ELIXIR
Scientific Programme
2024-28
During its first ten years, ELIXIR has grown into a mature organisation and a vibrant community. ELIXIR works with life scientists in all fields, from molecular structure and genomics to biodiversity and agricultural research. Over the ten years the core mission of ELIXIR has remained unchanged: to connect data and people across national borders and scientific disciplines by coordinating infrastructure and bringing together groups of experts. ELIXIR is rooted in bioinformatics, the science of transforming large-scale datasets into insights in the molecular and cellular sciences. Curiosity-driven and investigator-led projects provide the foundation of data-driven research into the societal challenges of food security, health and the environment. Life-science data forms the bedrock of a strong bioeconomy.

Ten years ago, in the first Scientific Programme, we described how ELIXIR would help researchers to access and analyse life science data. Our 2024-28 Programme sets out the ambitions for ELIXIR’s second decade. I hope you are as excited as I am.

Niklas Blomberg, ELIXIR Director
Cambridge, UK, 2023
ELIXIR is a distributed infrastructure organised around national data infrastructures called Nodes. Nodes are composed of national centres of excellence in bioinformatics, including both universities and research institutes. Each Node brings together services, standards and resources, and has a lead institute acting as coordinator.

Collectively, Nodes bring together experts in all fields of life science data. ELIXIR’s strength is this collaborative network of experts, working together to enable life science researchers throughout the world to access and analyse life science data.

About ELIXIR

Purpose
TOGETHER WE ACCELERATE THE UNDERSTANDING OF LIFE

Identity
WE ENABLE SCIENTISTS TO ACCESS AND ANALYSE LIFE SCIENCE DATA

Values
WE WORK TO BENEFIT EVERYONE
WE ARE TRUSTED
WE WORK WITH A SPIRIT OF OPENNESS
WE STRIVE FOR EXCELLENCE
WE WORK IN AN ENVIRONMENT OF RESPECT

Working together with shared purpose, identity and values:

Distributed infrastructures are people infrastructures.

People are the backbone of ELIXIR. Our experts form a vibrant European community of over 850 individuals with diverse skills and experience.

ELIXIR comprises many expert groups organised by scientific discipline, technical focus and special interest. There are working groups for technical services and external project tasks, and groups dedicated to training and knowledge exchange. These groups connect Nodes through people, and build the skills, capacity and depth of experience to guide all ELIXIR operations.
Connecting tools, data, experts and countries

ELIXIR’s ambition is for Europe to have a robust, connected network of established services, internationally recognised data resources and enabling technologies that meet the data needs of life science researchers. Open and reproducible science is critical to maximising the value of public-funded research and must be supported by accessible infrastructure.

To analyse data, researchers need access to diverse, high-quality, interconnected and meaningful data sets. To deliver on this promise, data, workflows, models, analysis and computational resources all need to be interoperable and available across borders.

Europe’s leading researchers rely on ELIXIR’s guidance and services to manage, analyse and publish both human and fish data from ground-breaking cellular and molecular research.

Large research datasets connecting biodiversity, agriculture and human health are assembled, integrated and analysed in the context of environmental and socioeconomic factors.

ELIXIR works with national and international partners to develop a diverse people network, allowing participation across sectors and countries. ELIXIR Nodes are resourced to efficiently manage and run the national coordination centres making up the distributed infrastructure. Each ELIXIR Node has the capacity and skilled people to fully participate in the pan-European network.

We will know when we have achieved our ambition when:

- Europe’s leading researchers rely on ELIXIR’s guidance and services to manage, analyse and publish both human and fish data from ground-breaking cellular and molecular research.
- Large research datasets connecting biodiversity, agriculture and human health are assembled, integrated and analysed in the context of environmental and socioeconomic factors.
- Millions of human genomes are discoverable and exploitable in biobanks.
- ELIXIR supported infrastructures and community-endorsed standards, software, workflows and analysis environments.
- ELIXIR Nodes are resourced to efficiently manage and run the national coordination centres making up the distributed infrastructure. Each ELIXIR Node has the capacity and skilled people to fully participate in the pan-European network.

ELIXIR is based on sustainability, standards-compliant and a service-focused, exemplified by the ELIXIR Core Data Resources, Deposition Databases and the recommended Interoperability Framework which have become a model for the Global BioData Coalition and adopted by funders worldwide. ELIXIR will continue to build a European network of biological data resources using common technical standards and best practices.

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ELIXIR’s purpose is to accelerate the understanding of life by facilitating data-intensive research. Scientists should be able to collaborate easily across borders to build large, multidisciplinary datasets for advanced analysis and modelling. The 2024-28 Programme will:

- **Science:** Enable scientists to access and analyze life science data.
- **Technology:** Deliver services to support federated data management and analytics in life science.
- **Nodes:** Equip national Nodes for successful long-term operations.
- **People:** Develop people and capacity to benefit science and society.

ELIXIR serves the life science community by supporting FAIR access to scientific data. As Europe’s distributed research infrastructure for life sciences, our purpose is to bring together data services to advance research by enabling scientists to access and analyse data of scale and complexity. Close partnerships with the science researchers driving the development and adoption of community-agreed standards and best practices in research data and software management.

ELIXIR develops trusted and freely available resources for research data management, data deposition, workflows, analytics, interoperability and computation. Effective collaboration in all these areas requires community agreement and a joined-up technical approach. In the 2024-28 Programme we expand on these resources by supporting a federated structure to build Node strengths and meet the requirements of our users.

Together, ELIXIR Nodes operate the services that allow data to be discovered, accessed, and analysed. The Nodes provide data management expertise and services, and support scientists with the backlogging of data into international deposition databases. ELIXIR Nodes are funded by national funders, often through national research infrastructure roadmaps. A distributed infrastructure builds on national operations, so we will therefore invest in our Nodes and the services they run.

The foundation for ELIXIR’s operations is people. To successfully build a federated ecosystem that supports scientists across the whole of Europe, each of our Nodes needs highly qualified personnel to operate national elements in the federation, for research data management and other advanced user support. This requires specialised skills and knowledge, so we therefore run a comprehensive training and capacity building programme which will be further expanded in the next Programme.

**ELIXIR priorities 2024–28**

*ELIXIR’s 2024-28 Scientific Programme is constructed from four interconnected tiers, each mapping directly to a strategic goal of the 2024–28 Programme.*
ELIXIR serves the life science community by promoting FAIR access to scientific data and the provision of high-quality digital services.

1. Enhancing biodiversity knowledge with molecular sequence data

2. Biodiversity, food security, and pathogens

3. Human data & translational research

4. Reproducible analytics and infrastructure

5. Federated service delivery

6. Node operations

7. Alignment of national research priorities & open science policies

8. Industrial & innovation

9. Impact and long-term sustainability

10. Security & pathogens

11. A diverse people network

12. Research data management

13. Cellular & molecular research

14. Scientific data

15. EMBL-EBI

16. EMBL-EBI website

17. EMBL-EBI services

18. EMBL-EBI resources

19. EMBL-EBI data

20. EMBL-EBI publications
Technology

ELIXIR will develop its infrastructure as a distributed, pan-European network of services that are stable, avoid duplication, and form a coherent federation.

We will do this by building on our strengths and by continuing to evolve to meet the needs of our users. We have defined three strategic areas:

- Research data management and knowledge sharing
- Reproducible analytics and infrastructure
- Federated service delivery

By anchoring the technology tier of our Programme in data-management and reproducible analytics, we create a connected infrastructure to support the FAIR management of all digital objects, including data, software and workflows. By further developing federated service delivery, we enable the complementary skills and expertise of our Nodes to be brought together into a single infrastructure. Furthermore, federations, especially of sensitive data, allows all European life scientists to benefit from the ELIXIR infrastructure, regardless of national borders.

Case Study

Actionable research data management

Connecting data is the key to progress in the life sciences. However, connecting datasets across experimental techniques, Omicscales and geographies needs careful data curation, metadata annotation and cataloguing. ELIXIR has developed a range of tools which put the ability to create and share high-quality FAIR data in the hands of individual researchers. The RDKit and the FAIR Cookbook form the nucleus of a growing framework of tools for knowledge sharing and research data management tailored to individual research communities. Together with the Data Stew- ardship Wizard, a tool for data management planning, and FAIRsharing.org, the registry for datasets and standards, ELIXIR has created a complete research data management ecosystem for life sciences data stewards and researchers.

https://elixir-europe.org/what-we-offer/usecase

Research data management & knowledge sharing

ELIXIR provides researchers with infrastructure to enable the creation, analysis, management and re-use of biological data.

In the 2014-2018 Programme we will promote closer connections between the Core Data Resources and the communities of life science and consumers of their data, we will put the tools and expertise developed by the large-scale data projects in the hands of research groups at all scales; and we will develop our research data management ecosystem to cover data, tools and other open digital objects.

Best practices will be shared by ELIXIR's expert networks to enable the creation and reuse of FAIR and open data across Nodes and user communities.

Data analysis in the life sciences is characterised by complex, multi-step workflows using a range of different representations, data management technologies, software architectures and compute environments. ELIXIR's users need support in undertaking, finding, using and contributing to this underlying recognised and reproducible ways.

In the 2014-2018 Programme we will develop a full software lifecycle foundation, from the development of software management plans to the registration and archiving of software and algorithms. We will extend and standardise the technologies and registries for the description and deployment of complex multi-platform workflows, and we will give users access to the resources they need from the growing portfolio of cloud and high performance computing services available to research.

Provide data and knowledge management infrastructure to support open, data-driven research in the life sciences

Develop our infrastructure to enable end-to-end management of life science software, workflows and containers

Develop a federated pan-European technical infrastructure for life scientists to access data, storage and compute services

1. Federation
2. Research data management & knowledge sharing
3. Reproducible analytics & infrastructure
4. Federated service delivery

Our ambition is for Europe to have a robust, connected network of established services, internationally recognised resources, and federation-enabling technologies for data-centric life science research.

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ELIXIR is a distributed research infrastructure bringing together 24 Nodes, which in turn connect over 240 leading institutes and universities in bioinformatics service provision. ELIXIR Nodes must be well-coordinated, professionally run organisations that meet the needs of national stakeholders by providing high quality support, expertise and services (described in Tier 4) that are aligned with national research priorities. To be successful over the long-term, these national operations require skilled personnel (described in Tier 4) as well as dedicated funding for service provision and coordination.

ELIXIR Germany

Germany became a member of ELIXIR in August 2016 and has grown to encompass 23 contractual partners (universities and research institutions) as well as EMBL Heidelberg.

In 2020, ELIXIR Germany offered 104 services to the life science community, organised the first Biotackathon Germany, the third Industry Forum meeting and played a significant leadership role in ELIXIR Platforms and Communities.

In addition, the user base was expanded over 2020 and more than 700 projects were supported. 

https://www.elixir.de/deg

Nodes have the operational capabilities to contribute to a European infrastructure for data

Nodes are aligned with national research priorities and open science policies

Nodes are fundamental to national industry ecosystems and engage in EU-wide industry efforts

Nodes are empowered and supported in their efforts towards long-term sustainability

Case Study

The organisational capabilities of Nodes need to grow to meet the demands of increasing resource usage and the requirements arising from close collaboration with many national, European and international collaborators. Developments such as the creation of common European data spaces will rely on national implementation, with ELIXIR Nodes increasingly acting as crucial components of bigger partnerships. We will support Nodes in their maturation to meet the demands of increasingly complex collaboration with a wide range of stakeholders.

ELIXIR Germany operates in the context of national open science and research data policies, and they not only manage digital assets produced by research infrastructures but also with other national, European and global projects. However, many national funders do not yet have open science policies or guidelines, and when they do, they don’t always reference ELIXIR resources.

We will support Nodes to work together with national funders and develop activities that highlight the benefits of ELIXIR-funded open science outputs. We will also work to ensure national funders recognise ELIXIR Nodes as key components of the data infrastructure when funding major research initiatives.

ELIXIR’s impact portfolio will continue to mature with a focus on systematic implementation across activities and projects, a leveling-up of its collaborative relationships, as well as an expansion of efforts to externally communicate ELIXIR’s scientific, socio-economic and societal impacts. We will provide opportunities for Nodes to exchange good practice in securing national funding and explore opportunities to exploit alternative funding sources. Activities to build Node long-term sustainability will be strengthened by the clear demonstration of the impact of ELIXIR’s activities at all levels.

ELIXIR’s services and resources are crucial for boosting open innovation in the European life sciences ecosystem. In the 2022-23 Programme, ELIXIR services will continue to be supported to expand their national industry engagement offerings. A new initiative, Node industry engagement days, will be implemented to help Nodes build strong links within their national industry networks. ELIXIR will continue working closely with industry partners in multi-stakeholder projects, and members will be supported to build collaborative partnerships with the industry via the Knowledge Exchange Scheme.

ELIXIR’s impact will continue to grow with a focus on systematic implementation across activities and projects, a leveling-up of its collaborative relationships, as well as an expansion of efforts to externally communicate ELIXIR’s scientific, socio-economic and societal impacts. We will provide opportunities for Nodes to exchange good practice in securing national funding and explore opportunities to exploit alternative funding sources. Activities to build Node long-term sustainability will be strengthened by the clear demonstration of the impact of ELIXIR’s activities at all levels.
All of ELIXIR’s activities depend on people. ELIXIR’s 2024–28 Programme highlights the importance of life-long learning, allowing individuals to stay abreast of technical developments, strive for excellence and see training as an integral part of working life. It is with specific and highly specialised expertise and skills who design, implement and maintain the ELIXIR infrastructure, Developing employees is critical for ELIXIR Nodes, along with retaining staff and knowledge.

To maintain and develop ELIXIR’s sustainability and strength, the 2024–28 Programme will also look outside ELIXIR to provide our service users with the skills and resources they need to gain maximum value from our European-wide data infrastructure.

ELIXIR’s resource portfolio.

ELIXIR has a strong and successful training community spanning all Nodes. The creation and delivery of targeted training, along with the development and maintenance of ELIXIR’s Training Portal (TeSS), supports Europe’s life scientists and bioinformatics experts to use ELIXIR’s tools and services. ELIXIR will continue to strengthen national training programmes, expand bioinformatics training capacity and competence across Europe, and empower researchers to use ELIXIR’s resource portfolio.

ELIXIR will build capacity and support Node personnel to run efficiently organised Nodes as part of a distributed research infrastructure. The size and complexity of projects such as the European Genome-phenome Data Initiative (EGiD), initiated in 2022, and involving 20 member states, requires Node operational expertise in areas such as business and organisational management, legal, ethical and social aspects. The 2024–28 Programme will increase the capacity of people to fulfil their roles, assume more responsibilities and advance to leadership positions, as well as to support others.

Technical experts need to be supported in learning new technologies to meet the growing need for expertise in specific areas such as Life Science Login, TeSS and GDI, and more generally in open-science, cloud resources, federated operations and research data management. ELIXIR’s 2024–28 Programme highlights the importance of life-long learning, allowing individuals and the research infrastructure as a whole to stay abreast of technical developments, strive for excellence, and embrace ongoing personal development.

ELIXIR is a large, distributed, interdisciplinary and virtual organisation based on a culture of openness, inclusivity and trust. We will work to further strengthen our culture and make it easier for newcomers to understand how we work. ELIXIR will increase efforts in equity, diversity and inclusion (EDI), particularly promoting the participation of under-represented groups. We will advocate for improved diversity in experimental design and awareness of gender in data analysis settings. ELIXIR will also encourage fair recognition and credit and promote the value of a wide range of contributions within the scientific community.

ELIXIR is a diverse network of people who are appropriately credited for their work.
The world of bioinformatics is highly interconnected, with multiple dependencies between different services and organisations, within countries, across Europe and globally. ELIXIR connects over 240 universities and research institutes, and we collaborate with many other organisations and initiatives to help scientists access and analyse life science data. These include global standard-setting organisations, national bioinformatics initiatives in countries outside ELIXIR, research infrastructures with data-related needs, and industry and technology-focused initiatives.

Working in partnership with these organisations helps ELIXIR better understand user requirements, minimises duplication of effort and improves service interoperability across the globe.

Securely accessing personal genomic data at the scale of populations, and across national borders, is an enormous challenge that will require significant investments in national and international infrastructure. The scope and complexity of this infrastructure are beyond the capacity and jurisdiction of any single organisation. International collaboration is needed to provide recognised, secure, standardised, documented and interoperable services.

The European High Performance Computing Joint Undertaking (EuroHPC JU) is an initiative for advanced high performance computing. Several ELIXIR Nodes are tightly connected to the consortia that are deploying pre-exascale computing capacity for research use. These new computing capacities will be deployed in Finland, Italy and Spain, with the ELIXIR Nodes in each country coordinating the national efforts. As a research infrastructure, ELIXIR plays a key role in bringing researcher requirements to the EuroHPC consortium.

The ambition of the European Open Science Cloud (EOSC) is to develop a ‘web of FAIR data and services’ for science in Europe. ELIXIR has long identified EOSC as a significant strategic partner, participating in EOSC projects on many aspects of the underlying technologies and applications enabled by this shared vision.

ELIXIR has forged close collaborations with other research infrastructures on the European Strategy Forum on Research Infrastructures (ESFRI) roadmap. This includes BBMRI-ERIC, Euro-BioImaging and EMPHASIS, which has led to joint meetings, workshops and formal collaboration strategies. Several ESFRIs provide access to technologies that generate data for which ELIXIR has solutions, and many also provide complimentary services that, along with ELIXIR’s activities, help to improve the life science data ecosystem for users.

In the 2024-2028 Programme, ELIXIR will seek to formalise collaboration strategies with a small number of critical ESFRIs where there is deemed to be strategic benefit. These include ESFRIs covering health, image technologies, biodiversity and industrial biotechnology.

The ELIXIR::GA4GH Strategic Partnership, was founded on a collaboration agreement from 2017, and formalised as a partnership in 2019. Building on these foundations, we hope to develop an even stronger collaboration in the 2024-28 Programme. We will coordinate the creation and implementation of the GA4GH suite of interoperable standards and policy frameworks to tackle technical and regulatory hurdles to genomic data access in Europe and globally.

For a number of years, ELIXIR has built strong links with the Office of Data Science Strategy at the National Institutes of Health (USA). This relationship will continue through joint events at international conferences, representation at meetings and technical workshops, and the facilitation and sponsorship of study visits or secondments. In the new Programme, ELIXIR will foster other collaborations with national-level bioinformatics communities beyond Europe where there is mutual benefit and alignment in goals.

The ongoing collaboration between ELIXIR and the Australian BioCommons has led to considerable mutual benefits in a range of technical areas such as tools, compute and training. The collaboration strategy was formally renewed in 2023 and will expand in scope to further capitalise on the synergies of our two organisations.
Table 1: Projected ELIXIR Financial Plan 2024-2028

<table>
<thead>
<tr>
<th>Financial Plan 2024-28</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
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<td>Income</td>
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<td>Member State Contributions</td>
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<td>Ordinary Contributions</td>
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<td>Secretariat</td>
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<td>Running Costs</td>
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<td>Capital and Equipment</td>
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<td>Total Secretariat Costs</td>
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<td>Activities with Nodes</td>
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<td>ELIXIR funded meetings (Platforms, Communities)</td>
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<td>Signature events (All Hands Meeting, BioHackathon)</td>
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<td>Governance events</td>
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<td>Total Activities with Nodes</td>
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<td>Total Internal Expenditure before Support and Admin Infrastructure Costs</td>
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<td>Support and Admin Infrastructure Costs</td>
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<td>Grants Expenditure</td>
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Table 2: Member State contributions 2024-2028

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<tr>
<th>MEMBER STATE</th>
<th>2024 CONTRIBUTION</th>
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<td>€1,339,259</td>
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</table>
| **Note:** NNI is based on the most recent three-year period for which complete NNI data is available (period 2019-2021). The 2023 contribution in the 2023-24 Programme provided as a reference. **UK pays contribution in Sterling. **Note:**