

Synthetic Biology Leadership Council
Minutes of the meeting held on Wednesday 19th March 2014
Room C13, BIS Conference Centre, 1 Victoria Street, London SW1H 0ET

Attendees

Co-chairs: Prof Lionel Clarke (Shell Global Solutions); Rt Hon David Willetts (BIS, 16:30 – 17:30 only).

Leadership council: Carol Boyer-Spooner (Chemistry Innovation and Industrial Biotechnology Leadership Forum); Dr Amanda Collis (RCUK); Dr Tim Fell (Synthace and BIA); Prof Richard Kitney (Imperial College London); Prof Dale Sanders (John Innes Centre); Prof Joyce Tait (Innogen Institute, University of Edinburgh); Dr David Tew (GSK); Prof Janet Thornton (European Bioinformatics Institute).

Policy advisors: John Betts (BIS); Mike Edbury (Government Office for Science); Ron Egginton (BIS).

Secretariat: Dr James Brown (SynBio SIG); Dr Amy Tayler (SynBio SIG).

Invited guests: Dr Megan Palmer (SynBERC, UC Berkeley, 12:00 – 13:00 only).

Apologies: Shamimara Ahmed (BIS, policy advisor); Prof Janet Bainbridge (UKTI, council member); Nick Bassett (Technology Strategy Board, observer); Paul Gemmill (RCUK, council member); Paul Mason (Technology Strategy Board, observer); Sharmila Nebhrajani (AMRC, council member); Chris Warkup (SynBio SIG, secretariat); Dr Zoe Webster (Technology Strategy Board, observer).

1 Welcome and introductions

The Chair, Prof Lionel Clarke, welcomed everyone to the 5th meeting of the SBLC. In particular, Lionel welcomed the two new members of the SBLC, Dr David Tew (GSK), and Dr Tim Fell (Synthace and BIA), and also Dr Amanda Collis (BBSRC and RCUK), who has returned to the SBLC to stand in for Paul Gemmill (BBSRC and RCUK). For the benefit of the new members, the SBLC members introduced themselves. Tim acknowledged that the BIA synthetic biology advisory group is a subscription organisation and a lobbying body. Tim clarified that his role in the SBLC is to represent the interests of multiple SMEs and the BIA group, not just Synthace.

Lionel thanked two departing members, Dr Belinda Clarke (TSB) and Dr Simon Dolan (GSK), for their excellent efforts and contributions to progress UK synthetic biology.

2 Internal Business: Minutes and actions from the last meeting

The Chair noted that the minutes of the last meeting (held on 16th October 2013) were agreed via correspondence and are available on the [SBLC website](#). The actions from the last meeting were reviewed and discussed (see Annex 1 for reference).

Actions 1 and 2

To be covered under item 8.

Action 3

To be covered under item 9.

Action 4

Noted as done. Dr Amy Tayler (SynBio SIG) reported that, thanks to the efforts of Caroline Channing (SynBio SIG), the [SBLC homepage](#) now has a tab called 'Latest news and announcements from the SBLC', which links to the items included in the research council/Technology Strategy Board update

from the last meeting, plus a few more recent announcements. SBLC members were encouraged to direct any feedback to Amy.

Action 5

To be covered under item 8.

Action 6

Prof Richard (Dick) Kitney (Imperial College London) and Prof Janet Thornton (European Bioinformatics Institute) reported that they are working on a list of companies for circulation amongst the SBLC.

Action 1: Dick Kitney and Janet Thornton to work with James Brown (who is reviewing the SME landscape and is involved in the RCUK Synthetic biology working group), Tim Fell (who can report activities of the BIA), Amy Tayler (who will consult colleagues in the IBLF) and TSB contacts to circulate a company list and plan of engagement in advance of the next meeting.

Action 7

To be covered under item 7.

Action 8

Dr James Brown (SynBio SIG) and Dick confirmed that a UK iGEM office, which was an explicit component of the IKC bid, will be established at the IKC. The office and the IKC will support all UK organisations that want to participate in iGEM. iGEM is an important education tool that can be adopted into university curriculums and the relevant doctoral training centres (DTCs). iGEM participants often go on to study PhDs and take up post-doctoral positions. BBSRC is working with the University of Glasgow to sponsor participation in iGEM. This year's competition, which includes 10 UK teams, returns to the format of a single jamboree rather than regional competitions, which is more appealing to the participants: they want the opportunity to attend the main event and meet other teams from around the world. The IKC is considering the intellectual property (IP) implications.

Action 2: At a future meeting, James Brown to provide an update on progress with establishing a UK iGEM office.

Action 9

Amy confirmed that the dates for the next two SBLC meetings are Thursday 3rd July 2014 (SBLC6) and Thursday 27th November 2014 (SBLC7, open meeting).

Action 10

To be covered under item 4.

Action 11

John Betts (BIS) reported that the Science and Innovation Network (SIN), part of a UK Government initiative, facilitated the submission of reports on synthetic biology reports from 15 countries. A [summary report](#) is available on the SynBio SIG website.

Action 3: Amy Tayler to ensure a link to the SIN report is included in the next SynBio SIG newsletter.

Action 12

To be covered under item 6.

Action 13

To be covered under item 5.

Action 14

James recently visited Prof Tim Dafforn at the University of Birmingham. Rational and precise strain engineering has been at the core of the bioprocessing community for a long time, and collaborations with synthetic biologists are starting to emerge. Tim recommends that the SynBio SIG engages with the likes of GSK, FujiFilm Diosynth Biotechnologies, Cobra, and UCB Celltech. The BBSRC Bioprocessing Research and Industry Club (BRIC) provides an ideal forum in which to reach these companies. James will likely attend the next BRIC dissemination event in October 2014. The upcoming merger of the KTNs means that Amy and James will be direct colleagues of staff from HealthTech and Medicines KTN, who already have good links with the pharmaceutical industry.

Lionel reported that a meeting between the industry chairs of the SBLC, industrial biotechnology leadership forum (IBLF), and agri-tech leadership council (ATLC) is planned to discuss coordination at the interfaces and opportunities for cooperation.

Action 4: At the next meeting, Lionel Clarke to provide a 15 minute update on the meeting between the industry chairs of the SBLC, IBLF and ATLC.

Action 15

Noted as done: circulated on 17th December 2013.

Action 16

To be covered under item 3.

3 Feedback from open meeting & Council Discussion of Format

All participants in the last meeting of the SBLC (the first open meeting) were invited to provide feedback via an online survey. The SBLC discussed the results, noting that very few responses were received.

Venue: There were some issues with the venue. James explained that, in this case, there was limited lead time in which to organise the open meeting, and the organisers were unsure of how many people would be interested in attending. It is tricky to combine the intimacy of a meeting with the capacity to accommodate observers. The SBLC agreed that the SynBio SIG needs to source a more appropriate venue for future meetings: the SBLC would like to accommodate more people, ideally without pre-registration. However, places may be restricted to one per organisation, at least until the organisers can gauge demand.

SBLC membership: During the open meeting, Lionel announced the review of the SBLC, which may have curtailed any discussion of membership during the meeting. However, the feedback highlighted a need for the SBLC needs to engage more with industry and SMEs, which has been addressed by the recent recruitment of Tim. The inclusion of a representative from the Ministry of Defence (MoD) was also suggested.

Agenda: Lionel clarified the purpose of the open meeting: it is not primarily an educational engagement exercise, but a mechanism to demonstrate the nature of the issues being addressed and the transparency by which the council operates. However, it was difficult to conduct internal business without presenting further context to the observers. Tim, who observed the open meeting before joining the SBLC, noted that he already knew the majority of the observers. If the SBLC reaches out to wider groups for future open meeting, the observers might not be so familiar with

synthetic biology. The SBLC discussed the benefits of holding a public engagement exercise shortly before the open meeting. Several people would have liked more time for public discussion and Q&A, preferably after each agenda item.

Observers: The SBLC secretariat specifically invited those NGOs that had previously submitted FOI requests relating to synthetic biology to the open meeting. Skype, Google Hangouts and Adobe Connect are tools that could help widen participation beyond those who can attend the open meetings in person, such as international participants.

General comments: Ron Egginton (BIS) suggested that the lack of ministerial cases following the open meeting indicates it was a success. Ron also suggested that the SynBio SIG website could host a public interest page with FAQs, a link to the synthetic biology dialogue, and an alert about the next open meeting (which is already posted on the SBLC webpage).

Action 5: James Brown and Amy Tayler to book a venue near BIS and to propose an agenda for the next open meeting (SBLC7) at the next ordinary meeting (SBLC6). SBLC members to provide input and feedback through James.

Action 6: Amy Tayler to seek permission from those named in Paper 2 (feedback from the open meeting) before publishing on the SBLC webpages.

4 SBLC review

The SBLC has recently been reviewed by BIS, with the aim of reflecting on progress to date and determining how the SBLC might operate in the future. John Betts (BIS) explained that a survey was sent to members of the SBLC, members of the SBLC governance sub-group, members of the Synthetic Biology Roadmap Co-ordination Group, and the observers from the open meeting. BIS did not receive many replies, although the arising comments do fall into a few themes: linking synthetic biology and genetic modification; company engagement; connecting synthetic biology with existing biotechnologies; international collaboration; and commercialisation.

The agility of the SBLC is attributed to its relatively small size. However, the SBLC routinely consults individuals with additional areas of expertise, and Tim has recently been appointed to increase the interface with industry.

The term 'sub-group' has been used loosely by the SBLC: many of the sub-groups have been informal and short-lived. Sub-groups must have clearly defined purposes that align with the SBLC. The most formally constituted sub-group, the governance sub-group, has to date been administratively supported by John Betts (BIS). John will shortly leave BIS, and neither BIS nor the SynBio SIG have the resource to provide administrative support to sub-groups of the SBLC.

In addition to sub-groups, the SBLC can also consider whether other activities fall under the remit of other groups outside the SBLC. For example, Dr Amanda Collis (RCUK and BBSRC) explained that the research councils intend to establish a network to pull together recent investments (such as the IKC, the synthetic biology research centres (SBRCs), etc.) to ensure a coordinated and coherent approach. Rather than repeat the activities of this network, the SBLC intends to implement a light touch mechanism to facilitate communication and dialogue between the expert community at the 'coal face' and the SBLC. This is vital in such a fast-moving field: the SBLC needs to remain well-informed about current thinking in synthetic biology as it evolves. Should a physical meeting be required, Amanda offered financial support from BBSRC.

Action 7: Lionel Clarke to initiate a dialogue between the IKC, the three SBRCs, and relevant CDTs so Dick Kitney and Dale Sanders can provide an update at the next meeting.

The BIA synthetic biology advisory group would also like to engage with these communities: they will be invited to deliver an update at the next meeting of the BIA synthetic biology advisory group.

5 Update on Governance sub-group and proposal for a Biosecurity sub-group

Joyce Tait (Innogen Institute, University of Edinburgh) explained that the governance sub-group provides an engagement mechanism for a wider cohort of experts from the synthetic biology community to contribute to SBLC activities. The sub-group, the current membership of which covers a broad range of interests and expertise, met for the first time on 27th January. The main agenda item was to discuss the terms of reference and guidelines for the sub-group, which have since been revised accordingly. It is intended that the standard mode of operation is that outputs of the sub-group will be submitted to the SBLC for approval. The SBLC approved the terms of reference and guidelines.

Action 8: Amy Tayler to upload the governance sub-group terms of reference to the SBLC website.

The SBLC discussed the membership of the governance sub-group and the representation of different stakeholders. Some additional participants were suggested, which Lionel and Joyce will explore. Considering the request from a social scientist to conduct research on the sub-group as an observer of its meetings, the SBLC agreed that this would be useful. The social scientist will be asked to submit a formal proposal to SBLC, for subsequent agreement with SBLC on the ground rules for the role of observer.

Action 9: Joyce Tait to follow-up enquiry regarding observation of the governance sub-group.

The next topic for consideration by the governance sub-group will be responsible research and innovation. Joyce recently participated in a stratified medicine public engagement exercise jointly organised by TSB and ScienceWise (the IBLF has previously engaged with ScienceWise, too). Joyce recommended that the SBLC consult ScienceWise regarding future synthetic biology public engagement activities. Joyce suggested early synthetic biology applications in industrial biotechnology might be suitable case-studies from which we can gauge public perception.

Action 10: Lionel Clarke to discuss public engagement and coordination of synthetic biology and industrial biotechnology during the meeting of the chairs of the SBLC, IBLF and ATLC.

Tim raised Defra's consultation on implementing the Nagoya Protocol (NP) in the UK, which closes on 21st April 2014. In 2011 the UK signed the 'Nagoya Protocol on Access and Benefit Sharing for Genetic Resources', an international treaty negotiated under the Convention on Biological Diversity (CBD). In order to ratify this treaty the EU and the UK must set down new rules, the planned implementation of which is outlined in Defra's consultation document. The current implementation plans include unlimited fines and up to two years imprisonment. It is intended that the UK Intellectual Property Office (IPO) will be 'gatekeepers'. However, the definition of 'a genetic resource' is ambiguous, raising concerns from patent lawyers: for example, if a patent application includes genetic code, the IPO could ask the filer to declare whether or not they adhere to the NP, which may not be practicable. It was noted that previous consultation on the Cartagena protocol received very few responses, and greater attention to this matter may be justified in future.

Action 11: Joyce Tait and Tim Fell to provide text explaining why the synthetic biology community should respond to Defra's consultation on implementing the Nagoya Protocol in the UK, for Amy Tayler to send round the SynBio SIG members, Tim Fell to send round the BIA, and Dick Kitney to send round the IKC contacts.

Action 12: Joyce Tait and Lionel Clarke to lead on preparing a response to Defra's consultation on implementing the Nagoya Protocol in the UK on behalf of the SBLC.

Lionel introduced the topic of biosecurity: regulations effectively address legitimate activities and are continually reviewed in the light of ongoing technological developments, but it is also necessary to consider the potential activities of those who do not abide by regulation, whether deliberately or inadvertently. This may be more effectively addressed via training, awareness and the application of suitable codes of practice, as already adopted by major sequencing companies. As advanced synthesis capabilities are introduced within the UK, it could be timely to review the processes that will be applied.

Dick highlighted the [Blackett review on wide-area biological detection](#), which sets out the findings of a review commissioned by the Government Chief Scientific Adviser at the request of the Home Office and the Ministry of Defence.

Action 13: Dick Kitney to send Amy Tayler the Blackett review for circulation round the SBLC.

If the SBLC is to explore biosecurity further, it must consider what questions need answering, how to best monitor emerging developments, and what are the best channels for engaging national and international bodies. The SBLC should consider engaging with DSTL on this matter.

Action 14: Dick Kitney and Amanda Collis to look at the Blackett review and suggest future activities for the SBLC at the next meeting.

Dr Megan Palmer (Deputy Director of Practices, SynBERC, UC Berkeley; and the William J. Perry Fellow in International Security at Stanford) was welcomed to the meeting.

Megan is involved in international security discussions through her roles at Stanford, iGEM, SynBERC and LEAP. Megan commented that despite policies being actively developed to address dual use risk in biotechnology, implementation strategies remain unclear. Biosecurity must be a collective responsibility: individual practitioners within the community must be capable of acting as sentinels to flag concerns, and have mechanisms to communicate those concerns. In venues like iGEM, we have seen that transparent engagement of the community, and partnerships with law enforcement officials like the FBI, can promote trust and develop new expertise in the community. Ultimately the hope is a 'see something, say something' approach that results in herd immunity within the synthetic biology community. However, there is a need to understand which designs can promote identification of concerns and a culture of responsibility, and the limits of these approaches. The SBLC questioned how such an approach would translate into an UK/European cultural context. It was noted that in the US the FBI is seen as an enabler and plays an active role in the community (e.g.: the FBI funds iGEM), although it can be a careful balance.

Megan and the SBLC discussed measuring risk and communicating risk to stakeholders. The perception of risk can often be disproportionate to the benefits that are delivered, and this is a topic that is currently being addressed with regard to advanced technologies in general. Megan

emphasised the importance of using trusted channels of communication. It can be difficult to anticipate what might become a concern.

There are currently ambiguities around list-based classification systems and the risk groups (RGs) of biological parts: RG2 parts can be assembled to deliver RG3 functionality, but they remain officially classified as RG2. New frameworks and policies are under consideration. However, we have fundamental knowledge gaps regarding functional-based classification, so organism-based classification is still the norm.

6 SynBio LEAP – progress with UK involvement

Megan explained that biotechnology is an evolving, globally distributed enterprise with leadership needs beyond the bench (e.g.: strategy and social implications). People rarely have the time and expertise to think beyond their core activities. The LEAP program gives rising leaders the time, space and resource to think about the implications of their research beyond the bench, and to do something about them. It has the potential to put people on the ground who can make plans and implement them by training individuals that can partake in public engagement, policy discussions etc.

LEAP improves people and plans using a place (a residence), partners (peers and mentors), proficiency, practise and productivity (committing to action). The inaugural LEAP program attracted approximately 150 applications, from which 20 rising leaders from academic labs, start-ups, multi-national companies, policy think tanks and government were selected. The program was delivered by a professional facilitation team and 20 senior mentors under Chatham House rules. The first 5-day workshop, held in an informal setting, developed ideas and plans. At the end of the week, new ideas and activities were pitched. White papers have since been written and peer reviewed. Lots of activities, plans and impacts are emerging (e.g.: five participants worked together around standards development and delivered a workshop at SB6.0, policy advice, presentations, organisations, workshops etc.). The LEAP annual report is available in the SBLC member space Dropbox folder.

The funding required for LEAP is relatively small. However, it requires investment in people and plans, and active management is required to sustain activities beyond the original workshop. The Sloan foundation has given LEAP a grant to expand to the UK in 2014/15 and Asia in 2016/17. Megan has identified key partners in the KTN and the IKC, which are working together to design a year-long program for participants from both the US and UK. It is hoped that the UK and US delegates will be brought together, rather than have replicated programs in each country. A year-long program will allow the participants to meet multiple times and disseminate their ideas. The program is expected to have two residential courses in the US (Washington DC or San Francisco) and the UK (London). It is anticipated that the program will involve 20 fellows plus 20 mentors, with up to half coming from the UK. The Sloan foundation offers catalyst funding for the best proposals coming through the program, which brings an added incentive without being too competitive.

The KTN is providing support through James' time, with financial support from the IKC (which is in turn funded by the research councils and TSB). Additional funders will be considered. James intends to explore the possibility of partnering new UK fellows in synthetic biology to the LEAP program. The program could be franchised if successful. A strategy meeting will be held in the US ahead of the upcoming SynBERC retreat. The SBLC is welcome to suggest participants, assessors and mentors, each of whom are expected to get a lot out of the program.

Megan left the meeting immediately after lunch.

7 Issues relating to technical standards, IP and standards for responsible innovation

Lionel summarised the four recent workshops in this area: a UK strategy workshop in June 2013; a US/UK/China meeting in the margins of SB6.0 in July 2013; an EU workshop in October 2013; and a British Standards Institution (BSI) workshop in January 2014). The IPO was represented at these meetings. Lionel reminded the SBLC that their comments on the draft report from Prof David Castle (Innogen Institute, University of Edinburgh) should be sent to Amy by 28th March 2014. The SBLC may consider sharing the final report with the IPO and EPO.

In summary, the IP issues identified are not unique to synthetic biology but it does have some distinct features. It is not practical to try and change the patent system, but it may be appropriate to consider influencing the way it is applied. Applications of synthetic biology cover a range of IP regimes, and so IP won't be treated consistently across the application space. There is a role for material transfer agreements (MTAs) and copyrighting.

'Patents thickets' and broad patents have the potential to block innovation, which is a problem across the board, not limited to synthetic biology. A synthetic biology 'patent watch' function has been suggested. Patents generally have a greater value when they are critical to supporting investment. Ideally, early stage developments should be open source to promote collaboration, with patents only put in place after optimisation to protect investments and potential products. This is particularly reflective of a fast-moving field (like synthetic biology), when patents can't move fast enough: each individual patent would have a relatively low value, creating a thicket with many work-arounds. In such field, patents may, through deliberate design (via excessively broad 'prophetic' claims) or inadvertently (via unanticipated pathways) block or severely inhibit future opportunities for innovation. However, this situation often needs to be explained to potential investors, who expect patents to be in place. Patenting is often used by technology transfer offices (TTOs) for financialising ideas, but unless clearly linked to specific commercialisation plans cases this may actually inhibit future utilisation of the idea. IP-free resources, such as IP-free vectors, could enable the wider uptake of synthetic biology. On the other hand, the UK patent box can deliver tax benefits that stimulate the research process. Achieving the right balance of timeliness and scope is critical. The IKC and SBRCs might be able to help identify successful models.

Dick briefly introduced the current proposed technical standards for synthetic biology (BioBricks, Dicom-SB, and SBOL). The synthetic biology community now has a good protocol for the characterisation of biological parts using lab robots. However, this has opened up metrology issues. SynBERC and the Flowers Consortium are working together to develop better measurement technologies, which may also have applications in nanotechnology. Dr Ben Sheridan (British Standards Institution) has prepared a draft strategy for standards to accelerate the commercialisation of synthetic biology through the creation of a digital biomanufacturing industry. The SBLC discussed the draft strategy.

Action 15: Amy Tayler and Dick Kitney to produce a response to Ben Sheridan's draft strategy on behalf of the SBLC.

8 Branding the SBLC and badging UK SynBio activities

Lionel thanked the SBLC for their recent contributions to a UKTI synthetic biology factsheet under the 'Innovation in Great' campaign. The factsheet, which the SBLC consider to be very powerful, will be used by UKTI and SIN teams the world over, who are often recruited locally. This document may encourage other businesses in the UK to identify themselves as using synthetic biology.

All policy advisory groups are required to have a page on the gov.uk website, hence the SBLC now has [a dedicated page](#).

James has been exploring options for an SBLC logo. The SBLC is not permitted to adopt the eight great technologies logo. Bellman, the branding agency used by UKTI, are too expensive for the SBLC to consult for this specific purpose. The SBLC discussed some options: one promising solution may be to write a brief and crowd-source a logo, which may deliver a relatively low cost solution.

Action 16: James Brown to continue to explore options for an SBLC logo and brand identity.

9 Looking back: Outputs of the roadmap workshops

James has revisited the outputs of the two workshops held in March 2012, which brought together 70 members of the synthetic biology community to shape the UK roadmap for synthetic biology. James has also revisited the outputs of the questionnaire completed by more than 100 members of the SynBio SIG in May 2013. The aim of James' work is to pull the information together in a coherent format to identify messages that were lost during previous consolidation, but which are still important. James has identified 30 suggestions and recommendations in 11 distinct categories. The SBLC is not expected to respond to all of them, but it may consider allocating a score to indicate to the community their ongoing consideration of the various ideas and suggestions.

Action 17: James Brown to circulate paper, on which the SBLC is encouraged to comment, and which will be revisited at the next meeting.

10 In the present: Current SynBio activities and the role of the SBLC

The SBLC discussed recent public funding investments, which was supported by a draft paper. The SBLC identified some investments that were missing: the Flowers consortium award; a Frontier engineering award; and BBSRC summer schools. The outcome of EU funding calls will be known shortly and can be added to the list.

Action 18: Amy Tayler to update draft paper with additional funding investments, for internal use by the SBLC.

Action 19: Amy Tayler, Paul Gemmill and Amanda Collis to calculate funding investments to date.

The SBLC discussed how the impacts of funding investments are recorded. Amanda explained that systems are in place to identify outcomes and impacts, but that time lag is an issue. It can be tricky to judge impacts, but case studies are useful. Tim suggested that business schools could help develop case studies.

Amanda described a lead agency agreement between BBSRC and NSF (USA). A pilot scheme, which specifically highlights synthetic biology as an area of interest, will launch in 2015 and operate for two years in the first instance. The agreement enables collaboration between researchers in the UK and US. Each agency will accept the others peer review processes to remove double jeopardy.

11 Looking forward: Upcoming events and plans

Dick briefly summarized plans for SynBioBeta London, which will take place at Imperial on Thursday 3rd April 2014. This event builds on the last SynBioBeta meeting, held in San Francisco in November 2013. SynBioBeta is a company that organizes meetings between venture capitalists, academics and industry. The event has been organized in partnership with the IKC, SBLC and SynBio SIG. An academic conference (for which registration is free) will also be held at Imperial on Wednesday 2nd April 2014.

Lionel alerted the SBLC to an upcoming consultation regarding plans for long-term capital

expenditure, which could have a total annual budget of £1Bn. Discussions with BBSRC and EPSRC suggest that demands for synthetic biology might be unconventional: funding for a single purchase might not be fit for purpose but rather a series of upgrades may be required; infrastructure could also be important. The SBLC is encouraged to engage with the upcoming consultation, where it will be important to get visionary perspectives from both academia and industry.

Action 20: James Brown, Tim Fell, Dick Kitney, Dale Sanders, Janet Thornton, and David Tew to work with Amanda Collis and others as appropriate in framing RCUK long-term capital expenditure proposals for synthetic biology.

James described some upcoming activities in which the SynBio SIG is involved: there are tentative plans for a UK-US policy meeting in the Autumn 2014, which will likely fit around the next SynBioBeta meeting in San Francisco and that could pave the way for a bi-annual meeting to share best practice; in September 2014, SIN Canada and Genome-Canada will host a UK contingent to share best practise and explore collaboration; TSB will likely commission a third responsible innovation workshop regarding stakeholder engagement; and Birmingham University are piloting a showcase to develop a regional cluster involving companies large and small.

Mike Edbury (Government Office for Science) summarised the first themed annual report from Sir Mark Walport (Government Chief Scientific Advisor), which will be on the subject of risk and innovation. The report, which builds on a workshop held on 7th March 2014, will explore cultural approaches, social approaches, the international situation, and governance to determine whether regulation and a risk averse approach holds back innovation. Mike will look for a synthetic biology case study for inclusion in the report, which will be published in Autumn 2014.

Amanda confirmed that the second phase of the call for synthetic biology research centres (SBRCs) is under development. The research councils are exploring opportunities for funding in addition to the £10 M already committed to the scheme. The research councils will shortly announce the outcome of recent competitions for DNA centres and capital investment. ERASynBio will shortly announce the outcome of the first joint call for transnational research projects, and the second call is now open. The ERASynBio strategic vision, to which members of the SBLC have contributed, will also be published shortly. SIN is also facilitating synthetic biology collaborations and joint activities.

John thanked the SBLC for their support during his secondment to BIS. Lionel and the SBLC thanked John in return: the SBLC agreed that John has done an excellent job.

Ron confirmed that a proposal for a new synthetic biology entrepreneur in residence (EiR) within the policy team in BIS has been approved. The Minister will announce it at SynBioBeta and an advertisement will go out shortly.

Action 21: Amy Tayler to work with BIS/TSB colleagues to see whether the outcome of the recent synthetic biology tools & services competition can be included in the ministerial address at SynBioBeta.

Action 22: Amy Tayler (SynBio SIG) and Tim Fell (BIA) to advertise the EiR position.

Dick will deliver an IET Kelvin Lecture entitled "Synthetic Biology – "One of the Eight Great Technologies" at the Royal Institution on 17th June 2014. The lecture will be available for live online viewing.

James encouraged SBLC members to help shape future SBLC agendas. Mike Edbury suggested that

the SBLC could benefit from hearing from someone affiliated with one or more of the other 'eight great technologies' (such as e-infrastructure or agri-tech).

The Minister joined the meeting.

12 Discussion with Minister

Lionel summarised the key messages arising from the meeting to stimulate discussion with the Minister as follows:

One year review of the SBLC: Now that many of the key recommendations of the roadmap are now in place, it's a timely opportunity to review the SBLC. A questionnaire was sent to a range of stakeholders, including the observers of the first open meeting of the SBLC. The SBLC membership has been revised to include Dr Tim Fell from both the BIA synthetic biology advisory group (representing 10 SMEs) and Synthace. James is also on the process of revisiting the materials arising from the roadmap workshops. The SBLC will contribute towards an upcoming consultation on long-term capital expenditure.

International links: The SBLC worked closely with UKTI to produce the synthetic biology factsheet, and continues to work with FCO and SIN offices in Canada, US (Chicago, Boston and San Francisco), and Singapore. Specifically, the soon-to-be-announced UK DNA synthesis centres will be partnered with the leading US DNA synthesis centres. The BBSRC-NSF lead agency agreement will enable research collaboration between US and UK academics. Members of the SBLC have contributed to the development of the two ERASynBio joint calls for transnational projects. The SBLC was today visited by Dr Megan Palmer to discuss biosecurity issues and the Leadership Excellence Accelerator Program (LeAP), which will be brought to the UK with the help of the SynBio SIG and the IKC.

Venture capital: The UK trade mission to San Francisco in November 2013 raised the profile of the UK capacity for synthetic biology in the US. SynBioBeta London will shortly take place at Imperial on 2nd and 3rd April 2014, at which the Minister will announce the recently approved DNA synthesis centres and the synthetic biology EiR vacancy at BIS. Midven, which is managing the Rainbow Seed Fund, has recruited an investment manager with a scientific background. The SBLC understands that ten investment opportunities are already lined up for consideration. The Minister asked whether any UK commercial funds are prepared to pick up the baton beyond the Rainbow Seed Fund. It is the opinion of the SBLC that, in general, US investors are currently more focused on synthetic biology than UK investors. There are UK investors exploring opportunities (such as IP group and Imperial Innovations), but they are generally much smaller than our American counterparts. However, overseas investors are willing to invest in synthetic biology the UK (e.g.: Sofinnova Partners, based in Paris, has recently invested in Green Biologics, based in Didcot). James is also working with the UKTI Venture Capital Group (shortly to be renamed the UKTI Innovation Group).

Standards and regulations: The British Standards Institution (BSI) is working to establish the right approach to help (not hinder) the uptake of synthetic biology. It is the opinion of the SBLC that a framework standard for responsible innovation could be of benefit to the synthetic biology community, and that the UK will benefit more broadly from BSI leading the way in Europe. However, a framework standard should not be limited to synthetic biology: it may contribute a useful worked example, but ultimately a framework standard should be potentially applicable to all emerging technologies. The SynBERC consortium (US) will discuss technical standards at their upcoming retreat, which will include delegates from the UK. The SBLC recognises the importance of the UK and US working together on the development of global technical standards, which will further enable collaboration on synthetic biology projects. It is anticipated that regulations will be most appropriate if they are product/application-based, rather than process-based.

SBLC governance sub-group: Joyce explained that the governance sub-group met for the first time to determine their terms of reference, which were agreed by the SBLC earlier in the meeting. The first major item for consideration by the sub-group is responsible research and innovation (a key component of the UK roadmap for synthetic biology). The sub-group also intend to refresh the plan for public engagement, which will be modelled on a recent stratified medicine public engagement exercise. As some synthetic biology products are emerging, it is the right time to frame a useful discussion. Tim raised Defra's consultation on the proposed implementation of the Nagoya Protocol, highlighting the concerns relating to the ambiguity of the definition of a genetic resource, the possible implications on patent filing, and the potential fines and jail sentences for those that fail to adhere. The SBLC confirmed that it intends to encourage members of the synthetic biology community to contribute to the consultation by 21st April 2014.

The Minister commented that the UK synthetic biology community has recently gained a lot of momentum, but acknowledged that we need to shape UK venture capital funding. The Minister would like to broaden the terms of reference of the Green Investment Bank. The Minister will shortly publish a consultation document, which will feed into the sciences strategy in the Autumn statement.

13 AoB and close

The SBLC agreed the actions arising from the meeting (see Annex 2). The chair thanked everyone for their participation before formally closing the meeting.

**SBLC Secretariat
April 2014**

Summary of actions arising from the 4th meeting of the SBLC (16th October 2013)

Action 1: Janet Bainbridge and the UKTI marketing team to consult the SBLC on key messages regarding synthetic biology and the GREAT campaign.

Action 2: The resultant UKTI GREAT marketing materials to be circulated to the SBLC via the secretariat.

Action 3: Revisit the outputs from the roadmap workshops and report back at next SBLC meeting (James Brown)

Action 4: SBLC secretariat to upload paper 2 to the SBLC pages of the SynBio SIG website, and to convey the information in a more digestible form.

Action 5: Explore opportunities to (i) brand the SBLC and (ii) badge UK synthetic biology activities, and report back at next meeting (James Brown, Janet Bainbridge and Ron Egginton).

Action 6: Janet Thornton and Richard Kitney to consult Belinda Clarke, Carol Boyer-Spooner, Chris Warkup and external experts (as required) to systematically identify biodata companies (mainly SMEs).

Action 7: James Brown to review the pilot LEAP programme and offer a proposal for UK SynBio LEAP at the next meeting of the SBLC

Action 8: James Brown to update the SBLC on iGEM discussions with Randy Rettberg and the IKC. If appropriate, a proposal for a UK iGEM office will be circulated and discussed at the next meeting of the SBLC.

Action 9: SBLC members to indicate their availability for meetings in March and July 2014 on the already circulated Doodle polls, and Amy Taylor to initiate a Doodle poll for November 2014.

Action 10: Lionel Clarke, Ron Egginton, John Betts and the SBLC secretariat to initiate a review of the SBLC and to report back to the SBLC in time for any necessary membership adjustments to be made in advance of the next meeting in March 2014.

Action 11: Ron Egginton and John Betts to share the outputs of the SIN network report before next SBLC meeting.

Action 12: At the next SBLC meeting, Lionel Clarke to report on IP issues and Richard Kitney to report on standardisation issues arising from the three workshops held in 2013.

Action 13: Joyce Tait to (i) finalise the membership of the proposed sub-group, (ii) engage with the confirmed members to finalise the proposed activities, and (iii) meet with the sub-group to craft a firmer agenda of activity.

Action 14: Belinda Clarke, James Brown and Carol Boyer-Spooner to discuss engagement with the bioprocessing sector with Tim Dafforn.

Action 15: SBLC secretariat to circulate the final briefing document to SBLC members as and when it is agreed.

Action 16: SBLC secretariat to work with Paul Gemmill to initiate a feedback mechanism for SBLC members and observers to report on this first open meeting of the SBLC.

Summary of actions arising from the 5th meeting of the SBLC (19th March 2014)

Action 1: Dick Kitney and Janet Thornton to work with James Brown (who is reviewing the SME landscape and is involved in the RCUK Synthetic biology working group), Tim Fell (who can report activities of the BIA), Amy Tayler (who will consult colleagues in the IBLF) and TSB contacts to circulate a company list and plan of engagement in advance of the next meeting.

Action 2: At a future meeting, James Brown to provide an update on progress with establishing a UK iGEM office.

Action 3: Amy Tayler to ensure a link to the SIN report is included in the next SynBio SIG newsletter.

Action 4: At the next meeting, Lionel Clarke to provide a 15 minute update on the meeting between the industry chairs of the SBLC, IBLF and ATLC.

Action 5: James Brown and Amy Tayler to book a venue near BIS and to propose an agenda for the next open meeting (SBLC7) at the next ordinary meeting (SBLC6). SBLC members to provide input and feedback through James.

Action 6: Amy Tayler to seek permission from those named in Paper 2 (feedback from the open meeting) before publishing on the SBLC webpages.

Action 7: Lionel Clarke to initiate a dialogue between the IKC, the three SBRCs, and relevant CDTs so Dick Kitney and Dale Sanders can provide an update at the next meeting.

Action 8: Amy Tayler to upload the governance sub-group terms of reference to the SBLC website.

Action 9: Joyce Tait to follow-up enquiry regarding observation of the governance sub-group.

Action 10: Lionel Clarke to discuss public engagement and coordination of synthetic biology and industrial biotechnology during the meeting of the chairs of the SBLC, IBLF and ATLC.

Action 11: Joyce Tait and Tim Fell to provide text explaining why the synthetic biology community should respond to Defra's consultation on implementing the Nagoya Protocol in the UK, for Amy Tayler to send round the SynBio SIG members, Tim Fell to send round the BIA, and Dick Kitney to send round the IKC contacts.

Action 12: Joyce Tait and Lionel Clarke to lead on preparing a response to Defra's consultation on implementing the Nagoya Protocol in the UK on behalf of the SBLC.

Action 13: Dick Kitney to send Amy Tayler the Blackett review for circulation round the SBLC.

Action 14: Dick Kitney and Amanda Collis to look at the Blackett review and suggest future activities for the SBLC at the next meeting.

Action 15: Amy Tayler and Dick Kitney to produce a response to Ben Sheridan's draft strategy on behalf of the SBLC.

Action 16: James Brown to continue to explore options for an SBLC logo and brand identity.

Action 17: James Brown to circulate paper, on which the SBLC is encouraged to comment, and which will be revisited at the next meeting.

Action 18: Amy Tayler to update draft paper with additional funding investments, for internal use by the SBLC.

Action 19: Amy Tayler, Paul Gemmill and Amanda Collis to calculate funding investments to date.

Action 20: James Brown, Tim Fell, Dick Kitney, Dale Sanders, Janet Thornton, and David Tew to work with Amanda Collis and others as appropriate in framing RCUK long-term capital expenditure proposals for synthetic biology

Action 21: Amy Tayler to work with BIS/TSB colleagues to see whether the outcome of the recent synthetic biology tools & services competition can be included in the ministerial address at SynBioBeta.

Action 22: Amy Tayler (SynBio SIG) and Tim Fell (BIA) to advertise the EiR position.