

Strategic Plan (2021-2024)

QUANTITATIVE BIOLOGY

Preamble





















A paradigm shift is occurring in biomedical sciences, whereby living systems are becoming amenable to quantitative description, with profound consequences for our ability to predict biological phenomena and for manipulating the regulatory networks that sustain them and that become altered in disease. Embracing this new paradigm is a challenge but also offers important opportunities. The CRG has the flexibility to incorporate new technologies and concepts through its faculty turnover, and has a distinct expertise in computational and systems biology, combining experimental and *in silico* approaches, as well as groups working on human diseases with strong collaborations with clinicians. The centre also offers unique opportunities to establish strategic alliances and partnerships locally and worldwide.

Our new Strategic Plan emerges from the perceived need to leverage our strengths to capture the opportunity to take a leading position in the implementation of quantitative approaches to fundamental problems in genomics, gene regulation, cellular and tissue organization and their pathological alterations leading to disease.

Vision

Our vision for the next years is that the CRG becomes a major contributor to the historical paradigm shift of converting biomedical research from a descriptive discipline into a quantitative, predictive, actionable science. While continuing nurturing a stimulating environment and cutting-edge technologies to conduct innovative fundamental research, we will develop/implement novel quantitative and computational approaches to address challenging questions in biology, therefore becoming an international reference in genomics and its applications to biomedicine and biotechnology.

The CRG Strategic Plan at glimpse (2021-2024)

QUANTITATIVE BIOLOGY	STRATEGIC AREAS	IMPACT												
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<p>QUANTITATIVE MODELLING AND PREDICTIVE BIOLOGY</p> <p>A new joint collaborative Centre with the EMBL-Barcelona focused on mathematical modelling and artificial intelligence (AI).</p> <p>Transforming technologies in genomics, with emphasis in high-throughput and computational approaches, including AI</p> <p>Quantitative cell biology with emphasis on quantitative imaging and quantitative image analysis</p> <p>NEW TRANSVERSAL MEDICAL GENOMICS PROGRAMME</p> <p>With a focus on:</p> <ul style="list-style-type: none"> • Methodological developments • Quantitative translational research <p>Strengthening collaborations with:</p> <ul style="list-style-type: none"> • Local and European hospitals, • Private sector: biotech and pharma industry 														

A. STRATEGIC SCIENTIFIC AND TECHNOLOGY PRIORITIES

The new Strategic Plan focuses on two grand **scientific and technological priorities** under the conceptual framework of “Quantitative Biology”.

i) To develop **quantitative modelling and predictive biology** to permeate quantitative approaches throughout the research of the whole institute, as well as in Barcelona. We will promote 3 main initiatives:

1. Creation of a new joint Centre with EMBL-Barcelona focused on **modelling and predictive biology**, with a truly and original collaborative spirit and organization – a “*collaboratorium*”.

Key actions

- Launch of the new Fellows Programme for outstanding junior researchers to support their early independence.
 - Implementation of a Scientific Visitor Programme with visiting fellows and sabbatical visitors.
 - Develop a training programme for PhD and Postdocs.
 - Organize regular workshops featuring international leaders in predictive biology.
2. Development and application of **transforming technologies in genomics**, with emphasis in high-throughput and computational approaches (including AI) applied to biomedicine. We contemplate biodiversity genomics as a way to develop large-scale comparative genomics analysis and tools to define functionality, which will be used in the new Medical Genomics Programme.

Key actions

- Hiring of one research group using/developing computational approaches to solve a biomedical problem. Will be part of the medical genomics transversal program (see below).
 - Develop/use quantitative genomics and computational methods by diverse CRG groups.
 - Participation in the international genomics projects in diverse fields, such as the Human Cell Atlas, Atlas of Variant Effects Alliance, Earth Biogenome Project, among others.
3. The development of **quantitative cell biology**, with emphasis on quantitative imaging and quantitative image analysis.

Key actions

- Build a strong collaborating community across the labs and institutes participating in CATCAT, and expand the network towards international collaborations.
- Organize training, scientific meetings and lectures on quantitative cell biology.
- Increase the attractiveness of cell and tissue biology groups in Barcelona by joint actions towards attracting new talent (e.g. posters advertising the PhD programmes, courses for Master and undergraduates, etc.).

ii) Building on the above initiatives, to create a **new transversal Medical Genomics Programme** with a focus on quantitative translational research, strengthening collaborations with local and European hospitals, biotech and pharma industry.

Key actions

- Create the transversal research Programme. Each group will pair with a clinical group at a local Hospital working in the same disease area to maximize the translational potential.
- Hiring three new PIs, two funded by the Severo Ochoa Award (one working in **transforming technologies in genomics**, see above) and one co-funded by a private company.
- Develop new CRG-clinical collaborations with the support of internal yearly seed grants.

- Embed clinically-trained medical doctors in CRG groups by dedicated fellowships, thanks to the launch of the recently awarded international PhD Programme for medical doctors with other EU-LIFE institutes (“EMERALD”).
- Develop new collaborations with the private sector, including co-funded discovery projects and a new group co-funded by CRG and the industrial partner.
- Develop a new programme for scientific exchange: yearly seminars and conferences to cover disease and translational research areas of common interest.
- Deployment of the ELIXIR EGA Beacon Network over the world to discover genomic information related to health.

B. STRATEGIC AREAS

To sustain and complement the scientific and technological priorities, we will develop novel initiatives in six strategic areas.

1. Technology infrastructure and development

The CRG Core Facilities (CFs) are key for the implementation of the new research lines. We will reinforce specific units and develop new technologies and services.

Key actions

- GENOMICS AND BIOINFORMATICS. Development/application of new genomic technologies and analysis in areas such as spatial transcriptomics, multi-omics, and clinical single cell sequencing.
- PROTEOMICS. Development of clinical proteomics in collaboration with hospitals and clinical experts.
- TISSUE ENGINEERING. Development of genetically engineered organoids to model liver, pancreas, brain and lung disease, eye cups and other organs.
- LIGHT MICROSCOPY. Development of quantitative imaging and quantitative image analysis, through internal synergies and other collaborations.
- CHEMICAL AND GENETIC SCREENS. Development of an integrated platform, combining high-content screening with single cell genomics and imaging read-outs.
- Development of new innovation-driven projects across all CFs, in collaboration with industry, with a specific focus on industry in Spain. We will elaborate marketing material to raise awareness of CRG CFs and their state-of-the-art services among Spanish companies.

2. Innovation

The CRG will develop new initiatives to ensure that CRG results, new knowledge and technologies can contribute to the economic growth of our society.

Key actions

- Develop partnerships with pharmaceutical companies to support joint projects and groups in the new Medical Genomics Programme, working in research areas of common interest.
- Create a minimum of 2 new spin-offs based on the CRG portfolio of mature projects.
- Develop a mentoring programme with entrepreneurs and business leaders to provide mentorship to CRG scientists engaged in innovation projects.
- Strengthen technology transfer skills in the curriculum of CRG junior researchers by introducing new inspiring lectures by entrepreneurs and new courses.
- Organize 2 workshops on entrepreneurship to discuss with multiple actors the issues around company creation in Spain, and the opportunities to stimulate knowledge-based innovation.
- Networking with other technology transfer offices - TTOs (e.g. SOMMa and EU-LIFE centres) and first meeting with TTOs of the Spanish ecosystem.

3. Training the new science leaders

One of the key goals of the CRG is to attract and nurture talent, through a rich portfolio of academic and training programmes, and career development activities.

Key actions

- Develop the portfolio of scientific and technological courses (internal and international), on quantitative biology, including online and engaging formats to broaden the audience.
- Reserve in all our open courses at least 2 positions for researchers from Spanish Institutes and Universities currently not harbouring SOMMa Awards.
- Develop scientific and technological courses to address the needs of industries in Spain.
- Develop new courses on innovation as well as on responsible and open research, including training on research data management, sex and gender dimension in research, ethics and research integrity.
- Implement a Master Research Internship Programme to prepare talented students for competitive doctoral programmes.
- Implement the newly awarded H2020 COFUND programme, EMERALD, to incorporate medical doctors as PhD researchers and facilitate clinical collaborations (e.g. new Medical Genomics Programme).
- Run the new joint PhD programme with the Guangzhou Regenerative Medicine and Health Guangdong Laboratory (GDL) in China.
- Incorporate new Postdocs to work on the new CRG strategic research areas, through competitive international calls.
- Pilot a new Fellows Programme in the framework of the CRG-EMBL joint Centre on modelling to support early independence of talented junior researchers.
- Renew mentoring offer to CRG Postdocs and other professional categories.
- Offer hands-on internships in some CRG departments (international collaboration, grants and science communication) to empower researchers with additional career skills.
- Support CRG PIs leaving after their 5+4 years contracts, and who want to stay in Spain in a Research Institute or University that does not provide core funding.

4. Collaboration

The new Strategic Plan will require new synergies and collaboration with researchers and other stakeholders locally and internationally. Moreover, we want to focus on boosting the attractiveness of Barcelona and Spain for research and innovation.

Key actions

- Launch the joint CRG-EMBL Centre on modelling and predictive biology to make it a vibrant European hub for modelling of biological processes, facilitating new collaborations through the Fellows and Visiting Scientist Programmes and workshops.
- Strengthen the recently born alliance on “Cell And Tissue research in CATalonia”, CATCAT, by organizing joint seminars, lectures and courses and engaging junior researchers to take an active role across the multiple activities.
- Launch the Severo Ochoa IMPULSE Visitor Programme for scientists working in Spain to foster new collaborations and promote research excellence in the country.
- Strengthen the collaboration with Bioland Laboratory, a research centre of the Guangdong province in China, to implement a long-term joint PhD programme to allow PhD students carrying out collaborative research between the CRG and Chinese research laboratories.
- Participate in international collaborative projects (e.g. Atlas of Variant Effects Alliance, ENCODE, Human Cell Atlas, 1+ Million Genomes Initiative, etc.) and lead new ones focusing on the novel strategic research and technology areas.

5. Open and responsible research

Openness and responsibility are core values of CRG research and embrace a broad portfolio of actions to promote equality, diversity and inclusion (EDI), open access to publications and results, science communication, education and outreach to multiple stakeholders.

Key actions

- Implement a new EDI plan, including actions to prevent harassment and bullying, monitoring gender in publications, a new Women Leadership Programme to empower women scientists in advancing their career and developing training on diversity.
- Increase the participation of women in the CRG governance.
- Organize new seminars and courses on bioethics adapted to CRG research and context.
- Boost Open Access of publications to 90% by 2024.
- Implement a new policy, guidelines and training for FAIR Research Data Management.
- Consolidate the CRG's brand as a biomedical research institute of international prestige, through a new digital communication strategy, renewing the CRG website and creating new engaging contents and storytelling.
- Launch of the Genigma app to engage citizens in cancer research and new actions to ground citizen science approaches in more CRG research projects.
- Organize new public dialogues where citizens can debate ethical and societal aspects of new strategic research areas (e.g. AI, Medical Genomics, etc.) directly with CRG researchers.

6. Sustainability

In collaboration with Barcelona Institute of Technology (BIST) and other institutes in the campus, we aim to reduce the CRG's environmental impact.

Key actions

- Launch awareness campaigns and seminars to raise sensibility about environmental issues.
- Measure CRG carbon footprint at diverse levels: direct emissions owned and controlled by CRG (e.g. travelling), emissions related to energy use (e.g. electricity) and processes not owned by CRG but are consequence of CRG activity (e.g. purchases of raw materials).
- Develop a Sustainability Handbook with good practice and clear guidelines (e.g. measures for the responsible use of equipment and for minimizing waste and energy consumption), and provide Sustainability training for all researchers, staff and newcomers.
- Implement new measures for the responsible use of equipment and for minimizing waste and energy consumption.
- Incorporate a financial sustainability plan in the risk management plans of the Institute (see below). We will monitor the risks of not obtaining sufficient funding to deliver the strategy and elaborate the corresponding contingency plans. Such plans shall explore diverse funding opportunities from the public and private sector.

C. GOVERNANCE AND MANAGEMENT

Transversally to the scientific and strategic objectives, we have designed a new governance structure with two Boards: a **Direction Board**, to align strategic planning and execution, and a **Scientific Board** to implement the centre's scientific and technology priorities. We will also adapt the structure and mission of the external **Scientific Advisory Board (SAB)** to benefit from annual in-depth analyses of our scientific strategies and assessment procedures. To deliver the ambitious Strategic Plan, we will further expand on past management actions to ensure smooth operations and effective implementation of the strategic objectives across the organisation.

Key actions

- Implement the new CRG governance through the creation of two Boards, while increasing gender balance and diversity, including women senior scientists in both.

- Re-organize the SAB, implement annual advisory meetings and establish follow-up mechanisms for SAB feedback and reviews.
- Further, engage with SOMMa and other stakeholders to ensure an adequate regulatory framework for science at the national and regional level.
- Improve efficiency in operations (i.e. digitalisation, teleworking, lean management principles and Key Performance Indicators).
- Design competitive operations metrics for benchmarking in future external evaluations of the Administration and incorporate recommendations from the past evaluation (2019). Recommendations range from specific improvements in each department to general feedback across departments (e.g. enhanced collaboration among the teams, streamlined processes and tools, improved recognition and appreciation of the Administration staff).
- Promote good practise sharing and community building (EU-LIFE, SOMMa, BIST, CERCA), and in particular, launch a pilot Admin Staff Exchange Programme that enables CRG staff with less opportunities for good practise exchange to visit other institutes for a few weeks.
- Develop a robust risk management map to provide effective response to global threats and risks that can seriously compromise research and operations (strategic, financial, physical risks and compliance).

D. EXPECTED SCIENTIFIC, ECONOMIC AND SOCIAL IMPACT

As expected from an institute that has already received the Severo Ochoa Award, we will devote significant efforts to collaborate with the productive and social environment and with other research and innovation centers, to increase the social and economic impact of science in Spain. As highlighted above, we contemplate **several actions**.

- The creation of the IMPULSE Visitors Programme for Spanish scientists from institutes without the Severo Ochoa Award to do research at the CRG, accessing our facilities and services.
- Promote new collaborations with Spanish biotech and pharma companies, scouting for joint projects, developing ad hoc training courses on CRG different technologies or expertise targeting their needs, and facilitating access to CRG services.
- Collaborate with clinicians and local Hospitals on biomedical research projects leading to new possible therapies to diseases.
- Launch public dialogue initiatives to discuss the societal/ethical aspects of science with citizens, and show them the importance of science for our society.

Impact on Science

- Conceptualization of biological problems in quantitative terms, increased ability to predict and engineer living organisms
- New quantitative methods and technologies to tackle biological and medical problems
- New interdisciplinary collaborations with Spanish and international centres and Universities

Impact on Economy

- New collaborations with the private sectors leading to joint projects, grants and research groups to drive innovation and technology development
- New collaborations among CRG groups and CFs with Spanish industry
- New spin-offs and jobs
- Higher entrepreneurship spirit among researchers to create new companies

Impact on Society

- New knowledge and tools to drive forward personalized medicine
- Contribution to the Sustainable Development Goals (e.g. good health and wellbeing, gender equality, industry, innovation and infrastructure)
- Promoting fundamental values such as equality, diversity and inclusion
- Contribute to a science-educated society.

Overall, the new ambitious CRG Strategic Plan aims for multiple impacts on science, economy and society, with a strong focus on the Spanish ecosystem, while continuing the international ambition and projection of the CRG.