EXCELERATE Deliverable D10.1

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WP leader:	Bengt Persson Jiri Vondrasek Brane Leskosek	45 - UU 34 - UOCHB 32 - UL
Partner(s) contributing to this deliverable:	45 - UU; 34 - UOCHB; 32 - UL	

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Table of contents

1. Executive Summary

One of the major goals of ELIXIR-EXCELERATE task 10.3 (Capacity Building in Genome Assembly and Annotation) is to build capacity in genome assembly and annotation where it currently is insufficiently developed. We have organised five advanced level courses in five different countries. Teachers have been from four nodes (SE, BE, FR, NO). For each of the courses, the ELIXIR eLearning-platform developed by ELIXIR-SI within WP11 has been utilised.

As a pilot for capacity building in new areas, an advanced course in single cell transcriptomics was held in Finland, Helsinki, May 27-29 2019. Eight countries were teaching at the course, which took the participants all the way from quality control to final results and also touched on related subjects such as spatial transcriptomics.

Furthermore, we have created a good practices document, "10 steps to get started in genome assembly and annotation", published in the F1000 ELIXIR gateway, a result of a year of work by 16 authors from 6 countries. It guides the reader all the way from early stages of a project, such as planning and DNA extraction, through analyses, to publication and submission of data following the FAIR principles. The publication has been extremely well received with the highest number of downloads of all publications in the ELIXIR gateway, and the second highest number of views (4169 downloads and 22126 views, as of 16 July 2019).

The concept developed during ELIXIR-EXCELERATE for capacity building has proven excellent for genome assembly and annotation, and we have also applied it successfully for the new area single-cell transcriptomics. For sustainability, we conclude that capacity building in established areas will be performed as part of the ELIXIR Training platform activities, while capacity building in new areas will be using the mechanism of Implementation studies, where ELIXIR has regular calls for activities engaging multiple nodes. Implementation study funding can be used for a limited number of advanced courses for new areas. When these areas have matured, the capacity building activities will be included in the ELIXIR Training platform.

2. Impact

Advanced courses	Location	Date	Participants
Genome Assembly and Annotation	Prague, Czech Republic	Oct 12–14, 2016	24
Genome Assembly and Annotation	Ljubljana, Slovenia	June 19–23, 2017	24
Genome Assembly and Annotation	Lisbon, Portugal	Oct 23–27, 2017	24
Genome Assembly and Annotation	Montpellier, France	Sep 24–28, 2018	24
Single-cell Transcriptomics	Helsinki, Finland	May 27--29, 2019	24
Genome Assembly and Annotation	Milan, Italy	July 1--5, 2019	24

The best practices document "10 steps to get started in genome assembly and annotation" in F1000 Research has attracted an enormous interest with 22126 views and 4169 downloads (numbers from 16 July 2019).

3. Project objectives

With this deliverable, the project has reached or the deliverable has contributed to the following objectives:

No.	Objective	Yes	No
1	Implement a programme of organisational capacity building in newly formed ELIXIR Nodes, including sharing of best practice between partners in accessing EU Structural Funds (ESIF) for operating infrastructure		X
2	Construct and coordinate ELIXIR-wide 'communities of practice' that support and develop the professionals who deliver advanced data and bioinformatics support and services in ELIXIR Nodes	X	

4. Delivery and schedule

The delivery is delayed:　　Yes　　•No ☑

5. Adjustments made

N/A

6. Background information

Background information on this WP as originally indicated in the description of action (DoA) is included here for reference.

Work package number	10	Start date or starting event:	month 1
Work package title	**ELIXIR Node Capacity Building and Communities of Practice**		
Lead	Bengt Persson (SE), Jiří Vondrášek (CZ) and Brane Leskosek (SI)		

Participant number and person months per participant

1 – EMBL 6.00; 5 – UTARTU 20.00; 9 – CIPF 1.33; 12 – BSC 1.00; 16 – FCG 2.00; 17 - INESC-ID 2.86; 20 – CSC 4.00; 21 – UiB 4.00; 23 – UiT 4.00; 26 – CNRS 7.50; 32 – UL 30.00; 34 – UOCHB 20.35; 35 – MU 41.970; 37 – VIB 10.00; 39 – BSRCAF 19.00; 40 – HUJ 8.00; 42 – FORTH 6.00; 44 - UCAM 4.00; 45 - UU 31.30, SU 11.60; WEIZMANN 9.50

Objectives

WP10 is focused on strengthening the ELIXIR infrastructure by supporting coordination of Node activities and increasing the organisational capacities of ELIXIR Nodes. ELIXIR Nodes are at very different levels of maturity, ranging from national infrastructures that have existed for over a decade to newly formed consortia. Activities will focus on spreading the knowledge and bioinformatics best practice that exists within ELIXIR's larger and more established Nodes, with newer or smaller ELIXIR Nodes in less research-intensive areas of the EU. This will help to create a stairway to excellence for partners involved, and support the creation of a true European Research Area. One of the deliverables will be a set of "Good practices" for setting up and running an ELIXIR Node, which will be of substantial value for both current and future Nodes.

Its two Objectives are:

• Implement a programme of organisational capacity building in newly formed ELIXIR Nodes, including sharing of best practice between partners in accessing EU Structural Funds (ESIF) for operating infrastructure.

• Construct and coordinate ELIXIR-wide 'communities of practice' that support and develop the professionals who deliver advanced data and bioinformatics support and services in ELIXIR Nodes.

Work Package Leads: Jiří Vondrášek (CZ) and Bengt Persson (SE)

WP10 - ELIXIR Node Capacity Building and Communities of Practice [Months: 1-48]

UU, EMBL, UTARTU, CIPF, BSC, FCG, INESC-ID, CSC, UiB, UiT, CNRS, UL, UOCHB, MU, VIB, BSRCAF, HUJ, FORTH, UCAM, WEIZMANN

This WP will address the issue of how to get people in Nodes coming together in capacity building, as detailed in the tasks below. There will be accompanying training needs in this capacity building and those training needs will be addressed in WP11. The training needs are in advanced training of the staff handling data and performing genome annotation and assembly. Other training needs for Use Cases will be in general addressed in WP11, but not specific to every Node. For Node capacity building, advanced training will be needed also in management and know-how on operating Nodes, performed in close collaboration with Task 10.1.

Specialized Capacity Building

A Community of practice is a group of people who share a craft or a profession, created to coordinate efforts to solve defined tasks and/or with the goal of gaining knowledge related to their field. ELIXIR is looking to establish such Communities of Practice of bioinformatics experts involved in advanced bioinformatics user support across the Nodes to effectively interact with bioinformatics infrastructure users at interfaces of different research fields. ELIXIR Communities of Practice would be the primary mechanism for ELIXIR to establish domain specific services, for example, forming a

community of genome annotators across Nodes to meet the need from national researchers of ready access to genome annotation resources. Other examples could be to meet the needs of Rare Disease or Medical genomics research, agricultural or marine bioinformatics and chemical compounds for biology.

ELIXIR will start to build these Communities of Practice to enable coordination and knowledge exchange in selected areas in tasks 10.2 and 10.3. Task 10.2 is directed to create Good Practices in setting up data Nodes, of importance to create a sustainable and scalable data flow from laboratories to national Nodes and further to European or global databases. Task 10.3 is directed to coordinate and exchange expertise in the field of genome annotation and assembly and to create Good Practice in for this field. In the future, further communities of practice are envisioned, arising from needs identified by the Use Cases (WP6 to 9) and identified through community workshops and surveys (Task 10.4). The creation of a sustainable mechanism for establishment of communities of practice is also addressed in Task 10.4.

Task 10.1: ELIXIR Node Capacity Building (60.21PM)

This task will support the formation of an ELIXIR community. There are significant differences between existing ELIXIR Nodes in their capacity, level of expertise and maturity of services/tools/data. We will increase the joint competence and capacity for Nodes lacking a large national user community, large-scale projects and big data or having a limited record of offered tools and services. These Nodes will benefit from mutual collaboration and connection with well-established and more advanced Nodes they can utilize their know-how for a more rapid Node development. In the first year of the project, the Greek Node will benefit from this by going through the process of community building followed by submission of the Node application. Altogether, this will help shape ELIXIR as an efficient pan-European infrastructure.

The major aim of this task is to provide management knowledge transfer among Nodes to create a set of well- balanced, well-functioning and compatible Nodes.

Support in coordinating national Nodes, including Skills and Knowledge exchange between ELIXIR Nodes. Nodes with different experiences will help to provide knowledge regarding good practice in different situations and providing direct support to implementation of national infrastructures (e.g. by national / regional workshops with external experts, support to national community building efforts). The heterogeneity of Nodes established will help providing multiple effective ways for coordination and to get funds from national providers and their commitments to the infrastructure. Knowledge exchange will be catalysed by workshops, staff exchange programme and visits. This activity is based on the ELIXIR community practice experience but it is more general and should cover some features brought by larger staff community.

Identify and apply technical solutions at/between Nodes. The reason for particular technical solution must be explicitly formulated and the solution must be applicable on more than 2 Nodes. The capacity building deliverables would be primarily workshops based on Technical Services and/or Training WP deliverables.

Partners: CH, CZ, EE, NO, PT, SE, SI, UK, ES, EL, IL, EMBL-EBI

Task 10.2: Capacity Building in Data Nodes Network (44PM)

One of the aims of ELIXIR is to establish a network of data Nodes (Nodes with large data collections and databases with established way of data deposition and curation) to enable scalable data storage and their transferability by means of standardised formats. In this task, we will focus on establishing guidelines and good practices to facilitate

efficient data collection into core data resources (cf. WP3), primarily focusing on data needed for selected Use Cases (WP6 to 9). This is tightly linked with IT solution by means of storage, dedicated networks and connections (cf. WP4). A distributed network following the same standards will also simplify international sharing of datasets for which this is ethically permitted.

This task both includes creation of routes for data publishing in a uniform manner across ELIXIR with data Nodes in each country and includes data repositories for replication of reference data allowing for fast access. The setting up of a data Nodes network has been identified by the technical experts within ELIXIR as a prioritised area. Task 10.2 also includes development of Good Practices in setting up data Nodes enabling secure storage of sensitive data, such as sequence data related to patients. The task is interfacing with WP4 regarding technical developments on AAI and data transfer. Furthermore, there are connections with WP4 on data interoperability and the Use Case in WP9 on sensitive data.

Partners: SE, FI, CZ, EMBL-EBI, SI, PT, ES, EE. In due time, all ELIXIR Nodes are expected to have an ELIXIR data Node.

Task 10.3 – Capacity Building in Genome Assembly and Annotation (54PM)

Specialised expert platforms for genome assembly and annotation are already available in several ELIXIR countries. They provide critical support to complex genome projects and deliver annotations that serve as the basis for scientific inquiry into the genomics of newly sequenced organisms. The specialised expertise at multiple ELIXIR Nodes would benefit from capacity building through competence-spreading advanced workshops and staff exchange.

The capacity-building efforts will benefit the Use Cases in WP6 on marine organisms and in WP8 on plant Use Cases. The genome annotation groups will contribute with domain-specific knowledge about different species, e.g. marine organisms (SE, NO), woody plants (PT) and crop plants (SI).

Furthermore, in order to facilitate access to genome annotation to the users, we propose a deployment of web services to enable genome projects in the scientific community to efficiently interact with the data. The development of such web services is intended together with the EnsEMBL team to create a pan-European collaboration on genomics resources to provide researchers with a unified analysis platform carried by multiple partners.

Partners: SE, NO, FR, PT, EBI, SI, BE, CZ, ES.

Task 10.4 – Sustainability of capacity building (40PM)

The main goal of Task 10.4 is periodical and long-term discovery of users with specific capacity needs at ELIXIR Nodes and/or research groups within Nodes. This knowledge of capacity needs/gaps will be gathered through surveys and face-to-face meetings. With capacity needs identified the Task 10.4 team will connect users with WP11 groups that have at their disposal training infrastructure, learning materials and knowledge needed to implement the capacity building. In order to ensure the sustainable flow of knowledge and stable capacity maintenance we need to provide long-term networking of capacity seekers and providers. They will be focused to the great extent to the Good Practices from Task 10.2 and 10.3 (and WP6 to 9). With well-formed ELIXIR Communities of practice, the Task 6.4 will be able to lead the reuse or even suggest the adaptation of WP11 courses and training materials for specific capacity building needs.

It is of great importance that capacity needs will be periodically (but in long-term perspective) tested through surveys, which will also contribute to the sustainability of training infrastructure and learning materials provided by WP11.

Task 10.4 will monitor the implementation of capacity building in Tasks 10.1, 10.2 and 10.3 in order to extract good practices and compile good practice recommendations and guidelines which can be used in other capacity building contexts.

Partners: SE, SI, CZ, BE, EE, EL, IL, EMBL-EBI

Task 10.5: Supporting ELIXIR Nodes in understanding Smart Specialisation Strategies and accessing EU Structural and Investment Funds (ESIF). (46.2PM)

The potential for exploiting funding synergies between EU Research programmes and ESIF are well known. Those ELIXIR Nodes eligible for ESIF are therefore presented with a real opportunity for local funding of their Node, particularly in light of the proposed focus on ESIF and ESFRI that many Member States are making within their national plans to the Junker Investment Plan. However, understanding the local priorities for funding, rules, and application procedures presents is complex and time consuming and securing ESIF for operational costs of life science infrastructures is a real challenge. For ELIXIR Nodes to access ESIF in any meaningful way, support needs to be targeted at the local level, allowing scientists to build up an understanding of their local Smart Specialisation Strategy, which dictates the funding opportunities for that region, and then develop a strong business case that can be used for subsequent funding applications.

Partners: CZ, SI, EE, EL

ELIXIR ESIF Task Force (Months 1-12)

ELIXIR Structural Funds Task Force grouping funding specialists across ELIXIR Nodes will be established to share best practice in ESIF use for research infrastructures. The Task Force would also engage external experts such as ones from national managing authorities for ESIF, DG REGIO, DG EMPLOY, DG Enterprise and Industry and Jaspers and would make use of existing reports such as the ESPON KIT report (www.espon.eu).

An ELIXIR-wide Workshop early at start of the project to pool good practice on using Structural Funds to support research infrastructures and facilitate personal interactions. Meeting will be hosted and organised by CEITEC, who leads this task.

This would include talks from ELIXIR Nodes with experience of accessing Structural Funds (Estonia, Czech Rep, Slovenia), as well as other ESFRIs such as ELI that have done this successfully in other disciplines.

Local priorities and their overlaps identification towards Business Case (Months 6-24)

As all regional priorities are different, and as the application process for funding is done in the local language and following local rules, target Nodes will work with their regional partners to understand the priorities. This task will support Nodes in understanding their local Smart Specialisation Strategy and the regional priorities relating to research and life sciences. Access support from Jaspers following the connections built up within Months 1-12.

Supporting Nodes in actually developing the Business Cases and applications for Structural funds to support the construction and/or operation of the Node. The timing of this work will depend on when the calls will be opened for each region.

Partners: CZ, SI, EE, EL

7. Appendix 1: Report

7.1. Introduction

Genome assembly and genome annotation are areas where significant resources, both manpower and computational, are needed. Compared to many other areas of bioinformatics, assembly and annotation are explorative and time-consuming, and there are no standard approaches. Experience, both organism-specific but also general knowledge of assembly and annotation, is necessary and this is often slowly built up over the years when working continuously on similar projects. It is rare that the individual research group can find the time and resources necessary to build up this competence.

Experience in genome assembly and annotation exists in Europe but it varies between the ELIXIR Nodes, with some already having built up stable infrastructures and others just starting out. However, the need exists in all countries, not least because new sequencing technologies have made genome assembly and annotation more affordable and more feasible. This pushes more groups to take the step to assemble and annotate the genome of the organisms they are working on. Consequently, one of the major goals of ELIXIR-EXCELERATE task 10.3 (Capacity Building in Genome Assembly and Annotation) is to build capacity in genome assembly and annotation where it currently is insufficiently developed.

We will here describe how we in ELIXIR-EXCELERATE approached the task of building a Community of practice for these subjects. We will discuss what we think worked well, mention areas where we think improvements are needed, and give recommendations on how to set up a similar Community of practice for other subjects.

7.2. General structure/timeline of task

The first year was focused on planning workshops and e-mail communication, intended to define areas that the task should focus on. This year was also important to initiate contacts between the nodes in the task, and to investigate areas where the Nodes could contribute and areas where the Nodes wanted to learn.

This was then followed by a period of advanced courses, as this was a main interest registered by several Nodes in the first year.

At the same time work was initiated aiming at the creation of a Good Practices document. No beginner guide existed and the task took on the responsibility to write such a document to ease researchers and core facilities into the subject. The document was published in the F1000 ELIXIR gateway in Jan 2018.

The last year of ELIXIR-EXCELERATE will be spent continuing the successful course program and potentially also an evaluation of annotation tools.
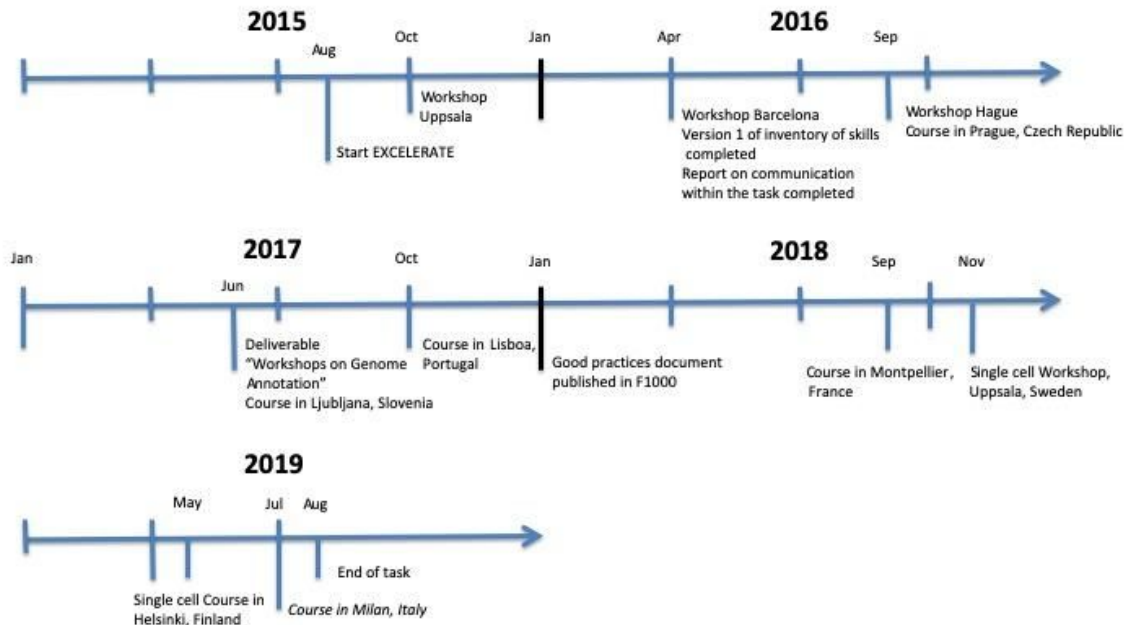
Figure 1. A timeline for ELIXIR-EXCELERATE task 10.3 "Capacity Building in Genome Assembly and Annotation".

7.3. Workshops

The first workshop was held in October 2015 in Uppsala, Sweden. All Nodes that had registered interest in task 10.3 in the ELIXIR-EXCELERATE application were present.

Outcome: A list of skills and interests was compiled based on the presentations by the participants. Feasibility of the original description of the task was also discussed, and tasks were both up- and down-prioritised.

The second Workshop was held in Barcelona in March 2016 in connection with the ISCB meeting that this year focused on genome annotation.

Outcome: The decision to go ahead with courses in genome assembly and annotation was taken. How to establish a network of experts was also discussed, and Slack was chosen as the tool for this.

The third workshop was at the ECCB meeting in the Hague in Sep 2016.

Outcome: The decision to go ahead with the Good Practices document was taken, and the format of the publication was discussed.

7.4. Advanced courses

During ELIXIR-EXCELERATE, we have for capacity building in Genome Assembly and Annotation organised five courses in five different countries. These are advanced level courses, with pre-requirements of experience of command line Linux and NGS-data. Teachers have been from four Nodes (SE, BE, FR, NO).

Table 1. Advanced courses performed in WP10.

Performed courses	Location	Date
Genome Assembly and Annotation	Prague, Czech Republic	Oct 12–14, 2016
Genome Assembly and Annotation	Ljubljana, Slovenia	June 19–23, 2017
Genome Assembly and Annotation	Lisbon, Portugal	Oct 23–27, 2017
Genome Assembly and Annotation	Montpellier, France	Sep 24–28, 2018
Single-cell Transcriptomics	Helsinki, Finland	May 27--29, 2019
Genome Assembly and Annotation	Milan, Italy	July 1--5, 2019

The first course was three days with approximately 1.5 days of genome assembly and 1.5 days of genome annotation. One hour of discussion with the participants about their projects was also included, and in the course survey this was lifted as one of the best parts of the course. Both participants and teachers also agreed that 3 days were not sufficient for such complex subjects as assembly and annotation, and the next two courses were therefore expanded to 5 days. The current structure of the course, which has turned out to be successful, is two days of genome assembly, 1 day of project discussion, and 2 days of genome annotation.

For each of the courses, the ELIXIR eLearning-platform developed by ELIXIR-SI within WP11 has been utilised. It has been used to host schedule, downloadable lecture/presentations, instructions for the practical sessions, and also a survey. A virtual machine has been developed by the Czech, Slovenian, and Portuguese Nodes, based on input from the teachers. The virtual machine can be re-used and thus greatly reduce the efforts needed for the practical operation of later courses. We strongly recommend that the ELIXIR-SI eLearning platform[1] is used for all courses in ELIXIR.

[1] https://elixir.mf.uni-lj.se

Survey results have been very positive, with overall ranking of 4.11 to 4.67 (max 5.0). Experiences have differed between the courses, with some participants starting out at a low level and needing more help with basic Linux, while others are much more advanced and also expect more advanced level teaching. Collecting information regarding the level of the participants and what they expect from the course already at registration is therefore of high importance.

As a pilot-test for future course activities, a course in single cell transcriptomics was held in Finland, Helsinki, May 27-29 2019. Eight countries were teaching at the course, which took the participants all the way from quality control to final results and also touched on related subjects such as spatial transcriptomics. A selection of participants had to be done as there were many more applications than available slots at the course (99 applicants for 24 slots). We therefore conclude that there is a need for continued course activity in this subject in ELIXIR, and we will investigate suitable ways to include this in the Training platform future activities.

7.5. Good practices document

Already at the start of the task, several Nodes registered interest for a document that would help researchers in their countries get started with genome assembly and genome annotation. In Jan 2018 we published our "10 steps to get started in genome assembly and annotation" in the F1000 ELIXIR gateway, a result of a year of work by 16 authors from 6 countries. Unique to the publication is that it guides the reader all the way from early stages of a project, such as planning and DNA extraction, through analyses, to publication and submission of data following the FAIR principles. The publication has been well received with the highest number of downloads of all publications in the ELIXIR gateway, and the second highest number of views.

7.6. Guidelines for building a community of practice

Here we present some advice on how to build a community of practice, based on our experiences building such a community for genome assembly and genome annotation.

*A leader, with time to spare, is needed
The time needed to build a community of practice should not be underestimated. There needs to be a leader appointed with the clear responsibility to build a community of practice, and with the time available to do so.

*A committee should be formed, already at the start
It was with the formation of a committee around a year into ELIXIR-EXCELERATE that concrete decisions really started. Every Node in the community should assign one person to act as member of the committee. At online quarterly meetings information can be disseminated and decisions can be taken. We recommend that note-writing is shared by the participants and done at the meeting using for example Google docs.

*Physical meetings

A personal connection between the community members is of huge importance to create a "we feeling". It is impossible to create this feeling of community membership without actual physical meetings. A kick-off meeting close to the start of the community-building is strongly recommended, but one or two more meetings already in the first year would be ideal. These meetings can ideally be planned in connection with ELIXIR all-hands meetings or scientific conferences.

*Decision power

When decisions need to be taken, for example at a meeting, there should be people present that have a clear mandate to take those decisions. Otherwise, decisions might be postponed and work will drag out in time. This is extra important when the decisions involve funding or how members should spend their time. This means that Heads of Nodes should delegate responsibilities clearly to their meeting representatives, or be present themselves. We would strongly recommend that at least one meeting is held early during the community building effort where both Heads of Nodes and those more actively involved in the effort are present.

*Added value for those involved

Those involved in the community building might need to take time from other responsibilities to be able to contribute. If their work in the community can have some kind of added value to them, this will encourage them to get involved. Networking is an obvious benefit, but for some experts, shared publications might be of bigger interest, or collaborations around development of tools. If it is possible to find some kind of added value for those involved in the effort, this should be encouraged.

*Community building takes time from those involved

Nodes interested in being part of the community building need to be prepared to set time aside for their representatives for the work needed. Considering that the most senior experts (e.g., professors) often also are the busiest, it can be a good idea to appoint a more junior representative, with time to spare, to the community building effort.

7.7. Difficulties encountered

Communication with researchers – We have set up a Slack channel and invited all course participants to this channel (around 70 people). We have strongly recommended them to contact us there if they need help in their assembly or annotation work, but so far the discussion channel has not attracted interest. We believe that the steps already taken during ELIXIR-EXCELERATE for community building should in the end benefit European researchers, but for this to work the researchers must know about and be in touch with the community.

Sustainability – The advanced courses have greatly helped individual researchers in several countries, but how do we make sure that the knowledge stays in those countries

and is maintained? Important initial steps have already been taken, but it is important to guarantee sustainability. One solution could be to establish an expert centre that European researchers can turn to with their advanced questions in genome assembly and annotation.

7.8. Mechanisms for capacity building in new communities

The concept developed during ELIXIR-EXCELERATE for capacity building has proven excellent for genome assembly and annotation. We have also applied the concept successfully for the new area of single-cell transcriptomics. For established areas the advanced capacity building will be performed as part of the ELIXIR Training platform activities.

To continue with capacity building in ELIXIR in new areas we will utilise the mechanism of Implementation studies, where ELIXIR has regular calls for activities engaging multiple Nodes. Implementation study funding can be used for a limited number of advanced courses for new areas. When these areas have matured, the capacity building activities will be included in the ELIXIR Training platform.

7.9. Conclusions

We have successfully built a community of practice for genome assembly and annotation. Expert groups in several countries are now in touch in this community and this has enabled a high level discussion and a wider sharing of tools and knowledge. The knowledge from the community has been disseminated to European researchers by advanced courses and a good practices publication.

The experience from genome assembly and annotation have been used to implement capacity building in another area -- single-cell transcriptomics. To get long-term sustainability in capacity building, we will utilise the ELIXIR Implementation Study mechanism.