

# National Institute of Chemical Physics and Biophysics

## Development Plan 2026

### Introduction

National Institute of Chemical Physics and Biophysics (NICPB) acts in the benefit of knowledge-based Estonia. As the only research institution in public law in Estonia, NICPB diversifies the science landscape and enhances the international competitiveness of Estonian science. NICPB is characterised by comprehensive interdisciplinary research programmes and co-operation with leading research centres of the world. Knowledge created by excellent research as well as movement of new ideas and highly educated young people from academia to different fields of society and industry are key to knowledge-based economy both in Estonia and the world. Success of NICPB is founded on attractive working environment valuing academic freedom and offering development opportunities.

The current Development Plan (DP) addresses the problems and challenges facing NICPB in a 10-year perspective.

### Mission

NICPB is an independent research institution in public law where the main task of the scientists is research based on academic freedom.

NICPB is a positively evaluated research institution that carries out fundamental and applied research and engages in the development (R&DI) of novel directions in physical, technological and biomedical sciences<sup>1</sup>.

NICPB helps to educate new generation of scientists pursuant to the association and other agreements with the universities and other academic institutions. All level students are allowed to start their scientific career and to perform their research in the Laboratories of the Institute.

NICPB participates actively in shaping national science policies, in the organisation of the activities of Estonian scientists and R&D institutions and in solving the challenges facing the society.

### Common Values

The Common Values of NICPB are **Openness, Science-Based, Interdisciplinarity and Future-Orientation**.

NICPB is a research institution open to Estonian and international science community and to Estonian society. It is an institution where academic freedom and quest and development of new ideas are valued.

<sup>1</sup> Common European Research Classification Scheme (CERCS)

Commented [TV1]: Kas Science- või Knowledge-Based

NICPB promotes knowledge-based development and harnesses its competences not only to further scientific research but to solve problems facing the society in general.

Co-operation and interdisciplinarity within NICPB, in Estonia and in the world broadly is the only way to sustainable excellent research.

NICPB is oriented to future – new knowledge created by us will be put to use in the future and we are open to new developments and trends in our research.

## Current Situation and Challenges

The DP originates from the NICPB Act and reckons that NICPB is a strategic partner to Estonian universities in advancing the cutting edge science in all our fields of science, i.e. physics, materials science, astrophysics and cosmology, chemistry, biology, ecology, energetics and information technology.

An inseparable part of our research is co-operation with universities, who's graduate and undergraduate students carry out their research in our laboratories. Our researchers, on the other hand, lecture at the universities and supervise thesis works of the students. Also, two Centres of Excellence housed by NICPB, numerous joint grants and projects and common Estonian Science Roadmap objects are good examples of the co-operation.

A public state-owned high school will soon be built next to us. That opens new possibilities to acquaint high school students with cutting edge natural science and hopefully paves way to more conscious career choices. In a long run that will help to shape future knowledge-based generations and to popularise sciences.

NICPB participates through national, European and other research programmes, grants, agreements, etc. in domestic and international R&D. The Institute supports and participates actively in current R&D programmes and in shaping future R&D programmes of local, national and international priority. NICPB is highly visible research centre both domestically and internationally and is a valued and sought partner to the state in matters concerning R&D.

NICPB prioritises fields of science related to its strategic research programmes (SRP) and pays appropriate attention to possible applications. Co-operation with industry in the development of fuel cells for H<sub>2</sub>-energetics, acquainting the domestic industry with the possibilities of CERN, coordination of CERN-oriented activities in Estonia and in the Baltics serve as an example. Development of nanoparticle based anti-bacterial coatings for surfaces and textiles in co-operation with both industry and universities has been revived due to the COVID-19 pandemia.

The single greatest threat to sustainability of the Institute is the predominantly short-term, project-based funding (soft money) of science in Estonia. This impediment was brought up during the regular evaluation of Estonian science in 2017 but also and already by the reports of the International Science Advisory Board (ISAB) of NICPB of 2012 and 2016. An important priority of the Institute is improvement of the national system of financing of science. Toward that end NICPB communicates actively with other R&D institutions, relevant ministries and Riigikogu (Estonian Parliament).

In order to maintain the high quality and overall sustainability of the Institute it is essential to find both new people and new ideas. A Development Fund has been set up in the Institute to open and support new research fields. The Institute works systematically both domestically and abroad to present its attractive and dynamic environment as a place to further one's scientific career.

## Strategic Research Programmes (SRP)

The research in NICPB is based on fields science set forth in the [NICPB Act](#), covering key areas of Estonian and European priorities and is fundamentally based on national and international co-operation. The R&D in the Institute is implemented through Strategic Research Programmes that converge different areas of research and fields of science and are integrated with one another. As a rule, a SRP covers full chain of logical cognition, mathematical description and creation and use of technical toolkit to solve a scientific problem. In comparison with other domestic R&D institutions, our Programmes are more comprehensive, covering both fundamental and applied research and being interdisciplinary. In 2020 NICPB has four such Programmes:

- Environmental Toxicology and Nanosafety;
- Physical Chemistry and Chemical Biology;
- Physics, Materials Science and Energy Technologies;
- Experimental High Energy Physics and Theoretical Physics.

## Competences

The basic competences (in no particular order) of NICPB include:

- Nanoecotoxicology
- Environmental Chemistry
- Fundamental and Applied Bioenergetics
- Investigation of Physical Properties of Materials, including
  - High Resolution and Solid State multinuclear NMR
  - Terahertz-Spectroscopy
  - Non-linear Optics
  - Quantum Chemical Calculations
  - Magnetic, electric and thermodynamic properties of materials in a broad range of temperatures and magnetic field strengths
  - Synthesis & Characterisation of (Nano)Materials
- Energy technologies, including
  - Investigation of Fuel Cells and H<sub>2</sub>-energetics
  - Safety of Nuclear Power
- Experimental Particle Physics and CERN
- Theoretical Physics, Cosmology and Gravitation
- IT-applications and development of scientific computing

- Theory of Complex Systems

## Vision 2026

NICPB is highly visible both in domestic and international research and development.

NICPB is effective and efficient independent R&D institution where all its academic and non-academic members sense the opportunities and responsibilities in achieving Institute's goals. The administration is transparent and intelligible and provides attractive working environment.

The success and reputation of NICPB is based on excellence in research, on competences, on initiation of innovative fields of research and on development of science infrastructure for both national and international co-operation.

NICPB is a leading national laboratory at least in 2 to 3 fields of R&D. NICPB houses several internationally renowned research teams, co-operates actively on international level and is an attractive employer for both domestic and foreign researchers.

The graduate studies (though NICPB is not a degree-awarding institution) provide pertinent qualification for scientific research and ensure critical accrual of early-stage researchers (ESR) in the Institute. NICPB has established an international network to support ESR's in the circulation of ideas, science and scientists.

## Strategic Goals 2026

1. Internationally recognised research in all research topics. Status of a Regional and/or European centre with at least two Strategic Programmes.
2. National Centre of Expertise in at least two fields according to public order and in keeping with our competences in particle physics, nuclear energy, analytical spectroscopy, quantum chemical modelling, functional materials, hydrogen energetics and nano- and ecotoxicology.
3. Sustainable financing of the Institute to pursue its vision and goals has been secured through different national and international financing sources and instruments.
4. The sustainability of research teams and the accession of Early-Stage Researchers has been secured. The Institute is known for its attractive working environment and all employees are satisfied and highly motivated.
5. NICPB engages vigorously in pursuing the Goals of the "Knowledge-based Estonia" programme, it is highly visible in the society and is a highly rated R&D institution.

## Milestones and Activities

### Organisation and Management

The organisation structure and the management of the Institute are transparent, dynamic and efficient. Strategic decisions are made by the Institute's Science Board, the implementation of the strategy and everyday management is carried out by the administration. Both the Science

Board and Administration follow the advices of the Institute's International Science Advisory Board.

Activities to achieve efficiency:

- (1) the relation of in-house and purchased (ancillary) services is kept optimal;
- (2) the number of support staff is kept optimal to ensure the provision of the support services;
- (3) state-of-the-art IT solutions (document and personnel management, accounting, etc.) are widely used;
- (4) an attractive working environment and efficient support services have been created.

The research is carried out in scientific units of the Institute, the laboratories. A laboratory assembles research teams working on related topics and houses the necessary (research) infrastructure. Laboratory is chaired by the Head of the laboratory, who's main task is the development of the Lab in concert with the Institute's strategic plan.

## Research and Development

The main fields of the R&D are defined as the Strategic Research Programmes. Due to the competition-based financing of science in Estonia, they can be funded from personal research grants of the researchers. From Institute's point of view, it is instrumental to introduce and develop new fields. Therefore, promising young researchers are supported at the outset of their careers until they have obtained their own grants and gained sufficient momentum. Also, the principal investigators in Institute's main fields of research are guaranteed a permanent salary.

### *Milestone 1 International level research in all fields*

#### **Activities**

- (1) Research fields that are possible candidates for regional or European centre status will be defined. The named fields will be manned with researchers with great potential of success and researchers will be guided and supported to achieve their ambitions.
- (2) Regular inventory and renewal of the SRPs, opening of new research areas in co-operation with universities.
- (3) Recruitment and keeping of researchers with great potential of success.
- (4) Support of innovation, knowledge transfers and start-ups.
- (5) Initiation of new activities with the help of NICPB's Development Fund.

### *Milestone 2 National Centres of Expertise*

#### **Activities**

- (1) Mapping of the demand for Centres of Expertise together with state agencies and agreement on the permanent funding of the Centres.
- (2) Launching of the Centres (personnel, infrastructure, procedures, accreditations).

**Milestone 3 Sustainable Funding**

**Activities**

- (1) Permanent and positive co-operation with legislators and participation in the shaping of (national) science policy. Motivation of the researchers to develop their ideas and to participate in funding calls.
- (2) Introduction of tenure track model for all research professors of the Institute.

**People**

At the fall of 2019 71 (FTE 61.6) PhD researchers, 11 graduate students and 14 lab technicians worked at the Institute. The Administration was 11-strong (FTE 10.8) and 12 (FTE 9.2) workers (cleaners, keepers, etc.) provided ancillary services.



Fig 1. Employees and postgraduate students in NICPB).

According to the Web of Science, Essential Science Indicators database 9 researchers (S. Bhowmik, A. Carvalho, J. Ellis, A. Ivask, M. Kadastik, A. Kahru, K. Kasemets, M. Raidal, C. Veelken) of the Institute belong to the top 1% most cited scientists in their respective field in the world as of May 2020.

Two researchers (A. Kahru and M. Raidal) are the members of the Estonian Academy of Sciences and two (E. Heinsalu – Past President, M. Kadastik – President) are members of the

Estonian Young Academy. Three of our scientists (A. Kahru, I. Krusenberg and T. Rõõm) are members of the Evaluation Board of the Estonian Research Council.

#### *Milestone 4.1 Sustainability of the research teams and accretion of researchers*

##### **Activities**

- (1) NICPB is in an orderly manner involved in the teaching at a number of universities and in supervising students' work at the Institute's own laboratories.
- (2) NICPB participates in international learning mobility of students and young researchers.
- (3) A tenure track career model will be introduced, including:
  - 1) scholarships or employment contracts to master and graduate students;
  - 2) support of Postdoctoral studies abroad, as a rule;
  - 3) support of young PhD researchers during up to 3 years to obtain their own grants;
  - 4) younger researchers are rapidly brought into PI status and then into leadership roles within the Institute.
- (4) Coordinated and systematic approach to introduce the possibilities and advantages of NICPB to students.
- (5) Annual awarding of Scholarships to students for working at the Institute.
- (6) Securing accrual of researchers in critical or strategic fields (in order to match and exceed expected retirements) is an important task of the Heads of the Laboratories.

#### *Milestone 4.2 Contentment and High Motivation of researchers*

- (1) High motivation and contentment are ensured through support of the development of employers and through creating excellent working environment.
- (2) Different training courses are held regularly to support personality development. All-Institute and Lab-based seminars oriented especially to master and graduate students and ESRs are held regularly.
- (3) A fund will be set up to finance training necessary to promote researcher's career and a mechanism is created to target individual training needs.

#### *Milestone 5 Knowledge-based society, visibility and high rating*

- (1) Active participation in the fulfilment of the Estonian R&D&I strategy "Knowledge-based Estonia" according to Institute's competences.
- (2) Participation in solving the challenges facing the society, especially in energetics, biomedicine and environmental toxicology.
- (3) Active standing in problems facing the society, participation in social debates and representative bodies of scientists.