Synthetic Biology Leadership Council
Minutes of the 6th Meeting held on Thursday 3rd July 2014
Room C13, BIS Conference Centre, 1 Victoria Street, London SW1H 0ET

Chairs: Prof Lionel Clarke (Shell, Co-Chair); Rt Hon David Willetts (BIS, Co-Chair, 15:00 – 16:00 only).

Leadership Council: Dr Amanda Collis (RCUK); Dr Tim Fell (Synthace and BIA); Dr Chris Jones (Technology Strategy Board); Prof Richard (Dick) Kitney (Imperial College London); Prof Joyce Tait (Innogen Institute, University of Edinburgh); Dr David Tew (GSK); Prof Janet Thornton (European Bioinformatics Institute).

Policy Advisers: Shamimara Ahmed (BIS); Dr Helen Bodmer (BIS).

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

Apologies: Prof Janet Bainbridge (UKTI); Carol Boyer-Spooner (Chemistry Innovation and Industrial Biotechnology Leadership Forum); Mike Edbury (Government Office for Science); Sharmila Nebhrajani (AMRC); Prof Dale Sanders (John Innes Centre); Chris Warkup (SynBio SIG and KTN); Dr Zoe Webster (Technology Strategy Board).

1 Welcome and introductions

Lionel Clarke welcomed everyone to the meeting and expressed immense shock at the news of Ron Egginton's untimely death. Ron has made an enormous contribution to many synthetic biology activities in the UK. He invited Lionel to lead the development of the UK strategic roadmap for synthetic biology, and his support was always constructive and enthusiastic. The SBLC will miss him enormously. Lionel welcomed Helen Bodmer, who will cover some of Ron's BBSRC and SynBio responsibilities until an appointment is made. Lionel also welcomed Chris Jones (TSB), who attended a meeting of the SBLC for the first time. The meeting attendees introduced themselves.

Lionel thanked the following departing members for the contributions: Carol Boyer Spooner has recently left the KTN and as such no longer holds a seat on the IBLF or SBLC. Lionel and the IBLF team are discussing how best to engage without Carol; Sharmila Nebhrajani left AMRC and is now the chair of the Human Tissue Authority; and Chris Warkup has been appointed CEO of KTN Ltd and can no longer commit to SBLC meetings.

> ***Action 6-1: Lionel Clarke to write a note of thanks to Carol Boyer-Spooner, Sharmila Nebhrajani and Chris Warkup.***

2 Internal Business: Minutes and actions from the last meeting

The SBLC briefly discussed the actions arising from the previous meeting (see Annex 1). Actions 3, 8, 11, 13, 18, 19, 21 and 22 were noted as done. Actions 1, 4, 5, 7, 9, 10, 14, 17 and 20 were covered under agenda items later in the day.

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

Randy Rettberg (iGEM) is working with Dick Kitney (IKC) and Rick Johnson (GlobalHelix LLC) to establish an EU iGEM office in the IKC. An external review panel recently endorsed the concept of an iGEM office within the IKC. In February 2014, Dick Kitney was also invited to join the iGEM board. The office will support all UK teams and a registry held at the IKC will contribute to the huge undertaking that is distributing parts and updating the registry each year.

This year the iGEM competition has attracted 245 teams and approximately 2500 participants are expected at the jamboree in November. This represents a combined investment estimated at $15-20 M. Since iGEM first began approximately 275 labs around the world have registered with iGEM and received parts. The organisers (together with the SynBio SIG, the IKC and BBSRC) are keen to capture the potential value of the iGEM projects by making it easier for teams and supervisors to maintain momentum and obtain follow-on funding. The organisers are exploring the idea that a panel (involving a handful of iGEM's many alumni) could each year identify approximately 20 projects with potential beyond iGEM.

The iGEM office at the IKC will also likely support the Leadership Excellence Accelerator Programme (LEAP) and Lean Launchpad, which have also received the endorsement of the IKC external review panel. A ten-week Lean Launchpad course will begin in January 2015, concluding at SynBioBeta at the IKC in April 2015. The IKC has recruited an outreach officer to help recruit participants for Lean Launchpad.

Action 6: Amy Tayler to seek permission from those named in paper 2 (feedback from the open meeting) before publishing on the SBLC website.
This action is on going. Amy will provide an update at the next meeting.

> ***Action 6-2: Amy Tayler to seek permission from those named in paper 2 (feedback from the open meeting) before publishing on the SBLC website.***

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.
Joyce Tait confirmed that Joyce and Lionel had a teleconference with Julian Jackson (Defra) before submitting a response on behalf of the SBLC. The response was relatively critical of the proposed implementation plan in that the proposed penalties were excessive and the regulatory precedents quoted were inappropriate. Joyce is aware that some responses took a different perspective and welcomed a tough response, suggesting it would make the UK an appealing place to conduct innovation in a responsible manner. However, the SBLC questioned the validity of this argument. The SBLC is concerned that the proposed regulatory framework could discourage venture capitalists and multinational companies from investing in the UK, leading them to invest elsewhere and also deter SMEs from innovating in this area. It was noted that the US has made relatively limited investment in regulatory science.

Tim Fell confirmed that he also submitted two robust challenges to the proposed implementation plan: a personal response and a response on behalf of the BIA synthetic biology advisory committee.

The SBLC noted the requirements for a nation to be a signatory to the Nagoya Protocol (as is the case for the UK) in order to be present at meetings that can influence its implementation. However, failure to achieve the desired influence means that the UK is in the position of being legally required to implement the legislation that is passed. Defra now has to provide robust legal instruments and guidance to implement the Nagoya protocol requirements in the UK and the development of such guidance provides an additional opportunity for the synthetic biology community to engage with Defra.

Helen Bodmer confirmed that the mechanism by which the UK will implement the Nagoya Protocol is still unresolved. The SBLC confirmed that it would like to see what Defra submitted to the Conference of the Parties to the Convention on Biological Diversity, and would welcome the opportunity to engage in a further dialogue with Defra.

> ***Action 6-3: Helen Bodmer and Shami Ahmed to consult Sharon Ellis before asking Julian Jackson (Defra) to (i) share Defra's response with the SBLC (ii) have another telecom/meet with any interested members of the SBLC.***

Joyce alerted the SBLC to the open EU consultation regarding the definition of synthetic biology and how it relates to GMO regulations and risk.

> ***Action 6-4: Dick Kitney and the science and technology sub-group to consider the EU consultation regarding the definition of synthetic biology.***

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

Amy confirmed that Ben has received feedback from the SBLC. Chris Jones (TSB) indicated that Ben has since updated the technical strategy. TSB is now comfortable with the revised framework, which takes the form of a set of guidelines rather than defined standards. It is likely that BSI will produce a 25-30 page document by February 2015. For clarity, the SBLC noted that the document would *not* cover standards for responsible innovation.

> ***Action 6-5: Amy Tayler to share Ben Sheridan's revised digital bio-manufacturing strategy with the SBLC.***

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

James noted that the Agri-Tech strategy has a logo that is applied to many documents to act as a visual reminder of the strategy. A logo for UK synthetic biology activities will allow us to be consistent in our messages across all stakeholder groups and communication channels. It is envisaged that the logo will be tagged with additional text identifying particular organisations and activities (including but not limited to the SBLC). James has obtained 450 designs from 150 designers through an online design contest. James shared a shortlist of designs and received feedback from the SBLC.

> ***Action 6-6: James Brown to finalise a logo for UK synthetic biology activities and provide guidelines for use.***

3 Tripartite meeting of the SBLC, IBLF and ATLC

Lionel described a recent meeting of the chairs of the SBLC, Agri-Tech Leadership Council (ATLC) and the Industrial Biotechnology Leadership Forum (IBLF), which was also attended by KTN staff and Celia Caulcott (BBSRC). The chairs recognised that the three fora have different natures, membership and modes of operation. However, the meeting explored mechanisms to align activities, interact and work together without duplicating effort. The chairs intend to hold a follow-up teleconference in the next few weeks.

The chairs discussed the on-going consultation for capital investment, to which James and Lionel will provide a response on behalf of the SBLC. Lionel explained that the UK strategic roadmap for synthetic biology describes how innovation in synthetic biology can be translated through both established and novel channels to deliver benefits. Market needs also direct such innovation. Capital investments are required to fuel the 'synthetic biology innovation engine'. The benefits of this are two-fold: (i) a world-class UK research-base, and (ii) effective translation.

The SBLC noted that synthetic biology requirements must be reflected in other capital expenditure proposals with relevance to synthetic biology. For example, microscopes, imaging technologies, data technologies, software, DNA sequencing and DNA synthesis all fall under high-throughput technologies and are highly applicable to synthetic biology. Chris explained that future TSB competitions might also support these areas. Further discussion was postponed until agenda item 7.

Lionel raised the recent review of Catapult Centres by Hermann Hauser, with whom Lionel will shortly meet. The SBLC discussed areas in which the various Catapult Centres (including high value manufacturing and stratified medicine) could use synthetic biology. Examples include: advanced manufacturing; combatting antimicrobial resistance; surrogates for relatively early-stage animal testing (saving resources, money and time); developing the right single cell and 3D-systems for different areas of application; and changing the way in which we look at natural products. The SBLC considered that an example of a grand challenge that might be solved by synthetic biology would strengthen the SBLC response to the capital consultation.

> ***Action 6-7: Dick Kitney, David Tew, Janet Thornton, Amanda Collis and Joyce Tait to consider how synthetic biology might be applied to a grand challenge, for presentation at the next SBLC meeting.***

4 SBLC Governance Sub-Group

The 2nd meeting of the SBLC Governance sub-group was held on 6th June 2014. Joyce explained that the members, by design, have very different perspectives and that the group works well. SBLC members discussed some individuals that might be invited to join the sub-group.

> ***Action 6-8: Lionel Clarke to invite nominee(s) to join the SBLC governance sub-group.***

The SBLC discussed the UK research integrity concordat and the many EU initiatives regarding responsible innovation. It was noted that the existing initiatives focus on research rather than innovation. The previously proposed TSB/BSI framework standard for responsible innovation could

have filled this gap, hence the SBLC governance sub-group expressed disappointment that the TSB had withdrawn support for such a framework standard and recommended that the SBLC give this consideration in the future. James explained that the SynBio SIG is working with TSB to develop a work package to specifically support responsible innovation, so there could be further action on this in the future. The SBLC supported the involvement of the Catapult Centres, the KTN and other stakeholders (including those in autonomy, robotics and nanotechnology) to develop a joint framework or translational initiative for responsible innovation.

The SBLC governance sub-group also recommended that the SBLC work with the research councils and TSB to develop regulatory systems that can meet the challenges arising from developments in biological sciences, including but not limited to synthetic biology. The SBLC noted the BSI framework for digital bio manufacturing could meet this need. It was noted that whilst synthetic biology should be regulated by the appropriate regulations, synthetic biology might also provide solutions for regulatory science.

Both the SBLC and the SBLC governance sub-group have recently been asked to contribute to consultations at relatively short notice. Longer timescales would help each group coordinate their responses.

> ***Action 6-9: Secretariat (KTN and BIS) and relevant UK Government Departments to look out for future UK, EU, UN and OECD consultations (which often come through a Government department) and to seek opportunities for the SBLC to be engaged at an earlier stage wherever possible and appropriate***

The SBLC commented that consultations don't always ask the right questions. Sometime, it is more appropriate to comment on the policies and processes that have generated a given proposal, rather than to comment on the proposal itself. In the past, this has been achieved through a preface to a consultation response. The SBLC, and the Governance Subgroup would like, if possible, to be more involved in the process of developing such proposals. It would be appropriate to involve BIS and the Government Office for Science in discussions of politics and public perception vs. policy and evidence in such cases. This discussion was parked for discussion with the Minister.

The proposed pro-regulation innovation framework has stimulated lively debate amongst the SBLC governance sub-group members. Joyce declared that she has previously submitted a grant application in this area, which could potentially represent a conflict of interest. Therefore, Joyce will act in a chair's capacity to coordinate a response from the sub-group, taking care to exclude her own views. The SBLC members agreed that it does not need to go through the SBLC prior to submission. Joyce will submit an independent personal response regarding her own views.

> ***Action 6-10: Shami Ahmed to check the deadline for responses to the pro-regulation innovation framework, and Joyce Tait to coordinate a joint response on behalf of the SBLC governance sub-group.***

Joyce requested additional secretariat support for the SBLC governance sub-group. James explained that the SynBio SIG, which provides secretariat support to the SBLC, does not have the resource to

support the SBLC governance sub-group. The existing memorandum of understanding with TSB and BBSRC provides a budget to support the SBLC. The SynBio SIG already has plans to lobby EPSRC and ESRC for additional funds to support the governance sub-group.

5 Biosecurity and the Blackett Review

Amanda Collis and Dick Kitney described the Blackett Review on wide-area biological detection that was published in February 2014. The review brought together approximately 30 international experts, including SBLC member Dick Kitney, from a range of disciplines to consider biological release and cutting-edge methods of detection. A series of sub-groups promoted different techniques. For example, some groups promoted massive amounts of sequencing, others discussed biosensors connected to mobile phones. The review considered synthetic biology, although greater focus was given to bioinformatics, data-handling, physical processes, micro-instrumentation, metagenomics, and sequencing advances to enable sensor development, all of which are of interest to the research councils, TSB and DSTL (which has recently seconded an employee to BBSRC and now sits on the cross-council synthetic biology working group).

The SBLC acknowledged a recent workshop report, which suggested that heightened biosecurity threats are often exaggerated. It was the SBLCs opinion that start-ups, spinouts and DIY bio-hackers pose a relatively small threat compared to that of state-sponsored terrorism. The SBLC recommends that, as part of responsible innovation and research integrity, synthetic biology practitioners should be vigilant stewards of their own and their colleagues work. Practitioners should have legitimate reason for every piece of work they do. In turn, we need to fund basic science to help detect agents and produce vaccines quickly (in as little as two weeks). Synthetic biology is a technology that will help meet these requirements, whether the threat is natural or man-made, hence biosecurity should be part of the synthetic biology research agenda. The SBLC noted that US synthesis centres raise concerns with the FBI agents, who also attend iGEM each year. A similar process is not yet in place in the UK, although BIS have some links with Scotland Yard and the Metropolitan Police.

> ***Action 6-11: Dick Kitney, Amanda Collis and Joyce Tait to summarise current activities concerning biosecurity for use at a policy meeting in October 2014.***
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> ***Action 6-12: Amanda Collis to discuss (i) the potential for synthetic biology to provide solutions for natural and man-made biosecurity threats and (ii) workshops to support policy discussions with the cross-council synthetic biology working group.***

6 Coordinating UK Synthetic Biology activities

The SBLC recently requested an informal science and technology group be established to better connect the IKC (based at Imperial College London but involving many additional academic and industrial partners), the synthetic biology research centres (SBRCs, based at the University of Bristol, the University of Nottingham, and the University of Cambridge in collaboration with the John Innes Centre) and two relevant doctoral training centres (DTCs, based at University College London and University of Oxford). The group will allow these organisations to better recognize their interfaces and identify potential for synergistic activities. This group has direct links to the SBLC via Dick Kitney and Dale Sanders. Dick summarised the first meeting of the group, which took place on 23rd May 2014 at Imperial College London. Each group (with the exception of the University of Oxford, which

could not attend) gave an overview of their activities, which stimulated a good discussion. The group also presented to the BIA and hopes to do so again. The group intends to meet on a regular basis, the next meeting planned for October 2014. Two SBLC members expressed an interest in attending and observing these meetings in the future: Janet Thornton (EBI) and James Brown (SynBio SIG).

The science and technology group is considering hosting an annual academic synthetic biology conference. As in 2013, in 2015 it could run immediately before or after SynBioBeta (23-24 April 2015), which also coincides with the culmination of the first Lean Launchpad program.

7 Moving Forward

The SBLC discussed company engagement, noting sensitivities about sharing the company names with SBLC members and the wider public. Many of those companies previously suggested by the SBLC are already engaged with the IKC, TSB and the SynBio SIG. The SBLC acknowledged the previous work conducted by Belinda Clarke at TSB. James Brown reassured the SBLC that the SynBio SIG has a company engagement plan. The SBLC would like to learn more about the SynBio SIG membership at a future meeting.

Action 6-13: SynBio SIG to analyse company membership of the SynBio SIG, including sectors and where they fit in the supply chain.

Action 6-14: Chris Jones to consider the outputs of TSB investments in synthetic biology.

James Brown has recently revisited the outputs of two workshops, on which the UK strategic roadmap for synthetic biology was built. The resultant paper will aid the SBLC in a future review of the roadmap, in which it may consider: whether the short-term goals highlighted in the roadmap have all been achieved; whether the medium and long-term goals are still relevant and what action is required to achieve them; and whether any issues have been overlooked. The SBLC considered this to be an incredibly valuable piece of work. The paper may be published on the SBLC website, subject to the necessary agreements.

James and Lionel updated the SBLC with progress on the SBLC response to the capital consultation. James and Lionel held individual meetings with various stakeholders before meeting with the research councils and TSB to coordinate the response. The response, to be submitted the day after this SBLC meeting, will take the form of a letter from Lionel and James that makes a strong case for future capital investment to support synthetic biology. The letter will highlight the importance of continued investment in the 'innovation engine' to: provide access to the latest technology; develop new ways of working in which sufficient numbers of relatively inexpensive equipment operate at scale in an automated fashion; develop software to move towards fully-integrated platforms; ring fence dynamic funding for as yet unknown cutting-edge equipment of the future; proliferate technologies and equipment through an innovative business ecosystem; provide incubator spaces for start-ups, SMEs and larger companies; and provide a distributed network of equipment and investment in industry to develop clusters, potentially based around application areas. The response will also emphasize the significance of maintaining the UKs position at the leading edge of technology development, and building the UK capacity to support commercialisation (which mirrors the response of the IBLF). The letter will also reference the identification of synthetic biology as one

of the 'eight great technologies,' existing UK commitments in synthetic biology and the opportunity to build on existing projects, and the potential to attract inward investment. The SBLC agreed with these points, adding that synthetic biology will benefit from advances in many fields including microfluidics, nanotechnology, sonic distribution systems, and software development, as well as developing the right standards to allow interoperability and increase reproducibility. Synthetic biology has, in the long-term, the potential to become the ultimate distributed manufacturing system, where protocols are sent to automated systems that conduct experiments and send data in reply. Long-term maintenance of equipment, funding for consumables and the importance of core support staff were raised as potential concerns. This discussion was parked until the arrival of the Minister.

Lionel announced the new BIS Entrepreneur in Residence (EiR) for synthetic biology, Prof Tim Dafforn from the University of Birmingham, with whom Lionel will meet again shortly. Tim is expected to commit approximately 40 days over the next year. Tim's role as EiR is expected to directly support the SBLC.

Action 6-15: Lionel Clarke to invite Tim Dafforn to join the SBLC.

8 International activities

SBLC members recently contributed to the development of the ERASynBio Strategic Vision, which has many similarities to the UK strategic roadmap for synthetic biology. The SBLC noted that the positions of the UK, EU and US vary.

In October/November 2013, the UKTI trade mission to the Bay Area highlighted the mutual benefits a joint UK/US view on synthetic biology policy could provide. As such, joint UK/US policy meetings are planned for 27th October 2014. The relevant UK minister(s) will be invited. Likely area of discussion include: standards and metrology; economics (capturing value and the best business models); safeguarding investment in the bio economy (including but not limited to risk regulation, biosecurity, and intellectual property); and human capital (skills, training, expertise). It is envisaged that the meeting would result in a white paper.

James is working with Suzanne Jones (BIS) and Alison MacEwen (FCO Paris) to organise a visit from a French ministerial delegation. The SBLC noted that French researchers already have good links with Imperial College London and the IKC, and consider that a French visit could help the UK understand how we might have a stronger influence regarding EU issues. The SBLC acknowledged existing links with France, the US and China and discussed which other countries the SBLC might engage, including some requests recently made to the SynBio SIG. The SBLC noted that the recent SIN report on international activities in synthetic biology and ERASynBio actions would help prioritise different countries.

9 Summary and discussion with Rt Hon David Willets

Upon the Minister's arrival, Lionel summarised the main points from the meeting, starting with the SBLC's collective sorrow regarding Ron Egginton's untimely death.

Lionel highlighted efforts to coordinate related activities in the UK, including the formation of the informal science and technology group and it's interaction with the BIA, and the meeting of the

chairs of the SBLC, IBLF and ATLC. The Minister noted that on a recent trip to the US, coordination of synthetic biology in the UK was looked upon very favourably. The Minister and the SBLC discussed potential application areas in which synthetic biology technologies, tools and platforms might deliver early success stories, including diagnostics, biosensors for in-field testing, chemical production, and drug manufacture. The Minister and the SBLC discussed the need for strategies to professionally and systematically explore the infinite biological design space, requiring multiple, relatively inexpensive and distributed robotic platforms in conjunction with the appropriate software. The SBLC recognise that relatively little data is reproducible, indicating that we need standards to benefit from what has been done before. An engineering approach can accelerate the process and allow distributed manufacturing. The Minister recommended that the SBLC link rationalising and managing biological complexity to an end-use for communication purposes.

Lionel highlighted aspirations for the future, to start the process of mapping out the next phase of technology development in the UK. Many new opportunities are continuing to emerge since the Roadmap was first constructed early in 2012. For example, the design and development of a range of synthetic tissues and 'organoids' as representative and reproducible test media for the rapid screening and evaluation of new vaccines and other treatments. These and many other emerging capabilities will need to be assessed to determine the key factors that could form the inspiration and basis for a future Roadmap update.

Following a conversation he had in the US, the Minister questioned the need for a library of characterised biological parts, since their behavior varies in different host organisms. The SBLC acknowledged that much research to date has been limited to particular strains and cells, the contexts of which are well understood. As such, current research characterises parts in relatively simple ways. Rather than using synthetic biology *ab initio*, existing synthetic biology tools are mostly designed to tweak organisms into behaving in a more useful manner to meet specific needs or deliver particular benefits. It is anticipated that in the future, the incorporation of more complex characterization and internal control systems will make functional parts more robust to differing external environments, enabling the benefits of modularity to be extended to an ever expanding range of applications.

In a discussion focused on commercialisation activities, Lionel reminded the Minister of Prof Tim Dafforn from the University of Birmingham's recent appointment as the BIS Entrepreneur in Residence (EiR) for synthetic biology. Dick also summarized plans for Lean Launchpad, a scheme which has previously run in the US and in which the UK will now take part. The scheme, which will run at the IKC from January to April 2015, is designed to teach people how to set up biotechnology companies and test new business models. Participants will be expected to engage with approximately 100 potential customers over a ten-week period in order to refine their business pitch. The Minister asked whether any UK-based venture capitalists are expressing an interest in synthetic biology. Contacts were discussed (to remain confidential). The SBLC is considering how to obtain sharper metrics regarding return on public investments. The Minister acknowledged that the research councils and TSB are better aligned through schemes such as the Catalysts, but that the TSB now needs to link with the British Business Bank.

Action 6-16: Secretariat to invite a representative from the British Business Bank to attend a future meeting of this council.

The Minister was informed about the recent meeting of the SBLC governance sub-group, and the intention to submit a response to the pro-regulation innovation framework. The SBLC was also anxious to emphasise how the proposed implementation plan for the Nagoya Protocol could have implications on venture capital investment in the UK. The Minister was notified that the SBLC response to the consultation was very critical of the proposed implementation plan. It was explained that the SBLC would like a better understanding of the process to which it is contributing. It is the view of the SBLC that the consultation process itself could be improved to ensure a more balanced outcome. The Minister confirmed that there is much discussion between BIS and Defra regarding the current status of the proposal. The SBLC highlighted a need for more pre-emptive engagement with the community and the provision of clearer guidelines to aid practitioners.

Action 6-17: BIS secretariat to share an update on the BIS/Defra discussions regarding the proposed implementation of the Nagoya Protocol with the SBLC.

Action 6-18: Joyce Tait and Lionel Clarke to plan (i) who should engage in a discussion of policy and evidence vs. politics and public perception, (ii) whether the SBLC, SBLC governance sub-group or other organisation should lead the activity and (iii) whether to invite Defra to participate in a telecon with the SBLC or attend a future meeting of the SBLC.

The SBLC and Minister had a very useful discussion about the infrastructure requirements for synthetic biology and the on-going capital consultation. It was concluded that the SBLC response to the capital consultation should include plans for an agile 'challenge fund' to enable members of the community to bid for the necessary equipment as and when it is developed and required. Such a fund would allow the community to build on what is already available, whilst justifying further expenditure in the future as will be needed to maintain progress.

The Minister was informed of upcoming meetings including the joint UK/US policy meeting in October 2015, plans to host a French ministerial delegation, and the next open meeting of the SBLC on 27th November 2015.

10 SBLC7: the next open meeting

The next open meeting of the SBLC will be held at the Royal Academy of Engineering on 27th November 2014. It is envisaged that the meeting feature a short session of internal business followed by a series of updates from SBLC members and invited speakers. In response to the feedback received from the last open meeting, time for Q&A will be allocated to each agenda item. The SBLC suggested the following agenda items:

- Training for early-career researchers, focussing on the Leadership Excellence Accelerator Programme (LEAP), which will launch in January 2015, and iGEM, which will have culminated in the 2014 jamboree on 30th October – 3rd November 2014.

- Coordination and collaboration amongst the UK infrastructure (from the science and technology group)
- A joint funding update from the research councils and TSB (if there is news) plus an update on outputs arising from recent funding.
- A commercial case study.
- Grand challenges to which synthetic biology may contribute and aspirations for the future
- Regulations applicable to synthetic biology (with an additional speaker from the SBLC governance sub-group)
- Links with Europe (such as France and ERASynBio)

Given the many activities taking place in November (including the UKTI trade mission to the Bay Area and iGEM), the secretariat warned the SBLC that the deadline for papers would be earlier than usual.

The SBLC currently meets three times a year: in spring (March), summer (July) and autumn (October, November or December). Given the calendar of synthetic biology activities, the SBLC consider that in the future it might be more appropriate that the summer meeting be the open meeting.

11 AoB and Close

The SBLC member agreed the action list (see Annex 2) before thanking the SBLC members for their contributions and formally closing the meeting.

SBLC Secretariat, August 2014

Annex 1 Summary of actions arising from the 5th meeting of the Synthetic Biology Leadership Council on 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.

SBLC Secretariat, April 2014

Annex 2 Actions arising from the 6th meeting of the Synthetic Biology Leadership Council on 3rd July 2014

Action 6-1: Lionel Clarke to write a note of thanks to Carol Boyer-Spooner, Sharmila Nebhrajani and Chris Warkup.

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

Action 6-3: Helen Bodmer and Shami Ahmed to consult Sharon Ellis before asking Julian Jackson (Defra) to (i) share Defra's response with the SBLC (ii) have another telecom with any interested members of the SBLC.

Action 6-4: Dick Kitney and the science and technology sub-group to consider the EU consultation regarding the definition of synthetic biology.

Action 6-5: Amy Tayler to share Ben Sheridan's revised digital bio-manufacturing strategy with the SBLC.

Action 6-6: James Brown to finalise a logo for UK synthetic biology activities and provide guidelines for use.

Action 6-7: Dick Kitney, David Tew, Janet Thornton, Amanda Collis and Joyce Tait to consider how synthetic biology might be applied to a grand challenge, for presentation at the next SBLC meeting.

Action 6-8: Lionel Clarke to invite the selected nominees to join the SBLC governance sub-group.

Action 6-9: Secretariat (KTN and BIS) and relevant UK Government Departments to look out for future UK, EU, UN and OECD consultations (which often come through a Government department) and to seek opportunities for the SBLC to be engaged at an earlier stage wherever possible and appropriate.

Action 6-10: Shami Ahmed to check the deadline for responses to the pro-regulation innovation framework, and Joyce Tait to coordinate a joint response on behalf of the SBLC governance sub-group.

Action 6-11: Dick Kitney, Amanda Collis and Joyce Tait to summarise current activities concerning biosecurity for use at a policy meeting in October 2014.

Action 6-12: Amanda Collis to discuss (i) the potential for synthetic biology to provide solutions for natural and man-made threats and (ii) workshops to support policy discussions with the cross-council synthetic biology working group.

Action 6-13: SynBio SIG to analyse company membership of the SynBio SIG, including sectors and where they fit in the supply chain.

Action 6-14: Chris Jones to consider the outputs of TSB investments in synthetic biology.

Action 6-15: Lionel Clarke to invite Tim Dafforn to join the SBLC.

Action 6-16: Secretariat to invite a representative from the business bank to attend a future meeting of this council.

Action 6-17: BIS secretariat to share an update on the BIS/Defra discussions regarding the proposed implementation of the Nagoya Protocol with the SBLC.

Action 6-18: Joyce Tait and Lionel Clarke to plan (i) who should engage in a discussion of policy and evidence vs. politics and public perception, (ii) whether the SBLC, SBLC governance sub-group or other organisation should lead the activity and (iii) whether to invite Defra to participate in a telecon with the SBLC or attend a future meeting of the SBLC.

SBLC Secretariat, August 2014