Minutes of the 6ᵗʰ Annual Community Meeting of

German BioImaging

on 6-8 July 2015 in Fulda

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1 Introduction, Status Quo, and Perspective of German BioImaging

After a short round of introductions of all participants, Elisa May and Nadine Utz gave a short overview about the history of German BioImaging (GerBI), activities during the last year, and the perspective of German BioImaging:

- The GerBI mailing list is subscribed by 130 microscopists.

- 57 Core Facilities (CF) and Research groups are registered on the GerBI web page, of which 39 are pure CF, 8 are a CF and research group and 10 are canonical research groups. 35 CFs and research groups are affiliated with a university, 10 at a Max-Planck, 4 at a Helmholtz, 3 at a Leibniz, and 2 with a Fraunhofer-Institute, 4 are affiliated at other type of institutions.

- At the GerBI Annual Community Meeting last year, it was decided that scientists from abroad are allowed to subscribe to the GerBI mailing list, that DACH scientists can take part in GerBI programmes (priority is given to scientists working in Germany), and that only German CFs and research groups can register on the web page. It was anonymously agreed to continue that practice.

- The registered Core Facilities on the web page represent 4897 microscopy users in Germany.

- The number of participants of the GerBI Annual Community Meeting from Core Facilities were stable during the last years, this year the number of participants is increased.

- Menu-item "Useful information" contains information for Core Facilities published by DFG (DFG Usage Guidelines, User Fees, RIsources) and ERA-Instruments, and also a list of literature concerning (Imaging) Core Facilities.

- "Scientific contributions" will be added to the web page menu. Some publications by GerBI members have been collected and new ones are welcome. Publications which show the expertise of CF staff are also welcome even if it is not a first or last authorship. Further suggestions include to add a field to the web page forms and to add a keyword list.

- The web page has been highly accessed. The "Main Page" has been accessed more than 140 000 times and the "List of Facilities and Research Groups", including sub pages, more than 175 000 times, to name but a few.

- GerBI Core Facility Management Course: Three courses took place so far, which received excellent evaluation results. Imaging & Microscopy published an article about the course in 2014 [1].

- One Place for GerBI and Job Shadowing: 9 participants for One Place for GerBI courses and 17 Job Shadowing stays so far. Please continue offering courses (contact the GerBI project manager). A list was circulated for new Job Shadowing hosts. It was discussed how Job Shadowing hosts can be made visible: different color of facility on map on "Main Page" or extra field in facility form.

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[1]N. Utz, E. May, Imaging & Microscopy 3/2014

- The hotline to report problems in financing repair or maintenance costs or when microscopy fees are cut from (DFG) proposals, will be removed from the web page. Scientists who experience problems are welcome to let the office know. It was noted that often the global cut of a DFG proposal is by coincidence in the same order of magnitude as the imaging costs. This does not mean that imaging costs were cut from the proposals.

- Content on the GerBI web page, mainly teaching material created by the Workgroup "Training of users", is published under the "creative-commons by" license so that others can use and modify the material if they cite the author of the original work.

- Public relations

  - The German Council of Science and Humanities (Wissenschaftsrat) published Recommendations on Career Goals and Paths at Universities, in which the WR states that heads of Research Infrastructures should be appointed at the level of professorships. The WR acted on a proposal from GerBI.

  - Elisa May was invited to report to the DFG Joint Committee (Hauptausschuss).

  - GerBI is also mentioned in the Yearly Report 2014 of DFG.

  - Three letters have been sent to members of parliament concerning the German Roadmap for RI.

  - Elisa attended the "Fachgespräch Infrastrukturen des Wissens" hosted by the Green Party discussing about a ten billion infrastructure programme announced by the German government.

- Best Practice Manual: 16 authors have contributed. The manuscript needs to be condensed and revised and will then be made available to the German community to receive feedback in a "Crowd writing phase".

- Steering Committee Meeting: took place in January 2015 and the following topics were discussed:

  - Activities until the end of first funding period (Cost neutral extension until February 2016)

  - Planning of the GerBI Annual Community Meeting

  - Best Practice Manual

  - GerBI follow-up proposal to DFG

- GerBI filed a follow-up proposal to DFG within the "Call for Core Facilities 2015". It is planned to continue some of the activities of the first funding period and to add some new activities such as outreach activities, the organization of the conference "Trends in Microsopy" together with one of the members, and to strengthen the interaction with microscopy research groups. The most important aim will be to transform GerBI into a self-sustaining organization (e.g. German Society for Light Microscopy). As a third topic, GerBI is going to participate in and coordinate with national and European initiatives in bioimaging and related communities.

2 Quality Assessment of Instruments

Representatives of the four big microscopy companies joined the German BioImaging Annual Community Meeting and were available to engage in discussion with the meeting participants:

Dr. Ankerhold and Dr. Heidkamp, Carl Zeiss Microscopy GmbH

Dr. Falke and Dr. Kappel, Leica Mikrosysteme Vertrieb GmbH

Dr. Eich, Olympus Europa SE & CO. KG

Dr. Möller and Dr. van der Oord, Nikon GmbH

In preparation of the meeting, the GerBI Workgroup "Microscope Specifications and Standardized Measurements" had sent questions concerning the topics "Laser power Measurement" and "Signal to noise ratio of PMTs" to the companies. Facility Managers would like to have criteria to characterize the performance and technical conditions of the instruments because of the demand for more quantitative imaging data; to make best perfoming instruments available to the facility users; to forsee upcoming repairs, and to learn more about the performance of an instrument before buying it.

The workgroup was interested in the following issues and had prepared the following questions:

- Necessary warm-up time of laser and whole instrument?
- Which objective?
- Brand of power-meter and head-type (are others acceptable)?
- Where and how to place the detector to be in focus?
- Instrument conditions: scanning conditions, pixel dwell time?
- Beam splitter type, AOBS, tube current and AOTF setting?
- What is your laser reference wavelength?
- How many and how often measurements (reproducibility, stability short/long term)?
- Laser noise (what time scales are important and can be measured easily)?

Dr. van der Oord gave a short presentation. Dr. Heidkamp had prepared a presentation in which all questions with short answers were listed. Dr. Kappel pointed out that Leica provides a Remote Care Service and Dr. Eich that Olypmus is handing in a Spec-sheet when delivering an instrument. In general, the companies' representatives agreed that general answers cannot be given because they depend on multiple factors.

Dr. Heidkamp informed about the preparation of an ISO-norm for "confocal microscopes for biological imaging". Supporters from the bioscience community are welcome to participate and he committed to propose to invite members of the GerBI workgroup to DIN committee meetings.

3   Booking and accounting

Introduction to booking software, Dr. Roland Nitschke

A list of commercial software can be found on the GerBI web page. Purchase prices of software packages range between a few hundred and some thousand Euros and often depends on the number of users, instruments, and calendars. Maintenance contracts of booking software can be very expensive. Differences between software packages include the effort to set it up and to maintain it (software on local server or remotly supported by company), tailored solutions for front ends, user management combined with booking software, coupled with LDAP Windows Active Directory system to controll the access of users, and procedure for generating invoices. The booking system should

- inform the user about instrument features (e.g. filters).

- list bookable accessories (e.g. incubation chamber).

- let users administer their bookings (e.g. cancellation).

- provide report and statistic tools for CF staff.

- provide accounting features including different discounts for research groups.

- show clearly defined booking rules.

- flexible to add service and maintenance times.

- be able to send emails to specific groups of users (e.g. all users who booked a specific instrument which is broken)

Booking rules should be clearly defined but might differ from institute to institute. The Life Imaging Center programmed a script to log the actual usage time by recording the log-in and log-out times of each user. Participants reported that storing this information is prohibited by some research institutes because of their interpretation of the Data Protection Act. Astrid Schauss reported that the CECAD in Cologne uses an open source software solution which is compatible with SAP. Interested facilities can contact her to receive a copy of the software.

Booking software based on Microsoft SharePoint, Dr. Anje Sporbert

SharePoint is a web application platform in the Microscoft Office server suite which can be customized. The requirements of the CF included statistics about the usage of the instruments, communication between CF staff and users, easy reservation and cancellation, to provide information about the instruments, inform the staff about user projects and needs (e.g. biosafety level), and bookings. The facility does not charge user fees and accounting is not included in the software. The system is flexible and can be changed if requirements change in the future. A good programmer is needed to reach a satisfactory tailored SharePoint solution.

Perspective of the administration, Elena Trovesi (CoreVision in Science, Management Consultancy, Dresden)

Administrations take an interest in the organizational, financial, and operational aspects of a core facility. The life cycle of CFs start with a development phase when start up money has been secured. The facility grows and reaches after some years maturity. At this point, new investment is needed to replace broken and outdated instruments. This critical point is often not forseen but should be anticipated and it should be planned how maintenance, repairs, and new investments can be financed. Some institutes recover part of the costs via user fees. Elena suggested to create a profile card for each facility, which should be elaborated by the facility manager and the administration together. Its purpose is to summarize in a simple way all information about the life cycle and funding of a core facility and should contain the following information:

1. One simple facility name

2. Type of facility: user facility (typically Light Microscopy CFs) or service facility

3. Access rules to the facility

4. Teaching and training activities of facility staff

5. Who are the users (internal and external)

6. Recovery of costs: which percentage of the costs are recovered by usage fees or "fresh money" (grants). This is important for the institute to plan the budget for the whole insitute and for financial long-term planning of the facility.

7. Vision for the next three to five years: how much personell, which new instruments to buy (keep in mind 6-12 months tender times), budget.

A booking system helps to proof the utilization of the instruments. For user fees, a cost matrix has to be developed which distinguishes between internal users, which might be subsidized in different ways, and external users, who have to be charged full costs plus VAT. An external collaborator, who is charged reduced user fees, has to be the direct collaborator of the CF and, for legal reasons (European Union competition law), it must be clear how the CF profits from the collaboration.

A full cost calculation, which should be generated with the help of the administration, is needed to plan the budget and includes following parts:

- Income of the facility: budget provided by the institute, user fees, and grants.

- Costs of a facility: staff costs, maintenance and unexpected costs (estimation: 3% of purchase prize).

- Personell: Around 1600 working hours per year and person; only part of staff costs can be charged to a user (time for maintenance, writing emails, attending conferences, teaching students,...).

- Additional costs: Running costs (realated to building): cleaning, heating, water (around 300 € per m^2 and year); Administrative costs (related to persons): HR to hire people, institute's safety officer, purchase department,... (around 22 000 € per person per year)

- Usage times of microscopes: down times, Christmas time, repair times, maintenance times (an electronic booking system is very helpful)

If user fees are charged, invoices have to be paid. Invoices should be sent a few times per year to avoid both that PIs run out of money in the end of the year and cannot pay and to receive income only in the end of the year (fiscal year).

A list was circulated among the participants to collect the information about which facility is using which booking software.

4 Open Session: user/staff and user/instrument ratios, by Nadine Utz

In the registation form for the meeting, participants provided their suggestions for topics to be included in the open session. Most of the topics were covered in the sessions "Core Facilities at the national and European level", "Introduction, Status Quo, and Perspective of German BioImaging", "Booking and accounting", "Teaching Tricks", and "Quality Assessment of Instruments". The topic user/staff and user/instrument ratios based on the updated poll among German Imaging CFs were discussed in the Open Session.

30 CFs provided data in a survey conducted in the end of June 2015 about the number and education of their CF staff and the number and type of instruments. Data of 27 CFs, which have been operating for at least some months and which support users from research groups, were included in the data evaluation. Respondents were asked to include only data of light microscopes and not to include time needed to support users in image analysis. In figure 1, the number of facility users/year versus the number of supporting staff is presented. Participants gave great importance to the fact that these data represent the actual situation in German imaging Core Facilities and not necessarily the needed number of staff to adequately maintain the instruments and to facilitate the users. A distinction was made between high end systems, normal systems, and low end systems:

High end systems: STED, OMX, Palm etc., FLIM, FCS, 2-Photon with SHG or other specials, Light Sheet, Laser Capture Microdissection

Normal end systems: Confocal, TIRF, SD, Ratio-imaging, Wide-Field with deconvolution, wide-pv convolution

Low end systems: Wide-Field, Stereo Microscopes, Biostation

In average, 69% of CF staff holds a PhD and at least one person holds a doctorate in all CFs of universities or research institutes.

Representing the experts for imaging Core Facilities, participants decided to adopt recommendations on the minimum and optimum user/staff and instument/staff numbers. It was unanimously agreed

- that at least 1.5 full time equivalents (FTE) should work in a CF to ensure permanent function of the facility also in periods of annual leave or sick leave.
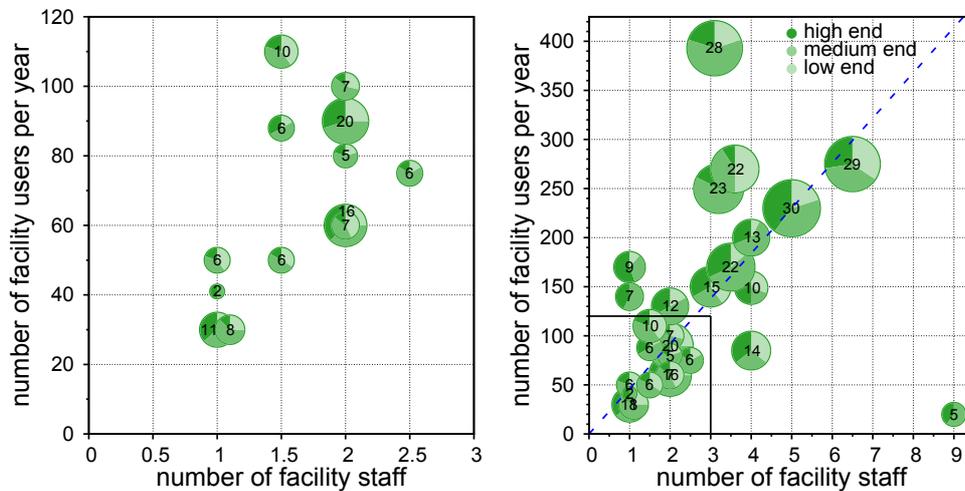
Figure 1: The graph displays the number of facility users/year (ordinate) vs. the number of supporting staff (abscissa). Each circle represents one CF. The number of instruments is enclosed by the circle area and ranges between 2 and 30. The proportion of high/normal/low end systems is given by the circle sectors.

- on recommending the median of the actual user/staff ratio as a <u>minimum</u> requirement for the number of CF staff. The median was calculated and found to be 45 users per FTE.

- on recommendations for the <u>optimum</u> instrument/staff ratio. Assuming 50% average usage or 2-3 users per instrument and day, including time needed for hands-on user training but not for other teaching activities and not for the support in image analysis, 17% of one FTE is needed to adequately support one low end system, 28%/FTE for one normal end system, and 53%/FTE for one high end system. These numbers should serve as a guidance. Less staff might be needed if several identical instruments are placed in a CF or if only few but heavy users have to be facilitated and trained. More staff might be needed if several different high end system techniques have to be supported.

An optimum instrument/staff ratio leads to reduced down-times of instruments, shorter queuing times for microscopes, and better support of users.

5   Teaching Tricks

Jan Peychl presented a variety of teaching materials including a "teaching tools suitcase". With the help of tools like grid slides, laser pointers, tonic water, and glas blocks basic concepts of light such as diffraction, excitation, bleaching, and light sheet were presented vividly. Further sources for teaching material are:

- Royal Microscopy Society courses (Peter O'Tool, Peter Evennett)

- IMP Vienna (Pawel Pasierbek)

- iBiology

Microscopy companies can be asked for old components to be used for teaching, and also decommissioned components from labs or CFs can be utilized. Participants asked to publish a list of useful components on the GerBI web page.

6 Core Facilities at the national and European level

Elisa May gave a short introduction to Euro-BioImaging and a brief overview of the status quo of the project. At present, the Interim Phase is steered by the Interim Board which has been established by 14 European countries and EMBL. These are allowed to nominate Nodes and to elect the Hub. To become a member of the Interim Board the Memorandum of Understanding (MoU) must be signed by a country to express its interest in Euro-BioImaging and that it wants to be engaged in the transition phase. The signature does not constitute a financial committment nor is it legally binding.

Achim Tieftrunk (DFG) reported that the German Research Foundation (DFG) nominated him as the German observer for the Interim Board. The president of the DFG sent a letter to the Federal Ministry of Education and Research (BMBF) on behalf of the Alliance of German Research Organizations (DFG, Helmholtz Association, Leibniz Association, Max Planck Society, and German Rector's Conference) asking to sign the MoU, which can only be signed by a government. The BMBF responded that it will not sign the MoU because German Euro-BioImaging was not included into the national Roadmap for Research Infrastructures. A new Call for the National Roadmap will be published in late summer.

Many participants expressed their support to continue to work to make the participation of Germany in Euro-BioImaging possible. It is important to raise the awareness for CFs and of Research Infrastructures and participants agreed to organize a German wide open house day of imaging CFs.

The number of light microscopes purchased via DFG grants has been decreasing since 2012. In the last years the number of microscopes granted to CFs has increased. Achim Tieftrunk and Elisa May asked the meeting's participants to send to the GerBI office the total hours of usage of the microscopes in their CF of last years to investigate whether the utilization of microscopes in CFs increased since 2012.

7 Image Analysis Software

Introduction, Dr. Jürgen Reymann

Jürgen Reymann gave an overview of the activities of the GerBI Workgroup Image Analysis during the last years. Based on the results of a survey, a software repository was launched on the workgroup's web page. In Jürgen's opinion there is a gap between expert solutions and the needs of the typical microscopy user. The ideal solution would be an analytics platform which provides solutions for the need of the user.

Fiji, Dr. Pavel Tomancak

Pavel Tomancak gave an insight about the necessity to develop Fiji (Fiji is just ImageJ). To gain biological information, image data has to be analyzed. To develop such a complex software, he and Albert Cardona hired computer scientists to build a plugin architecture on top of the core of ImageJ which can be used by biologists who know only little about coding. Today, the publication has been cited more than 2000 times and there is a strong community of plugin programmers and users. Pavel calculated the value of the software resulting in 500 million €. It is very difficult to raise funds to finance the maintenence and the further development of the software. Fiji developers are bombarded with user requests via the mailing list, have to respond to reported bugs, develop new features, and write a documentation. A stable carreer prospect in academia is needed for staff maintaining the software.

Image Analysis Tools, jun. Prof. Olaf Ronneberger

The research group of Olaf Ronneberger develops software for Biomedical image analysis and computer enhanced microscopy. Olaf gave an insight about the software packages for stiching (3D multichannel images), a virtual brain explorer for zebra fish (ViBE-Z), iRocks for the analysis of Aradopsis roots, and the image segmentation software U-Net. Resources needed to develop the software range between one to several man years and were financed by BMBF and Cluster of Excellence projects. The development of user interfaces for the software took up to two man years and were not included in the project proposals, as, by his experience, this part of a software project is always cut. There is no funding at all for maintaining the software. In his opinion, career perspectives in academia for programming end-user interfaces and for software maintenence is very poor.

Ilastik, Dr. Ullrich Köthe

Ullrich Köthe kindly stepped in for Prof. Fred Hamprecht to present the main features of the software Ilastik. Ilastik is a machine learning image analysis software, in which a training mode is implemented which can be used by biologists via an interactive user interface. The design of algorithms is funded, but it is very hard and a lot of additional work to create reusable software. For this reason, only very few data formats are supported by Ilastik. Additionally, the support of different platforms (operating systems), writing documentation, answering user questions, and fixing bugs is very time consuming. Unfortunately, this is often not considered as being science. New metrics should be found to indicate the success of a software in addition to the number of citations. It took 19 person years to develop the software not taking into account the development of new algorithms. Now for the first time, Ilastik developers are financed via third party funds. Ullrich reported that it is very difficult to find good programmers as universities are not able to offer competitive salaries.

Funding of software development, Dr. Achim Tieftrunk, DFG

DFG is aware that in the past it was difficult to receive funding for the creation of user interfaces or software maintenance. The need for data analysis in the life sciences and in particular in light microscopy is a rather recent development. It is important, that the bioimaging community makes its representatives at DFG, the

Fachkollegiaten, aware about their needs. DFG has realized that software is often not "kept alive" and is currently reshaping some of its programmes so that they can be used to keep software usable. The programme for scientific library service and information systems is developing the new funding programme "E-Research" which might be suitable to fund image analysis software and data handling. Scientists working at the Helmholtz Association, Leibniz Association, Max Planck Society, and Fraunhofer Society are also applicable to the programme. Achim Tieftrunk gave the advise to get in contact with DFG to discuss the needs of the image analysis community.

Current activities of the image analyst community, Dr. Kota Miura

Kota Miura showed that the number of publications using Fiji has risen sharply during the past decade as an example for the increased need for image analysis. As a result of a survey from March 2015, which was completed by 1800 scientists, image analysis is the most difficult step in an imaging based research project for the majority of the respondents. The increased complexity of biological problems has lead to more software packages, algorithms, and libraries, making it more and more difficult to choose the perfect tool for image analysis. This development led to the profession "Bioimaging Analyst". In 2013, the Euro-BioImage Analysis Symposium (EuBIAS) was initiated to create a Bioimage Analyst community, and to develop webtools and courses. As a result, the bioimage information index webpage http://biii.info was published.

8   Wrap up and Closure

Elisa May summarized the meeting and reminded participants to send the total number of usage hours to the GerBI office (see chapter 6).