development of novel therapeutics targeting glucose and energy metabolism.

3. Obesity

Obesity is treated as both an independent disease entity and a central risk factor for CVD and T2DM. The research topics are mechanistically connected to chronic metabolic disorders and cardiovascular risk.

A2. CarDia website

a) URL link

<https://cardia.ikem.cz/en/home>

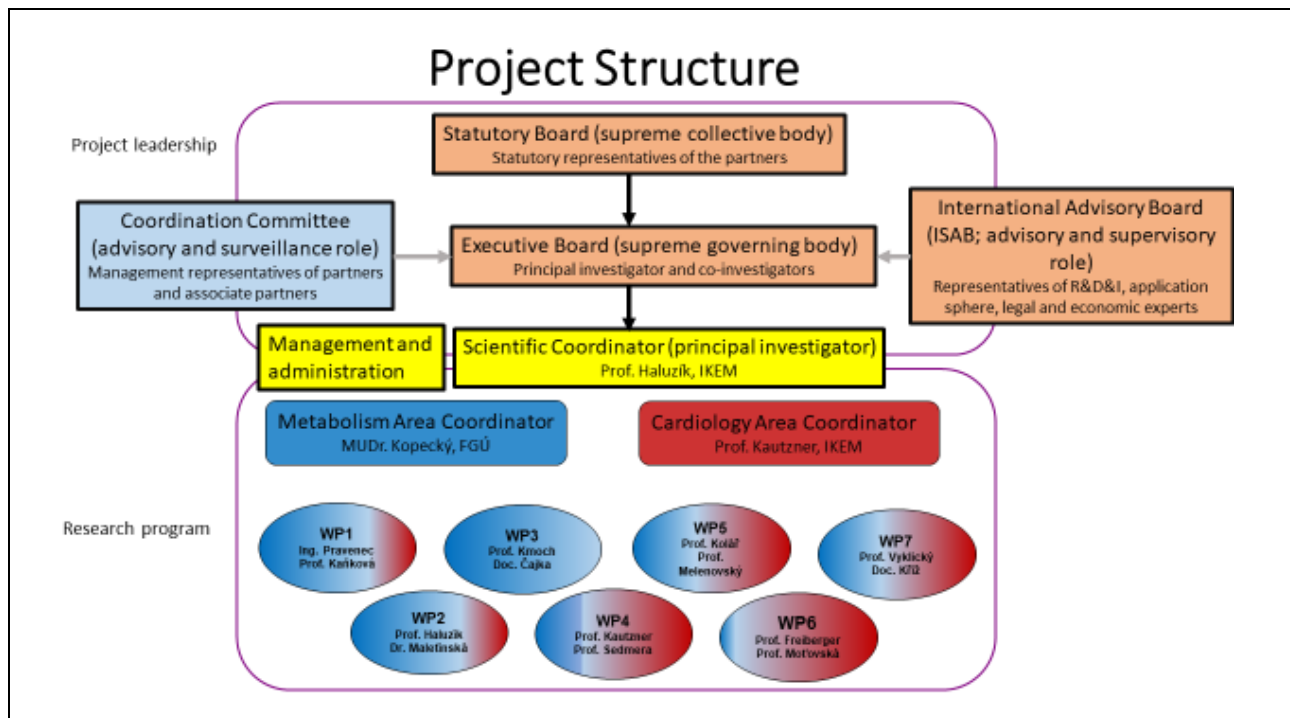
b) A summary of the content of the CarDia website and a clear navigation diagram of published information

The content of the CarDia website is divided into these 7 chapters:

1. Intro
 - More about the project
 - Project partners
 - News
 - Disease research
2. About the project
 - Introduction
 - Stakeholders
3. Partners
 - Institute for Clinical and Experimental Medicine
 - Institute of Organic Chemistry and Biochemistry of the CAS
 - Institute of Physiology of the CAS
 - Charles University
 - Masaryk University
4. Expertise
 - Obesity
 - Diabetes mellitus
 - Cardiovascular disease
5. Research infrastructure
 - Sharing research infrastructure within the CarDia consortium
6. Publications
 - Papers by researchers from IKEM, FGÚ, ÚOCHB, UK and MUNI supported by the CarDia project
7. Contact

A3. Organisational structure of the CarDia (valid as of December 31, 2025); professional and economic management of research

a) The organisational chart that was functional during the last year of the project solution and a description of the management method if it is not clear from the chart



- b) Concise description of the optimisation changes in the organisational chart compared to the original project proposal

There was no need to optimize organizational chart. The core organizational structure of the CarDia National Institute was maintained in its original form primarily because its initial design proved sufficiently robust and scientifically sound to meet the project's complex interdisciplinary demands.

- c) The organizational chart for the sustainability period if it differs from the one above

The organizational chart remains the same for the Sustainability period 2026 – 2028.

A4. Integration of the CarDia into participating research organizations and links to their management structures

Describe the links to the organizational and management structures of the participating research organizations and the method of the CarDia financial management in relation to their institutional budgets.

The National Institute CarDia functions as a consortium that integrates the research capacities of several major Czech institutions into a unified strategic framework. Organizationally, the institute uses a dual reporting system, whereby researchers remain employees of their home organisations for administrative and budgetary purposes but functionally report to CarDia work package leaders regarding the scientific outputs of specific projects. This structural link is reflected in the approach to financial management, which consists of establishing specialized, "separate" administrative and financial centers/offices within each partner's accounting and management system to ensure that EXCELES funding is strictly separated from the institutions' general budgets or other project subsidies. The budget is being distributed according to the signed Subsidy Contract. While partners retain autonomy over their day-to-day expenses and purchases, the CarDia Coordinator, Executive Board, and Scientific Coordinator provide centralized oversight and regular monitoring, as well as annual reporting to the grant provider to ensure full

compliance with national and European funding requirements, effectively balancing institutional independence with strict project accountability.

A5. Support provided for project implementation

Enter the amounts specified in the latest effective amendment to the contract in millions of CZK, rounded to one decimal place.

Year	2022	2023	2024	2025	Total
Total amount of support (mio CZK)	145,4	378,4	259,8	228,4	1012,0
of which investments (mio CZK)	41,2	174,0	26,3	5,0	246,5

B) Fulfilment of project objectives

Sub-objective a) Achieving and maintaining the European level of excellence in oriented research

a1) Summary of the results of the bibliometric analysis conducted for the supported priority area of R&D&I

The National Institute CarDia consortium demonstrates a high level of publication activity of the Jwos type, which accounts for approximately 65% of all reported publications. The proportion of authors who have published at least one Jwos-type article is also very high (91%), indicating a strong orientation of the consortium toward basic research based on within consortia, national and international collaboration.

From the perspective of the qualitative structure of publications and citations, none of the institutions stands out markedly. The strengths of individual partners are discipline-specific, and the partner institutions therefore tend to complement one another rather than compete directly.

The National Institute CarDia consortium exhibits a high level of co-authorship, both within the consortium itself and with other institutions in the Czech Republic and abroad. The intensity of collaboration among individual CarDia partners is uneven: some institutions (particularly FGÚ, IKEM, and UK) tend to collaborate more intensively on a bilateral basis. ÚOCHB has been less involved overall in intra-consortium collaboration. Authors from 90 countries and more than 1 400 foreign institutions have contributed to the consortium's Jwos-type publications, confirming a strong degree of international collaboration.

The bibliometric analysis shows that the National Institute CarDia constitutes a strong and internationally connected research consortium with a substantial publication output, dominant in key medical fields. Citation impact, including citations from top-tier journals, indicates that the published research is recognized and utilized by the global scholarly community.

Detailed analysis – annex 2 - Bibliometric analysis (LX22NPO5104-ZZP-anx2-bibliometrix.pdf)

a2) Change/progress in the production and quality of publication results compared to the initial state (according to the project proposal, or the beginning of 2022) in international comparison

In the three years preceding the submission of the project proposal, the key members of the research team published a total of 429 scientific papers, of which 19 were ranked in the first decile (D1) of the relevant scientific categories, indicating a high level of research excellence.

Since the start of the project, cooperation within the consortium—based on shared research infrastructure and increasingly intensive exchange of scientific data, methodologies, and know-how—has significantly

enhanced research efficiency, improved the quality of outputs, and stimulated the development of new interdisciplinary collaborations.

This strengthened cooperation is reflected in the growing number of joint research outputs, including 520 scientific publications and 219 conference contributions. The consortium's publications demonstrate a strong international dimension, with contributions from authors representing 90 countries and more than 1,400 foreign institutions. In particular, the consortium's JWoS-type publications confirm a high level of international collaboration and position the consortium competitively in the global research landscape.

a3) Change/progress in the production and quality of non-publication results compared to the initial state (according to the project proposal, or the beginning of 2022)

In the three years preceding the proposal, the key members of the research team were granted 10 international PCT patents, demonstrating a strong capacity for translating research results into protected intellectual property.

During the realisation of the CarDia project were invented these non-publication results:

1. Protected inventions:

- 2023, IOCB Patent application - PCT/CZ2023/050072 Insulin derivatives
- 2023, IOCB Patent application - PCT/CZ2023/050087 Cyclen-based compounds and their Gd(III) complexes for use as combined MRI-PET contrast agents.
- 2023, IOCB Patent application - PCT/CZ2023/050082 Palmitoylated analogue of prolactin-releasing peptide for intranasal administration
- 2024, IOCB - Compounds for Complexation of Rare Earth Elements and/or S-, P-, D- Block Metals, their Coordination Compounds, Peptide Conjugates, Method of their Preparation and Use thereof, patent No. IL310752 (Israel) - Miroslav Polášek, Tomáš David, Michal Straka, Adam Jaroš; <https://hdl.handle.net/11104/0359693>
- 2024, IKEM - Intracardiac expander; utility model No. 37872
- 2024, IKEM - Patent application EP 24210453.7. Use of phosphonium compounds for prevention and treatment of metabolic diseases.
- 2025, IKEM - Patent application - PCT/CZ2025/050086 Use of phosphonium compounds for prevention and treatment of metabolic diseases. This PCT application claims priority from invention application EP 24210453.7. The priority date is November 4, 2024.
- 2025, IKEM and UK - Invention application No. 2025-432 "Contrast agents for 1H CSI magnetic resonance imaging" in the Czech Republic
- 2025, Charles University - Ultra-high-frequency ECG - This new ECG technology, protected by patents and recognized internationally, was developed with the support of the CarDia project. After successful testing, the new ultra-high-frequency ECG technology has obtained European CE certification and is now available for use in Czech and European hospitals

2. Shared inventions and results:

- 2025, IKEM - Diabetes registry - National Technological Registry of Diabetes Patients - The registry allows physicians to monitor the course of the disease in their patients, compare results with anonymised data from the entire database, and thereby better personalise treatment. The data will allow us to use advanced technologies and the latest medicines more effectively and move Czech diabetology among the leaders in Europe and worldwide. The registry is freely accessible for all interested physicians or diabetes centers at

[Dia Panther National Technological Registry of Diabetes Patients](#). We are prepared to cooperate with partners from pharmaceutical or technology companies, to whom we can provide selected data for a fee.

- 2025, IPHYS - The Circadian Ontogenetic Metabolomics Atlas (COMA) – an interactive and open database that provides a detailed mapping of circadian (daily) metabolic rhythms in 16 anatomical structures of the rat across different developmental stages. The database is freely accessible through an intuitive web interface at coma.metabolomics.fgu.cas.cz

a4) Three most significant publication results (provide the title and a functional link to information about it in a trustworthy repository)

Běhounek M, Lipcseyová D, Vít O, Žáček P, Talacko P, Husková Z, Kikerlová S, Tykvartová T, Wohlfahrt P, Melenovský V, Beneš J, Petrák J: Biomarkers of RV dysfunction in HFrEF identified by direct tissue proteomics: Extracellular proteins fibromodulin and fibulin-5. *Circ Heart Fail* 18: e011984, 2025. [doi: 10.1161/CIRCHEARTFAILURE.124.011984](https://doi.org/10.1161/CIRCHEARTFAILURE.124.011984)

We studied myocardial proteomics of patients with heart failure and controls and tried to identify metabolic dysfunction abnormalities in the right ventricle versus the left ventricle. We found that the major discriminator between failing and non-failing right heart is in proteins of the extracellular matrix, and we were able to demonstrate these proteins in the circulating blood of another cohort of heart failure patients, where these proteins predicted survival.

Kmochová T, Kidd KO, Orr A, Hnízda A, Hartmannová H, Hodaňová K, Vyleťal P, Naušová K, Brinsa V, Trešlová H, Sovová J, Barešová V, Svojšová K, Vrbáčková A, Stránecký V, Robins VC, Taylor A, Martin L, Rivas-Chavez A, Payne R, Bleyer HA, Williams A, Rennke HG, Weins A, Short PJ, Agrawal V, Storsley LJ, Waikar SS, McPhail ED, Dasari S, Leung N, Hewlett T, Yorke J, Gaston D, Geldenhuys L, Samuels M, Levine AP, West M, Hůlková H, Pompach P, Novák P, Weinberg RB, Bedard K, Živná M, Sikora J, Bleyer AJ Sr, Kmoch S: Autosomal dominant ApoA4 mutations present as tubulointerstitial kidney disease with medullary amyloidosis. *Kidney Int* 105: 799-811, 2024. [doi: 10.1016/j.kint.2023.11.021](https://doi.org/10.1016/j.kint.2023.11.021)

We described five families found to have autosomal dominant medullary amyloidosis due to two different pathogenic APOA4 variants. We revealed amyloid deposits limited to the medulla, with the mutated ApoA4 identified by mass-spectrometry as the predominant amyloid constituent. ApoA4 mutations can cause autosomal dominant medullary amyloidosis with autosomal dominant CKD with a bland urinary sediment. Diagnosis relies on a careful family history, APOA4 sequencing and pathologic studies.

David T, Šedinová M, Myšková A, Kuneš J, Maletínská L, Pohl R, Dračínský M, Mertlíková-Kaiserová H, Čížek K, Klepetářová B, Litecká M, Kaňa A, Sýkora D, Jaroš A, Straka M, Polasek M: Ultra-inert lanthanide chelates as mass tags for multiplexed bioanalysis. *Nat Commun* 15: 9836, 2024. [doi: 10.1038/s41467-024-53867-1](https://doi.org/10.1038/s41467-024-53867-1)
Coordination compounds of lanthanides are indispensable in biomedical applications as contrast agents for magnetic resonance imaging and radiotherapeutics. We developed ClickZip, an innovative synthetic strategy for irreversible entrapment of lanthanide ions, producing coordination compounds with stability up to million-fold greater than in current lanthanide-based MRI contrast agents and radiotherapeutics. Click Zip may substantially expand the scope of use of lanthanide chelates in organic synthesis, diagnostic, and therapeutic agents, and other areas requiring the highest possible stability and inertness.

a5) Up to three most significant non-publication results or outputs (provide the title and a functional link to information about it in a trustworthy repository, if there is a record of it or its metadata)

- 2024, IOCB - Compounds for Complexation of Rare Earth Elements and/or S-, P-, D- Block Metals, their Coordination Compounds, Peptide Conjugates, Method of their Preparation and Use thereof, patent No. IL310752 (Israel) - Miroslav Polášek, Tomáš David, Michal Straka, Adam Jaroš;
<https://hdl.handle.net/11104/0359693>

- 2025, Charles University - [Ultra-high-frequency ECG](#) - This new ECG technology, protected by patents and recognized internationally, was developed with the support of the CarDia project. After successful testing, the new ultra-high-frequency ECG technology has obtained European CE certification and is now available for use in Czech and European hospitals

Other important application results mentioned in Annex P1 – PZP2025.

a6) Benefits of the creation of CarDia for the field of study, i.e., for scientific knowledge in the R&D&I priority area in the international context, possible influence on research trends abroad (give a specific example)

The project CarDia has made a significant contribution to the creation of an integrated research ecosystem, bringing together experts from different institutions and disciplines to foster genuine interdisciplinary synergy with a clear impact on clinical practice. This interconnectedness significantly increases the quality and impact of research. It is crucial to maintain these links even after the end of the project, as they represent long-term strategic value. Thanks to investments made within the project, the visibility of research and expert teams has increased, leading to their greater international recognition.

The research conducted by teams involved in the project CarDia has the potential to improve the health of patients with metabolic syndrome, obesity, diabetes, liver and cardiovascular diseases, including the development of innovative and new diagnostic and therapeutic procedures and the development of new substances for possible treatment. The research is fully in line with the international priorities set out in conceptual documents in the field of public health, as many of the objectives specified in these documents are reflected in the professional objectives and activities of the project.

A number of CarDia project solutions have achieved success and recognition in an international context. One example is the new patent-protected ultra-high frequency ECG (UHF-ECG) technology. After scientific research, successful testing, and clinical trials, it has obtained EU CE certification and is now available for use in medical practice in Czech and European hospitals. Thanks to this technology, doctors can detect details of cardiac activity that were previously undetectable, allowing them to better tailor treatment for patients with cardiac electrical activation disorders.

a7) Socioeconomic impacts of the creation of the CarDia, i.e., its social relevance

The CarDia project

- focused on improving the quality of life of patients suffering from diseases with a high social and economic burden (cardiovascular disease, diabetes, obesity). Improvements in therapy and prevention have a direct impact on patients' and families' daily functioning.
- enabled faster implementation of results into practice: A centralised platform shortens the path from laboratory discovery to clinical deployment, thus increasing the chance that project interventions will actually be used in patients during the project duration;
- It has helped to increase public confidence in science and healthcare: Visible results (publications, clinical studies, new technologies) strengthen society's perception of the benefits of research and can improve the public's willingness to participate in preventive programs.

The main socioeconomic impacts of the project include

- Improved population health and reduced healthcare costs: Better prevention, early diagnosis, and more effective treatment of CVD, diabetes, and obesity leads to reduced morbidity, hospitalizations, and chronic complications. This has a direct impact on public healthcare savings (shorter hospital stays, fewer complications requiring costly interventions) and an indirect impact through higher population productivity. (Supported by the project's objectives: faster transfer of research into practice and more effective prevention and treatment).
- Strengthening research and innovation capacity (R&D ecosystem): The concentration of experts, infrastructure, and capacity (including investment in research equipment) has increased innovation potential, attracted cooperation with foreign partners, and increased publication and patent outputs and commercialization. In the long term, this can improve the position of the Czech Republic in the field of biomedical research and support the creation of spin-offs and technology start-ups.
- Economic effects at the regional level: Investment in infrastructure and the employment of researchers and technical staff supports the local economy (wages, services, subcontractors). The concentration of experts in key centres can stimulate the agglomeration of the knowledge economy (teaching, conferences, professional courses).
- Education and human resources: The project created a number of opportunities for young scientists, doctors, and students (internships, doctoral students, clinical studies), thereby increasing the quality and capacity of human resources in the health and research sector. This has long-term benefits for the availability of skilled labor.
- Social equality and patient access to innovation: Involving patients in studies and making new diagnostic and therapeutic procedures more widely available can reduce inequalities in access to modern care (provided that measures are designed with disadvantaged groups in mind).

Sub-objective: b) Strengthening interinstitutional, interdisciplinary, and interregional cooperation and the quality of national research through further growth in international cooperation

Critical assessment of changes/progress compared to the initial state at the beginning of 2022 – in the overview, provide specific examples of activities and their outputs and impacts, supported by data.

b1) Contribution of the project to strengthening interinstitutional cooperation in the supported R&D&I priority area

The project significantly strengthened inter-institutional cooperation by unifying infrastructure, data, and expertise across the five institutions involved. It established joint research programs, multicentre clinical studies, and shared biobanks. By introducing common protocols, a data-sharing platform, and regular trainings, it improved interoperability, accelerated the transfer of results into practice, and enhanced the consortium's ability to compete for major international grants.

As a result, it created a lasting partnership with better coordination of research priorities, higher R&D performance with the ability to deliver unique R&D&I results, and a strengthened position in the supported priority area on national and international level.

Interinstitutional cooperation example: [Lecture by Prof. Barry A. Borlaug: Obesity and Heart Failure – From Mechanisms to Therapies](#)

b2) Contribution of the project to strengthening interdisciplinary cooperation in the supported R&D&I priority area

The project strengthened interdisciplinary cooperation by integrating expertise from cardiology, diabetology, molecular biology, data science, and clinical research into unified research programs.

By connecting basic, translational, and clinical teams, it enabled joint methodological development, shared use of specialised infrastructures, and faster exchange of knowledge across disciplines with strong potential to clinical impact

This led to more comprehensive research approaches, improved innovation potential, and a stronger capacity to address complex challenges within the supported R&D&I priority area.

Strengthening interdisciplinary cooperation examples:

[Faster and more targeted prodrug activation promises more effective treatments](#)

FEMINA study, which examines cardiovascular risk factors and lipid profiles in pregnant and breastfeeding women ([Klevmoen et al., BMJ Open 2025](#))

b3) Contribution of the project to strengthening interregional cooperation in the supported R&D&I priority area

The project strengthened interregional cooperation by linking research teams, clinical centres, and technical infrastructures across multiple regions in the Czech Republic. Through shared research activities, coordinated clinical studies, joint workshops, and harmonised data-collection protocols, it established stable collaboration channels between institutions operating outside a single geographic area and the CarDia consortium. This improved the flow of expertise, enabled broader recruitment of study participants, expanded access to specialised facilities, and supported the development of a cohesive national network capable of addressing challenges in the supported R&D&I priority area more effectively.

As an example of strengthening interregional cooperation in the supported R&D&I priority area, we want to mention the work on the [National Technological Registry of Diabetes Patients](#). The creation of this registry involves so far 14 hospitals from almost all regions of the Czech Republic, and we are continuing to work together to improve treatment for our patients.

b4) Contribution of the project to strengthening the internationalization of the Czech Republic in the supported priority area of R&D&I

The project contributed to strengthening the internationalisation of the Czech Republic in the supported R&D&I priority area by fostering collaborations with leading international research institutions, participating in multinational clinical studies, and sharing high-quality data and methodologies globally. It enhanced the visibility of Czech research, facilitated the exchange of expertise and best practices, and increased the country's competitiveness in securing international funding. As a result, it positioned the Czech Republic as an active and credible partner in the global research community within the supported priority area.

Examples:

[New ECG technology advances the diagnosis and treatment of heart failure](#)

[Report from the ESC Heart & Stroke Congress – EuroThrombosis 2025**](#)

[Molecular trap from IOCB Prague promises safer diagnostics and faster drug development](#)

[New molecules from IOCB reduce appetite and protect the brain from Alzheimer's-like diseases](#)

b5) The ability of the CarDia to utilise the capacities of large research infrastructures (ESFRI) - Provide a specific example and, if applicable, a reference to the best output

The CarDia National Institute partners cooperate with several major scientific infrastructures and utilise their methodological and instrumental capacities.

- Several tasks are carried out in cooperation with the National Infrastructure for Biological and Medical Imaging (Czech-Bioimaging), which provides modern equipment for comprehensive optical analysis of tissue samples and tissue substitutes for the consortium's experimental and clinical teams. An example is the measurement of protein preparations suspected to contain amyloid structures using negative-stain electron microscopy.
- The National Center for Medical Genomics (NCMG) contributes significantly to the achievement of many of the project's objectives through genome and transcriptome analysis and the expertise required for genome sequencing, including bioinformatic and statistical support. Cooperation is ongoing in the analysis of the genetic causes of familial cardiomyopathies and hypercholesterolemia, and in the analysis of the transcriptome of the myocardium, skeletal muscle, and epicardial fat in obesity and heart failure, as mentioned in the previous report.
- The Czech Center for Phenogenomics collaborates with consortium teams in the preparation of specific mutations and transgenic mouse models, e.g., for use in the study of pathogenic mechanisms underlying obesity, diabetes, and related cardiovascular diseases.
- The Czech infrastructure for integrative structural biology primarily provides its services to a team that uses cryo-electron microscopy to study cardiomyocyte morphology.
- The Czech National Infrastructure for Biological Data is also used for processing and storing data from proteomic studies, and the CESNET MetaCentrum computing infrastructure is mainly used for processing metabolomic and lipidomic data.
- In addition, the capacities of the Czech National Node of the European Clinical Research Infrastructure Network (CZECRIN) are used, in particular, in connection with the preparation of clinical studies with SANOFI and AstraZeneca.

Example: [Czech Discovery Changes the Understanding of Fabry Disease Causes](#)

Sub-objective: c) deepening skills, scientific education, and support for the younger generation of researchers, including ensuring high-quality working conditions

c1) Forms of scientific education applied in the CarDia beyond the standards of participating research organizations (specific examples)

Forms of Scientific Education in CarDia Beyond Standard Practices:

- [Young Researchers' Day](#)

CarDia organized a dedicated Young Researchers' Day (on 5 September 2025) that brought together early-career scientists from all partner institutions to present their research and network.

This event was specifically tailored for young researchers in cardiometabolic disciplines, providing a platform to present results, receive feedback, and build collaborative ties beyond their home labs.

There was also an award component ("closing ceremony with awards for the best presentations"), which could motivate junior scientists.

- [Annual CarDia Meetings](#)

CarDia held Annual Meetings from the beginning of the project, where young scientists from all consortium institutions could present their most recent work in metabolism, diabetes, cardiovascular disease, etc.

These meetings did more than just share scientific results — they fostered cross-institutional peer learning, interdisciplinary exchange, and built a strong community of young researchers.

- **Specialized Training Through Partner Institutions**

Because CarDia is a consortium of top research organisations (IKEM, IOCB, FGÚ AV ČR, Charles University, Masaryk University), junior researchers get access to postgraduate education and mentorship in cutting-edge areas they might not otherwise experience in their "home" institution.

For example, IKEM's Centre for Experimental Medicine supports postgraduate studies in molecular biology, physiology, biochemistry, and metabolic disorders.

Masaryk University links its science education (e.g. natural sciences, molecular biology) very closely to primary and applied research, offering young researchers strong integration into high-level R&D.

c2) Individual support for early-stage researchers in the CarDia beyond the standards of participating research organizations (specific examples)

CarDia provides early-stage researchers with personalised mentorship across consortium institutions, interdisciplinary project experience, and mobility through secondments, offering exposure to specialised equipment and methods not available at their home organisation. They also benefit from targeted workshops, career development support, and recognition through awards, going beyond standard institutional training and supervision.

Individual support for early-stage researchers in the CarDia is also realised through international internships at various universities.

c3) Changes in the quality working conditions compared to the initial state (2021 or early 2022) in the participating research organizations

Compared to the early state (early 2022), CarDia significantly improved working conditions in its partner research organisations by investing in infrastructure, stabilising staffing, strengthening collaboration, enhancing training, and creating a more coherent, future-oriented research environment.

All partner institutions, except IKEM, fulfil the HR AWARD standards. IKEM improves the quality of working conditions through its [Gender Equality Plan](#).

Sub-objective: d) Strengthening the relevance of research outputs or supplementing existing knowledge by considering the gender perspective

- d1) Critical assessment of changes/progress compared to the initial situation (provide specific steps, examples of good practice, and new procedures that have led to gender issues being considered in research practice)

From the very beginning, the consortium's experimental and clinical research activities have taken gender differences into account in all relevant studies. Several activities are focused on uncovering cellular and molecular mechanisms that may contribute to the disease's pathogenesis and influence therapeutic approaches by gender. Gender aspects are already considered in the formulation of research hypotheses and methodological procedures, as they can provide a more comprehensive view of the research topic and a better understanding of the various manifestations that may be influenced by gender. This applies particularly to activities related to the study of metabolic and cardiovascular disorders in projects with both experimental and clinical objectives.

- d2) Identified positives of incorporating a gender perspective into research practice in the supported priority area of R&D

The gender of a subject influences, for example, the progression, complications, and treatment of metabolic diseases (obesity, diabetes). In women, in particular, different hormone levels can significantly impact metabolism and response to treatment. Taking gender into account in research on metabolic diseases has already yielded new findings that deepen our comprehensive understanding of disease mechanisms and can thus increase the effectiveness of treatment.

The gender perspective is considered in a wide range of consortium activities. Here are just a few examples. Several activities focused on cardiovascular issues in the female population, including changes in reproductive age and prevention. Despite some improvement, there is still a lack of larger studies focusing on the female population. For example, the association between hypertriglyceridemic gene scores and the risk of acute coronary syndrome was tested. The FH-FEMINA project evaluates statin therapy in fertile patients with familial hypercholesterolemia due to genetically elevated levels of low-density lipoproteins from the first years of life.

Another study has shown that obesity partially modifies adipose tissue endocrine activity and blunts the dynamics of insulin signalling in response to prolonged fasting and re-alimentation, as observed in lean women. The AMETIS study showed that metabolic flexibility, as assessed by euglycemic clamping in lean and obese women, is not directly related to insulin sensitivity and is therefore a separate parameter of metabolic status and metabolic health.

In a project monitoring the effect of bariatric surgery on the reduction of cellular senescence in obese patients, gender is one of the parameters evaluated, alongside patient age and the presence of diabetes. The HOBIT FS 2 project addresses, among other things, the quantification of epicardial fat using MRI — preliminary data suggest possible differences in its distribution and amount by gender.

We also study the effects of senolytic agents depending on gender in naturally aged mouse models. Furthermore, significant gender differences have been found in the pathophysiology of heart atrophy development caused by unloading, which are not related to sex hormone levels. In collaboration with the Salk Institute for Biological Studies (La Jolla, CA, USA), a study was conducted to examine the influence of gender differences and the role of ADTRP hydrolase on the effects of exercise on FAHFA lipokines. Gender-dependent effects were further investigated in experiments on ADTPR-deficient mice exposed to acute and chronic increased physical activity.

d3) Complications identified in achieving the objective of incorporating a gender perspective into research practice in the supported priority area of R&D&I

No major complications were encountered when taking gender into account in the consortium's research. However, the gender perspective cannot be applied uniformly. Some studies focusing primarily on uncovering basic regulatory mechanisms and relationships at the molecular level are usually conducted on only one gender for ethical, time, space, and financial reasons.

Sub-objective: e) Modernization and development of research infrastructure and capacities, including ensuring expert information capacities and mechanisms for the protection and sharing of results and scientific data obtained

e1) Modernization and development of research infrastructure and capacities (List up to 3 of the most significant specific cases that contributed to achieving and maintaining excellence in the supported R&D&I priority area)

Within the project, each partner purchased research infrastructure to address the proposed research questions. These investments enable both individual partners and the consortium to introduce previously unavailable technologies or significantly expand existing platforms, in both quality and capacity. Here are the specific investments by each partner suitable for sharing with others:
<https://cardia.ikem.cz/en/investment>.

The three most significant cases that contributed to achieving and maintaining excellence in the supported R&D&I priority area are listed here:

1. MR BioSpec 70/20 USR, Bruker - magnetic resonance imaging for advanced imaging in small laboratory animals (IKEM)
2. GC-MS platform for targeted metabolomics and lipidomics (gas chromatograph with mass spectrometer) (IPHYS) and
3. LC-MS platform for untargeted metabolomics and lipidomics (liquid chromatograph with mass spectrometer) (IPHYS)

Ad 1.

This equipment allows small samples, including laboratory rats and mice, to be imaged with high resolution and sensitivity. This device is among the most advanced in its category and an indispensable tool for non-invasive imaging in preclinical research.

Ad 2. and 3.

State-of-the-art equipment for comprehensive analysis of metabolites and other low-molecular-weight substances.

This equipment has significantly strengthened the capacity of Czech research in the field of basic and translational studies.

- 2 Mechanisms for protecting intellectual property and sharing results and scientific data obtained within the CarDia

Provide specific examples of protecting and sharing. Briefly describe how the capacities of expert information staff are secured and indicate the range of capacities that are necessary for the sustainability period and the extent to which they are secured.

Intellectual property is protected throughout the project by the standard security mechanisms of all project partners. IOCB, MUNI, Charles University and IPHYS have their own transfer office for protecting intellectual property.

IPHYS, IOCB Tech and MUNI are members of [Transfera.cz](https://www.transfera.cz), which associates Czech technology transfer offices.

IKEM in this area follows the processes set by the Intellectual Property Protection Commission.

During the sustainability period, the mechanisms will remain the same as stated.

- 3 Coordination of the scientific data sharing and cooperation of the CarDia with external institutions, including existing international platforms and networks in the field (provide examples and functional hyperlinks to them, if available)

In the CarDia project, data management and the international sharing of research data are systematically coordinated in accordance with the principles of FAIR, Open Science and open licensing. This enables full interoperability, data reusability and active participation in the European Research Area.

Data are stored in a structured format and made available via recognised international platforms and repositories under open licences (e.g. CC-BY).

- Metabolomics Workbench (MW) (<https://doi.org/10.25504/FAIRsharing.xfrgsf>),
- bioRxiv.org (<https://doi.org/10.25504/FAIRsharing.0736e1>)
- Mass Bank of North America, European Nucleotide Archive – ENA (<https://doi.org/10.25504/FAIRsharing.dj8nt8>),
- Webshare (<https://webshare.cz>),
- Gene Expression Omnibus – GEO (<https://doi.org/10.25504/FAIRsharing.5hc8vt>),
- GeneNetwork (<https://genenetwork.org/>),
- PubMed (<https://pubmed.ncbi.nlm.nih.gov>),
- Wiley Online Library (<https://onlinelibrary.wiley.com/>),
- UK repository (<https://publications.cuni.cz/>),
- PRIDE (<https://doi.org/10.25504/FAIRsharing.e1byny>) a
- ProteomeXchange (<https://doi.org/10.25504/FAIRsharing.92dt9d>)

Research outputs are openly published and archived long-term in repositories such as:

- ZENODO (<https://doi.org/10.25504/FAIRsharing.wy4egf>),
- ASEP (<https://doi.org/10.25504/FAIRsharing.a24678>),

AIR/IRIS- University of Milan Repository (<https://www.unimi.it/en/research/research-data-and-outputs/air/iris-institutional-research-repository>).

For effective management and secure sharing of research data within the National Institute CarDia, CarDia project partners use the CESNET infrastructure, specifically ownCloud services and S3 object storage. This combination of tools enables both the rapid exchange of documents and the long-term storage of large data sets in accordance with modern data science standards.

In 2025, a dedicated training environment was set up within the CarDia S3 storage. The aim of this initiative is to promote the adoption of the platform among researchers who have not yet used these advanced capabilities, thus ensuring uniform access to digital resources across the entire consortium.

The process of consolidating selected data into a unified project repository on the S3 CESNET platform is currently underway. This central repository is designed as a shared space for all working groups, serving to:

- Systematically archive research results.
- Ensuring data availability for analysis during the project's sustainability period.
- Guaranteeing data integrity and security through structured access rights management.

With this step, the CarDia project is creating a stable, scalable data infrastructure that fully supports research transparency and the long-term evaluation of results.

Sub-objective: f) Integration of the national scientific authority into the existing R&D&I system in the Czech Republic and ensuring its sustainability

- f1) Concise description of key links (examples and forms of cooperation) with other research organizations and ways of ensuring those links during the sustainability period, in relation to the CarDia management structure described above in seEvction A3. a)

Researchers from partner institutions involved in the project have established cooperation with several academic, university, and healthcare institutions that are not directly involved in the consortium's tasks. This cooperation is based primarily on the provision of experimental models, the use of technical equipment, specific analyses and expertise from these institutions.

Cooperation with the Czech Academy of Sciences institutes mainly includes:

Research into the role of hypoxic signalling in the pathogenesis of cardiovascular diseases and testing of new therapeutic approaches in the treatment of pancreatic cancer (Institute of Biotechnology), analysis of the intestinal microbiome in new experimental mouse models of obesity as well as in experiments focused on characterizing the effects of various chemical forms of omega-3 fatty acid supplementation (Institute of Microbiology), development of contrast agents for magnetic resonance imaging, measurement and evaluation of brain perfusion (Institute of Molecular Chemistry, Institute of Experimental Medicine, and Institute of Scientific Instruments), studying the effect of plectin deficiency on cardiac function (Institute of Molecular Genetics), and analysing the effects of modified magnetic nanoparticles on oxidative stress in the liver (Institute of Macromolecular Chemistry).

Cooperation with universities includes, for example:

Study of the role of nitric oxide transduction pathways and soluble guanylate cyclase in the pathophysiology of chronic heart failure (Faculty of Medicine, Charles University, Hradec Králové), analysis of a unique collection of patient samples before and after partial jejunio-ileal diversion (University of Ostrava), the effect of oligolactide on intestinal microflora and the improvement of pathologies caused by obesity and type 2 diabetes (University of Chemistry and Technology, Prague), analysis of data from imaging methods (Czech Technical University) and the effect of melatonin on cardiac contractility and electrophysiology (Faculty of Science, Charles University).

The consortium's clinical centres also continue to collaborate with the Hospital Na Homolce, the International Clinical Research Centre at St. Anne's Hospital, and other faculty and non-faculty centres in the Czech Republic to collect material and clinical data on shared patients. This collaboration includes, for example, the analysis of metabolic changes in patients undergoing bariatric surgery, the analysis of genes that cause high cholesterol levels, and the modelling of the effects of pulmonary drugs on cardiac contractility and electrophysiology. The ongoing close cooperation between IKEM and the University Hospital in Olomouc, Motol University Hospital, and the Central Military Hospital is important for creating registries of patients with type 1 diabetes and obesity.

At this point, the continuation of individual research topics is ensured by joint international projects and grants from national funders (in particular, the Czech Science Foundation and AZV).

- f2) The current concept of cooperation between the consortium and public authorities. Concise description of the key links (examples and forms of cooperation) with public authorities (also indicate their role in the Czech Republic if this is not evident from the name). Methods used to ensure the links for the sustainability period

Consortium cooperate with several public authorities, e.g.:

1. The Ministry of Health

- As the main conceptual output in terms of public recommendations, the consortium is participating in the drafting of the **National Program for the Prevention and Treatment of Obesity**. This program for the prevention and treatment of obesity was discussed and refined at several levels between 2024 and 2025. This program should fundamentally change the current approach to the prevention and treatment of this significant disease of civilisation. At present, the consortium is working closely with the Ministry of Health, where final comments and remarks on the program are being made.

2. The Institute of Health Information and Statistics of the Czech Republic ([IHIS CR](#))

- Memorandum of cooperation was signed between IKEM and IHIS CR
- The cooperation between these two key institutions in Czech healthcare focuses on the exchange of expert data, implementation of joint research projects, popularisation of science, and improvement of health literacy among the public. The memorandum also supports the development of educational activities and specialized training for students and professionals in medicine and related sciences.
- More information at [IKEM and ÚZIS have signed a memorandum of cooperation on the CarDia project](#)

3. The Chamber of Deputies of the Parliament of the Czech Republic – 3 round tables

- First and second round tables were about Obesity (April 17, 2024 and December 2, 2024)
The topic of the obesity epidemic among Czechs – trends and risks, negative health impacts on adults and children, the Czech Republic's new strategy – the National Prevention and Treatment Program, what else the Czech state can do and what it is doing to prevent obesity and mental health. These topics were discussed by politicians and representatives of healthcare organisations.
- More information at [Round table on OBESITY in Chamber of Deputies, Parliament of the Czech Republic](#) and [Round table on Obesity, environmental influences, and mental health in Chamber of Deputies, Parliament of the Czech Republic](#)
- Third round table was about Cardiology (May 5, 2025)

The latest research findings in cardiology were presented, ranging from international collaborations to the treatment of atrial fibrillation and heart failure to the relationship between obesity and heart health. The program also included a panel discussion on the future of cardiovascular research in the Czech Republic.

More information at [Round table on Cardiology in Chamber of Deputies, Parliament of the Czech Republic](#)

4. [National Institute of Public Health](#) (NIPH)

- Preparation of an amendment to the decree on school meals – Decree No. 310/2025 Coll.; (Decree amending Decree No. 107/2005 Coll., on school meals, as amended)
- More at: <https://www.zakonyprolidi.cz/cs/2025-310>

5. National Screening Centre

- A round table on the methodology of universal newborn screening for familial hypercholesterolemia (FH) in the Czech Republic was held in Prague on 11 October 2023. Representatives of lipidologists, biochemists, geneticists, paediatricians, obstetricians, the National Screening Centre and CAKO met. A specific procedure for cord blood FH screening for clinical practice was agreed upon by all. The aim was to create rational procedures as simple as possible that would not unnecessarily burden the child's parents or health care professionals. Procedures for managing data obtained from the screening were also discussed, which will be very valuable for patient care, evaluating the effectiveness of screening, and further research. The implementation of nationwide FH screening in children became part of the National Cardiovascular Plan, which was approved in the Czech Republic in the fall of 2024, making it one of the first countries to do so. By implementing universal FH screening, complemented by family-based cascade screening, the Czech Republic will move to the top of the world in FH management.

f3) Concise description of key links (examples and forms of cooperation) with other entities not mentioned above and their maintaining during the sustainability period

CarDia research groups collaborate with several private companies on projects ranging from basic to applied research. Some collaborations result in publications, others are a source of specialized external services necessary for conducting research, others are in the field of clinical studies, and still others help translate research results into practice through the necessary technological solutions. Collaborations often arise from the implementation of research projects in which individual companies participate. Below are just a few examples from 2025:

The Novo Nordisk Foundation is funding the T-GATE project. This project is being carried out at academic institutions (the consortium comprises teams at the University of Copenhagen, Aarhus University, UOCHB, and INSERM Lille), and it includes Gubra, a biotech company.

The team working on analytical methods in the field of genomics, together with a group from the Institute of Pathological Physiology of the First Faculty of Medicine of Charles University, collaborates with its partner GeneSpector Innovation on the commercialisation of an ELISA kit for the diagnosis of ADTKD-MUC1 (autosomal dominant tubulointerstitial kidney disease).

CarDia (Charles University, 3rd LF, doc. Čurila) and partners (Institute of Instrumentation, Czech Academy of Sciences, Cardion, St. Anne's University Hospital) continued, thanks to the start-up VDI Technologies, to commercialise the original technology based on ultra-high-frequency ECG analysis for assessing ventricular activation dyssynchrony.

CarDia (IPHYS) collaborates with Norwegian producers of omega-3 fatty acid concentrates, namely Rimfrost AS, Epax Norway AS, and Zooca-Calanus AS. Using metabolipidomic LC-MS analysis at FGU, it helps characterise new products, which it then uses in research into the beneficial effects of these fatty acids on the body, particularly on liver health and insulin sensitivity. These collaborations have the potential to lead to contract research in the near future.

As part of the CarDia Institute, specifically the HOBIT-FS project, there was also collaboration with Apple, which used Apple Watch smartwatches to monitor rhythm and detect paroxysmal atrial fibrillation in patients with this condition. The results were presented at the Health Research Summit, an annual conference organised by Apple at its headquarters in Cupertino, California. During this presentation, the results were discussed with both fellow physicians and Apple developers, which may contribute to the optimisation of technological solutions for heart rate monitoring in new Apple Watch models.

The Institute of Physiology of the Czech Academy of Sciences, under the leadership of Tomáš Čajka, has become a new partner in the European research project CAPTIVATE, funded by the Horizon Europe programme through the Hop-on Facility call. The project is coordinated by the European Vaccine Initiative E.V. and brings together leading European experts in malaria research, vaccination, immunology, and systems biology. The aim of the CAPTIVATE project is to develop a more effective vaccine against *Plasmodium falciparum*, the causative agent of one of the most dangerous forms of malaria.

ERA4Health Project – Martin Haluzik, ATTENTION-T2D: A study focused on evaluating the effectiveness of continuous glucose monitoring as an adjunctive therapy in individuals with newly diagnosed type 2 diabetes; although this project is funded on the Czech side by AZV ČR, it will be implemented from February 1, 2026, in international cooperation with, for example, the Medical University of Graz, ECRIN, Medical University of Innsbruck, Latvian University Hospital, Lithuanian University of Health Sciences, and Medical University of Warsaw.

- f4) Concise description of the key forms of communication aimed at professionals and the general public, in particular the method of media presentation and dissemination of the results and outputs of the CarDia project in the supported R&D&I area. Provide three specific examples

The key instruments of communication aimed at professionals are the active participation of researchers at various conferences in the Czech Republic and worldwide, through which results and outputs are disseminated. Main forms: professional articles in peer-reviewed journals, monographs, contributions to conference proceedings.

We also have a website (<https://cardia.ikem.cz/en/home>) through which we inform professionals and the general public about the project's activities, results and outputs. You can also find the CarDia Newsletter there.

Social media are being used on regular basis, such as LinkedIn. All partner institutions tag their posts with #NationalInstitutCarDia and #NextGenerationEU.

We have also held some press conferences, such as [Press conference to the Registry DiaPanther](#) and [Press conference to the new ECG technology](#).

- f5) Ensuring the sustainability of the CarDia organizational and administrative management

The implementation document for the CarDia National Institute Strategy for the sustainability period is currently being prepared. It will clearly define areas of research cooperation, data sharing, efforts to establish joint follow-up projects (including ERC projects), sharing research capacities, providing administrative support for monitoring and reporting indicators specified by the grant provider, annual meetings (conferences) of participating researchers across the entire project, and more.

In terms of management, the organizational structure will be maintained at both the partner institution level and the international oversight level.

- f6) Ensuring the financial and economic sustainability of the CarDia, including a description of the mechanism for financing joint activities

We aimed to obtain a project within the HORIZON-WIDERA-2025-ACCESS-01 call, which, in terms of funding volume, would ensure the necessary continuity for the functioning and established research platform of the National Institute CarDia by aspiring to establish the first clinical and experimental center of excellence (CoE) for the prevention and personalized treatment of obesity and diabetes (diabetes), including related diseases (especially CVD) in the Czech Republic. However, with a score of 7.5 points (out

of the required 8), we did not advance to the second round of evaluation and were unsuccessful in competition with 340 other projects.

Any other, by definition, smaller projects such as GAČR, TAČR, ERA, etc., will always only provide funding for certain parts of a large and interconnected research area.

Research groups across all research packages (WP1-WP7) will now reduce their involvement

At this point, the continuation of partial research questions is ensured through international projects (Prof. Freiburger's group <https://cordis.europa.eu/project/id/101155885>, Dr. Maletínská's group <https://projects.au.dk/open-odin/t-gate>, Prof. Haluzík's group (2 ERA for Health projects), Doc. Čajka's group <https://cordis.europa.eu/project/id/101081028>). The rest will be covered by other grants or by the parent institutions of the researchers involved.

f7) Assessment of the ability to secure funding to maintain the scientific portfolio created within the project

The CarDia project has made it possible to fund experts across several partner institutions and research groups. The exact numbers vary between partners, but what is crucial for the functioning of the National Institute CarDia is that it has succeeded in building a stable and functional collaborative network across disciplines. Currently, coordination is underway between partners on how to maintain individual research capacities within follow-up projects, institutional support, or international grants.

We take concerns about the so-called brain drain seriously. That is why we are trying to offer continuity, especially to teams and experts who are key to the strategic areas of the project.