Australasian Synthetic Biology Challenge Handbook 2023

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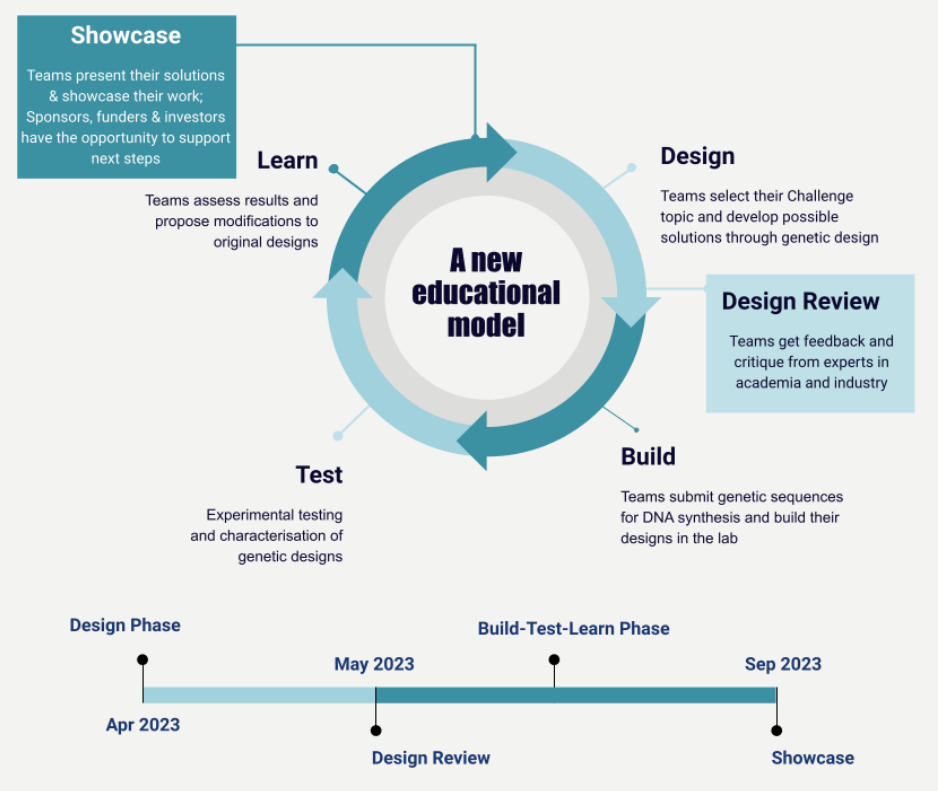
Contents

Introduction to the Challenge	**3**
Introduction to Synthetic Biology	**5**
Diversity and Inclusion	**6**
Schedule and key milestones	**6**
Challenge Deliverables	**8**
Designing Your Presentation	**11**
Teamwork and Teams	**12**
Team Recruitment	**14**
Communications	**15**
Suggested Project Ideas and Planning a Project	**15**
How to Build a Continuing Support Network	**18**
How to Find Lab Space, Funding and Publicity	**19**
Travelling to the Final Showcase	**20**
Intellectual Property (IP)	**20**
Redefining and Embracing “Failure”	**21**
Rules and Guidelines	**22**
Frequently Asked Questions	**26**

1. Introduction to the Challenge



Welcome to the Australasian SynBio Challenge! Through participation in this challenge, you are helping to build a vibrant, diverse, and connected synthetic biology community across Australia and New Zealand. The challenge aims to create a framework through which student teams and their mentors in academia and industry can apply synthetic biology principles towards tackling real-world problems.

The premise of the Challenge is simple; each university will form a team (or multiple teams) to work together to develop an original synthetic biology project designed to be innovative, scientifically feasible and that aims to solve an important problem that is prevalent in Australasia. As a challenge team, you will have opportunities to receive feedback on your project ideas from experts in the field before building and testing your biological designs in the lab. Throughout the process, you will have opportunities to learn from other team members and from a wider synthetic biology network to push your project forward. Your team will have opportunities to not only develop scientific lab skills, but to also delve into project design and gain experience communicating your idea to expert and non-expert audiences. An important goal of the challenge is to consider the larger social, cultural,

environmental, and ethical implications of your project. Taking these considerations into account will help deliver greater impact from your work.

Ultimately the challenge aims to be a catalyst for scientific innovation within Australasia and launch future investment in the field. This can only be achieved by a well-connected scientific ecosystem with strong ties between academia, industry and a deeper connection with the broader community. Through the challenge, we aim to reinforce these professional connections through connecting teams with the broader ecosystem and move closer to a resilient bio-economy that can address some of the world's most pressing challenges.

The following document was created as a reference guide for creating a team and participating in the challenge. We look forward to working with all the teams for a successful year!

2. Introduction to Synthetic Biology

Synthetic biology (SynBio) is a rapidly evolving field of research that merges the latest advances in biology, chemistry, computer science and engineering. This merging of ideologies enables us to look at biology in a manner more accustomed to an engineer, setting aside (but still appreciating!) the complexity of biological systems and treating genes, proteins and cells as discrete parts and components that can be re-assembled and re-engineered to create new systems with novel functions. It is a field that aims to provide sustainable, bio-based solutions to some of our biggest problems but also help push the bounds of our knowledge and understanding of the world around us.

Synthetic biology is growing rapidly and already delivering solutions to real-life problems. Examples of commercial SynBio projects include:

1. Bioproduction of Artemenisin, an antimalarial drug
2. Spider silk based materials used for sustainable clothing
3. Production of fragrances and cosmetic additives used in cosmetics
4. Cruelty-free meat replacement products

For more inspiration please visit:
Current Uses of Synthetic Biology

If you would like to learn more please also see the following links for an introduction to synthetic biology:
Synthetic Biology Explained
Synthetic Biology - What should we be vibrating about?

3. Diversity and Inclusion

Synthetic biology brings together a diverse range of fields and people and we want the challenge to do the same. Diversity drives innovation and we are committed to ensuring that everyone is welcome and that difference is valued. Part of the goals of the Challenge is to advance STEM by harnessing the diversity of our people within a genuinely inclusive culture to drive better scientific outcomes. We strongly encourage participating teams to strive for gender balance as well as other forms of diversity such as cultural, ethnicity, academic background, sexual orientation and ability where possible. It is a requirement that teams are inclusive in the Challenge milestones. Therefore, there should be equal gender participation in the Challenge tasks including the event presentations and lab-based tasks.

4. Schedule and key milestones

The challenge is built around the Design-Build-Test-Learn cycle with the program divided into phases to ensure all teams can move together and have the same experience overall. There are two key events to mark your progression throughout the Challenge:

1. **Design Review & Design Showcase**
2. **Final Showcase**

The **Design Review** is the first key milestone. It's important to take time to design and develop your ideas to ensure your project will be achievable within the given time-frame. We encourage all teams to put time into planning their projects in the "Design" phase of the Challenge – hint: check out the guidelines below for some questions to be asking yourself along the way. When you're feeling confident in your design, fill out the Design Review template that will be emailed to each team and submit it to the Challenge email. We will organise an expert in the field to go over your plan and provide feedback on your approach.

The **Design Showcase** is a virtual meetup for all the teams! Each team will be required to deliver a short presentation (more on this in sections 5 & 6) to all the other teams. The ability to communicate your ideas and approach in a quick and digestible way is incredibly important in science, so the Design Showcase serves as a great way to develop your skills! It'll be the first time you're meeting all the other teams, and will be another place to get feedback on your project. Remember this is a Challenge not a "competition" so be open with your ideas and be constructive with your feedback.

The Challenge culminates in the **Final Showcase** in September, where all teams and their mentors will gather together in Canberra for the first ever in-person event since the

Challenge started to celebrate the achievements of the year. There will be invited special guests and reviewers, as well as members of the wider Australasian synthetic biology community who will be invited to attend to hear all about the Challenge. Each team will be required to deliver an investor-style pitch and a more formal presentation.

During the year teams will be invited to take part in a series of workshops provided by key stakeholders and sponsors. Topics may include: Intellectual Property management, SynBio techniques, ethical considerations in SynBio, Commercialisation, and Pitch training. Teams should keep an eye out for these seminars as well as in-person meetings with representatives from our partners as they will be highly useful to success in the Challenge.

Deadline	Milestones
Feb - April 2023	• Fill in Student and Instructor surveys and return to the Challenge • Confirm timetable for the year with all Team members • Instructors/Leads should ensure all lab resources and needs are available • Start your Challenge! Remember to use the Guidebook and reach out to your team mentors, and the Challenge Team should you get stuck or confused. We are here to help!
May - July 2023	• Complete the Design Review template and submit it to the Challenge. The Challenge will organise an expert in the field to review your plan and give you any comments or feedback. Design Review Templates will be emailed to each team. • If you are still designing, remember you need to submit your **Design Review template by the deadline.** • Alongside this, remember to put together your Design Showcase Presentation. The **Design Showcase** will be held on July 17 - more details to come!

July 2023 – August 2023	• Continue working in the lab on your project and gathering data for your Showcase Presentation • It's a good idea to think about what you want to put in your presentation throughout this time and not leave it all to the end • Prepare your logo and abstract for the AusSynBio Challenge website • Start fundraising to help support the Final Showcase trip so that all the team can make it to the event.
29th September 2023	**Final Showcase event!** The Final Showcase will be a hybrid virtual/in-person event on the 29th of September 2023 and held at ANU in Canberra! A limited amount of support for teams to travel to the event will be provided. Make sure you have: • Put together your Presentation and other submission requirements • At the end of the Showcase, please make sure to fill out your post-Challenge surveys

5. Challenge Deliverables

There are five main deliverables that are required by each team in this project. These are described in more detail below.

- Design Review document
- Design Showcase short presentation (8-10 mins)
- Final Showcase presentation (10-15mins)
- A pre-recorded 3-minute investor pitch
- Web presence: 1-250 word description of your project and at least one visual aid (photo, schematic, or video) for the Challenge to upload on our website to show your fantastic work to the world.

DESIGN REVIEW TEMPLATE

Your Team's participants should work together to fill out the provided Design Review template. The template will ask you to explain your idea and genetic design. This will be submitted to the Challenge, and we will pass it on to an expert. You will then be provided with feedback about your approach and ideas! It's good to have another pair of eyes look over your designs, and help fine-tune the project. You should aim to provide as much information as you can, but because this is still early in the process, we don't expect polished details. Your Team should view the Design Review as an opportunity to get feedback and improve your idea and design. It is useful to consult the "Guidelines" to help guide your idea development. It is not expected that you will have thought out every aspect of these guidelines, but rather keep them in the back of your mind as you move through your project and think about why you are doing what you are doing. Some things that you should be thinking about when you fill in the template are:

- A quick intro of your Team (participants, instructors, leads, classroom format – e.g. is your Team run through an internship program or a course, and how many hours per week you have allocated to your project, etc.)
- the motivation for your project
- the biological design itself
- genetic parts needed to deliver the design and which organism you have chosen
- The laboratory work pipeline (e.g.: transformation, screening, testing, etc.)
- an expected working timeline and expected budget

Once you have had your Design Review, you have the green light to get started in the lab! Note that design reviews can be submitted any time but must be submitted by the Design Showcase. Remember that your audience in this case is a panel of biology experts, so tailor your submission accordingly.

DESIGN SHOWCASE

Your Team's participants should prepare a short (8 minute) presentation of their idea for the Design Showcase. This should articulate their problem, give a background of the "why" of their project and a brief overview of their proposed solution – so remember to bring heaps of enthusiasm! Keep it short and simple and remember to include what your idea/product is, how you arrived at it and most importantly your "why". The aim of the Design Extravaganza is to connect with your community! Take this opportunity to get to know your fellow Challengers and what they are up to, ask questions and maybe even discuss shared problems or solutions. Remember that your audience in this case is a mixed group of people who might not know as much or as little as you, but who are probably more interested in why

you're doing what you're doing and who you are. Again, we ask the teams not to include technical details that might lose your audience (although some might have technical questions for you). The most important part of this is to have fun and bring as much of your passion for your work to the presentation.

FINAL SHOWCASE PRESENTATION

At the final Design Showcase your Team's participants will present at the Showcase Event to be held in Canberra on September 29, 2023. We expect to have an audience of professional synthetic biology researchers, as well as a mixed audience of people including our partners SynBio10x, CellAg, Integrated DNA Technologies, New England BioLabs, and Twist Biosciences well as other investors or entrepreneurs and experts from non-synthetic biology disciplines. For this Final Showcase presentation, it is important to make sure you are now well familiarised with the 'Guidelines and Values', which will aid judges where prizes are concerned. These guidelines should help you decide what information to include and address in your presentation. It might not always be possible to address every guideline in the time frame, and some guidelines might apply more strongly to certain projects than others. Just try to bear these in mind and think about including relevant information where you can. The sections of your presentation should address:

- 10 minute presentation with an additional 5 minutes for questions.
- A quick intro of your Team including names of your participants and academic background; e.g. our team is made up of 2 engineering undergraduates and 3 honours students working in microbiology, synthetic biology and social science.
- The "why" for the project
- An overview of the biological and genetic design
- The lab work you conducted
- Your results and findings and interesting or key 'failures' in the design. Technical failures such as troubleshooting PCRs are generally not required but can be included if important to the discussion.
- Your final conclusions
- Acknowledgement of your Team Lead and Mentors (their names and their roles in your team).

SHOWCASE PITCH

At the Final Showcase, teams will also present a pre-recorded pitch presentation. This will be 2-3 minutes in length and should be presented in a style as if teams were pitching to potential investors. This can be done as a recorded powerpoint presentation or video

recording. Teams will learn more about this during the workshops throughout the year, however as a reminder the pitch should:

- Be concise! You only have 3 minutes to get people interested
- Articulate your problem and why it is important
- Recognise the opportunity for innovation
- Explain your solution (don't be technical - this is a pitch to gain interest and follow on discussions)
- Identify your team and why they are the best to take it forward
- A basic techno-economic analysis for feasibility or financial projections
- Be clear and don't use jargon – these are investors NOT synthetic biologists

WEB PRESENCE

We ask that you also submit a 250 word description of your project and a logo for your team to upload on our website. This provides a nice way to summarise your idea and project and have a place online to reference your participation in this Challenge after taking part. Photos and Videos are also a great way to creatively share your project with a wide audience of diverse backgrounds. You can get others to help you with filming and editing your video, but any non-participant contributions should be made known and appropriately acknowledged. Social Media is another great way to promote your work. If you set up an account let the Challenge Committee know so we can follow you and promote your work to the world!

Examples of videos:
Visualise your thesis.

6. Designing Your Presentation

Presenting your team's work is a major part of this Challenge, so it's important you take the time to think about how you can best communicate your project. Below are some tips on how to design a good presentation:

- **Keep your audience in mind** – who's going to be listening to your presentation? It's important to know who your audience is so you can tailor the technical content of the presentation accordingly. It's important to explain acronyms and scientific techniques, but there are many cases where this may not be as important if your audience has a scientific background.

- **Signpost** – good presentations take their audience on a journey, and signposting is a really good way to help keep your audience engaged so they know what's coming next.
- **Use clean graphics, colours and fonts** - a good presentation is an engaging one that uses colours and graphics to keep the audience's attention. Transitions between slides, emphasis text effects and other animations can help guide you through the presentation as well, and can be particularly helpful if you're nervous about forgetting what you were planning on saying next. That being said, use them wisely, because when overdone they can derail a presentation completely.
- **Tell a story** – take some time to think about the logical order to present your results. Sometimes the results make more sense when presented in an order that differs from the way that you performed the experiments. The right order can help build a case and sell your project, and can also bring about some interesting analysis.
- **Be honest** – if something needs more time to confirm, or you just couldn't get a technique to work, let the audience know. It's okay to show a work in progress, and it lets the audience know that you're approaching a problem from multiple angles.

7. Teamwork and Teams

The Australasian SynBio Challenge welcomes teams of all shapes and sizes. We want teams to focus on tackling big problems, this requires them to be made of a range of disciplines and skills. Start-ups talk about having a "designer", a "hustler" and a "hacker", we want teams to keep this in mind when assembling members. It is very important not to limit your recruitment to the most obvious, closest environment. Apart from life sciences (e.g. molecular and synthetic biology) students and those from adjacent science departments you should be advertising more widely within the University. Students with backgrounds in general engineering, computer engineering, automation, design, business, social sciences, humanities and other disciplines will make a great addition to your Team! You should also remember that you are not only looking for "hard skills" in the Team members, students that show ingenuity, creativity and initiative are key for helping projects form and progress. Another thing to keep in mind is that the Team will need to work closely together in a span of a few months, so it would be advantageous for the students to enjoy each others' company and be able to work collaboratively. Remember you are trying to solve a societal problem and therefore need to understand what that problem is, how it presents itself to the public and how your solution will be implemented.

Once you have decided on your project it would be wise to divide your team by both their strengths and interests, as it is not possible for all team members to participate in all activities. This doesn't mean that some team members can rely on others to complete their tasks while they wait for their turn. Team members should be participating to a reasonable capacity to keep the challenge running and may help other teammates or delegate tasks to make sure everyone has work packages that they are working on given the short timeline of the Challenge.

Participants

Ideally a team will comprise of 5-10 participants who are students and are the main stars of the Challenge. For team members, students can range from Undergraduate level through to Masters level. Students can come from any discipline; be it life sciences, engineering, art and design, or social sciences. In fact, mixed discipline teams are highly encouraged! However, participants are expected to follow the design-build-test-learn cycle of synthetic biology, which will involve researching literature, designing DNA parts, building and testing them in the lab, and recording/learning from the results you obtain. If your team does not have any students with molecular biology or genetic engineering backgrounds, make sure your Team Leads and Instructors have accounted for training you appropriately so that you are able to participate effectively!

Participants are responsible for working as an effective team to design their project, plan how their project will run, do the lab work, analyse results, and meet the other requirements of the Challenge such as meeting milestones to prepare and deliver presentations and documents for the Design Review and Showcase events. While students may receive expert guidance and support from their team leads and instructors, the students will be undertaking all experimental work to gain valuable experience in synthetic biology.

It is up to each individual team to decide how they organise student team members and distribute tasks and responsibilities. Teams may like to consider teamwork tools such as team charters, team-building activities, electronic collaboration, and agreed forms of communication. Remember that working in a team is a vital skill in research, although it can sometimes be a challenging experience.

Team Mentor(s)

Team Mentors are the people who are there to help the student members of the team and provide supervision in the lab. These could be Masters students, Ph.D students, post docs,

or even principal investigators who can demonstrate that they are able to support their team in the lab. Team Mentors are not allowed to do the lab work for the students. Each Team may have more than one Team Mentor who might share the workload between themselves, but the time dedicated to the Team by each Team Mentor should be clearly agreed on from the onset.

Team Lead

The Team Lead is normally a Team Mentor. In some cases, the Team might have a more senior Team Lead who is not necessarily in the lab with the students, but is available to check-in and to provide feedback and expertise. Team Leads should be able to dedicate a minimum of 30 minutes a week (or 1 hour bi-weekly) to meet with and support their Team. The Team Lead will be responsible for checking in regularly with the Challenge executive should any problems or questions arise. Your team lead is responsible for ensuring the Challenge complies with the University's criteria and is responsible for overseeing all administrative and regulatory requirements (e.g. safety and insurance). Any problems with the University should be discussed with the Challenge executive using the email contact details provided.

8. Team Recruitment

As the Challenge is still growing, team recruitment may take significant effort due to students not being aware of the Challenge or having the benefit of processes in place with a longer lead time period for notifications. To help expedite this process and set up your recruitment well we've listed a few ways you can recruit students.

For team leads and faculty:

a) Send an email to the relevant student mailing group announcing the Challenge and the recruitment of a Team (this would require appropriate approvals and adherence to your institutions e-mailing policy).
b) If you are involved in a course in your university with a relevant student audience you can advertise the recruitment through it. You can even get creative and use the course to organise a preliminary selection for potential Team members.
c) It is also possible to advertise the recruitment via "word of mouth" – encourage the already-recruited members to reach out to their contacts and encourage them to apply.

For students:

a) Share the announcement emails and documents with your friends by word of mouth or through different socials – remember diversity is key!
b) Share the application flyers on your socials and direct potential teammates to your team lead or faculty member.
c) Take time at your next practical class or tutorial to make an announcement to your peers and provide the application information

Finally, in some cases where the number of applicants is above the Team size limit (currently 10 members) you may have to either:

a) Decide to start two or more teams
b) Do a preliminary selection by either starting a mini-competition within a course (as mentioned above) or *via* a round of interviews that would limit the student pool based on relevant criteria.

9. Communications

Our contact email (hello@aussynbiochallenge.org) should be the first point of call if you need help or clarification at any point during the challenge.

Once your team has formed, you will be required to complete a registration form. On this form, we'll ask you to nominate one team member to be responsible for communications. We will be emailing the teams every 2 weeks or so, and we ask that this person is responsible for replying to those emails when required and contacting us if there are any problems with receiving those emails.

10. Suggested Project Ideas and Planning a Project

Project Ideas

Generating project ideas can be a difficult task, particularly if this is your first time designing a research project, or even your first time in a molecular biology lab. However, to help the process, there are a few steps that can be taken to form a project.

One approach is to look towards the expertise that is available in your university environment. While we do not recommend continuing on from what existing research laboratories are already working on, instead, having a look at the areas of expertise that are

available in your university can be a great way to achieve something new and exciting at the synergy of different scientific fields. It can also be a way of splicing off a separate project from an existing research program that is unique to the challenge.

The second approach is to look towards the world's biggest problems. Check out the UN's link to the most pressing problems in the world for some inspiration:

- Sustainable Development Goals

It's not expected that you can solve these problems during the Challenge, but ideas that move us closer to a sustainable bio-economy are highly welcome in synthetic biology. You could brainstorm amongst your team or look to the news, Australian charities or even social media for potential problems to help solve.

Related to this topic, some familiarisation with synthetic biology and its "ethos" can also help with project ideas. Following basic courses on synthetic biology as well as taking a look at past iGEM projects, could help your team to generate some basic ideas. Using an online synthetic biology course as a source of inspiration could also result in ideas with more application potential. Therefore when you're coming up with a project, it may also be useful to consider how your project might continue beyond this challenge and towards a real-world solution.

United Nations Sustainable Development Goals (originally at un.org sourced from: Wikimedia Commons)

Developing an idea should entail conducting deeper literature searches and developing short proposals to refine the idea. You should discuss and consult with the team leads at your

university for feasibility. A few meetings may be required before the team selects their favourite/ best project.

A team should only have one project, but we encourage you to think big so it may contain multiple sub-projects with focused ideas and measurable results that can be achieved within the time frame of the Challenge. If a team cannot settle on just one project, consider splitting them into two smaller separate teams. A project may contain a variety of aspects including: mathematical modelling or simulation, molecular biology, social science research, instrumentation development, and also appropriate collection and analysis of results. Keep in mind that presenting your results and working through the social impacts is also a significant part of the project which should be prioritised as work packages for team members to manage and complete.

Learning to manage this process through collaboration and teamwork is one of the important takeaways from participating in the Challenge. If participating in multiple Challenge years, this would be a perfect opportunity to change the area you worked in if you wish to do so. Lastly, we do not work in isolation in science and public acceptance and understanding of our work is essential. Therefore we ask that you also please consider the ethical, environmental, economic, legal and social issues surrounding the project.

Planning a Project

After selecting a project with your Team Lead, a detailed planning process should begin. A successful project has an incredible number of elements to be designed and made, models to be written and tested, data to collect and analyse, presentations, fundraising, travel, etc. This would be overwhelming for any one person, so it is important to delegate and coordinate.

You can consult with the Challenge organisers, however it is also wise to elect someone from the Team as a manager that is responsible for keeping track of the timeline of the challenge activities. They say that “time flies when you’re having fun” but believe us, time really flies in the Aus SynBio Challenge!

Once the plan is defined, the plan can either be outlined in more detail either by the whole team or by small working groups dedicated to particular sub-domains or parts of the project. Some parts of the project, such as the poster or presentation, will need to be planned at a later stage, once progress has been made and (perhaps) data collected. Planning along with

progress reporting should be a continuous process driven by the team's manager, but it's up to the teams to also keep track of their progress.

The scientific portion of the project is the most likely to contain the greatest challenge for the team and will likely require considerable input from advisors and instructors. The effort invested in planning the project will not only greatly enhance the chances of a successful conclusion, but also reduce the amount of work required throughout the competition.

Once you have your project planned out, make sure you also arrange regular meetings with your team members and instructors. This will help you all stay on the same page and keep the momentum up. Also, think about creating a team slack or other communication channel so you can share ideas, keep people updated on projects and fundraising or just share your favourite articles, gifs and memes for #inspo!

Part of good scientific practice is taking clear and practical notes. Your mentors will have their own styles and so will you, but just remember to be consistent with your style and make sure you are noting down all the important information – both good and "bad" results and information is necessary to record. Perfecting this habit early on even when you are busy will make sure you keep to your plan and identify any possible mistakes or potential problems that could derail the project. Keeping a good lab book is also one of the requirements for working in a university lab and the project you start now might be continued on by you and your team, or someone else entirely. To ensure that it wasn't all for nothing and things don't need to be needlessly repeated, a good set of lab book notes can save a lot of time and keep projects progressing well so your hard work pays off.

Some universities may have already implemented online lab books (E.g. Benchling or Lab Archives) or have specific requirements either allowing or banning these tools. Therefore it's important to chat with your Team Lead before organising lab books. The same goes for other collaborative online tools such as Google Drive or Dropbox. If allowed by your institute's IT and record-keeping policies, these tools can be fantastic for collaboration and therefore highly useful in managing the team.

11. How to Build a Continuing Support Network

In addition to the team instructors, successful teams should reach out to the academic, commercial or general community when they need to recruit additional expertise. The more extensive and effective the network of specialists and consultants, the less likely the team is

to become bogged down in problems and the more they will feel part of something important. Encourage network building by having team members identify professors or companies that have valuable information, then contact those people to ask for help or just to invite them for a chat. This is a national challenge with teams from all over the country, so in the spirit of cross-pollination and collaboration, we encourage teams to connect with one another, whether that be within your respective cities or interstate.

Talk to your Team Lead and mentors as they may be able to facilitate some local mixer events for your teams to come together and grow your networks. Additionally, there are national SynBio groups like the Australasia Synthetic Biology (SBA) community, the CSIRO Advanced Engineering Biology Future Science Platform (FSP) or the ARC Centre of Excellence in Synthetic Biology (COE) who all might help you and your team build your network within the Australian synthetic biology community.

12. How to Find Lab Space, Funding and Publicity

Lab space

Your team instructor will have organised a Lab space via a sponsoring department/ company. You can also try to find permanent lab and meeting space for the team as this will permit year-round use. This will be especially important in the final showcase approaches and lab work needs to be finished in a hurry. As part of this you will have to go through the appropriate Health, Safety and Biosafety inductions and training, these are routinely held in most organisations or can be booked for special groups. Your team instructors will be able to help you organise a time to do these. Also, remember that if you are in a research lab, it is a communal space, so please be respectful of the other users in the area and don't feel afraid to ask for help! Everyone has to start somewhere and your fellow lab users will appreciate you asking first.

Funding

One fundamental question each team will need to answer is how much fundraising to attempt and what sources to focus on. Some projects are very suitable for approaching specific industries, such as biotech, energy, or pharmaceutical companies. Other teams will have easier access to more traditional forms of academic funding. To a certain extent, some element of fundraising should exist in all team projects, as the entrepreneurial experience is an important element of the challenge. It is important to consider what you might need the

extra funding for as some of these activities might be readily available *via* your support network (which is why it's important to reach out!).

How to Approach Companies/Industry for Networking And Fundraising

A lot of companies will be happy to contribute a small fraction of their annual budget in return for some recognition if they can relate to the importance of what you are trying to achieve with synthetic biology. The best approach is to have a clear objective and a well thought out plan about how to achieve it. Make sure you give a brief, clear, professional pitch that conveys the importance of your project, and be clear on any recognition they will receive in your final showcase.

The challenge organisers have already received support from a number of organisations, and the details of this support will be released very soon!

13. Travelling to the Final Showcase

After three years of online only events we are excited to announce that 2023 is on track to hold the Final Showcase in person. We will announce details and plans for an in-person event as early as possible. Alternatively, the Final Showcase may be a hybrid online/in-person event where teams meet locally in their state. Keep in mind that the Final Showcase may require your team to travel to the event. While some teams may get support from their institutions for this, it is likely that teams will require extra funding in the event of the need for travel and so we encourage you to factor this into your plans early and seek out extra fundraising opportunities. Publicity can be a key element for teams as a recognition of effort, promotion of their institution, attracting new team members, rewarding sponsors or sourcing new ones, and developing new course programs, around the Aus SynBio Challenge.

14. Intellectual Property (IP)

The Aus SynBio Challenge currently has the preference of treating intellectual property (IP) arising from the challenge as open-source, especially as teams are asked to present on work in the equivalent of a public forum. However, intellectual property is also an important asset and if the team feels that aspects of the work could be commercialised and patented then they are advised to seek advice early in the project. Most, if not all, universities have access to teams of experts who can help teams with specific questions regarding intellectual

property, and may be able to assist with pathways towards protecting IP. If the work is to be patented, then aspects of the work can still be discussed without specifics of the sequences used for example. It is the Aus SynBio Challenge philosophy to allow for as much information sharing as possible to advance the field of synthetic biology. Teams will retain the copyright of any documents or presentations. Teams are encouraged to contact their Team lead and Tech transfer offices about any specific concerns they might have regarding managing IP and an Intro to IP seminar will be conducted at the beginning of the Challenge.

15. Redefining and Embracing "Failure"

The Australian SynBio Challenge is rewarding but also challenging. It wouldn't be called a "Challenge" otherwise. However, your mental and physical well-being is of the utmost importance. Yes, you're here to do an exciting research project as part of the Challenge but it is important to look after your wellbeing and the wellbeing of your teammates. Real science research is hard and often things will not work out the first time (or second, or third time...). But don't view "unsuccessful" experiments or negative results as useless, they are only useless if you don't learn from them. Embrace the "failing forward" ideology and treat these as opportunities to learn and refine your skills and abilities. Plans and schedules are there to make it easier to run a successful project and pivot when things change, NOT to blame the responsible person when things don't go according to plan. The early recognition of mistakes and failures should be encouraged and congratulated as this will enable the team to get back on track and move forward together. Admitting error is much less costly than trying to hide them.

In fact, admitting error is an important part of scientific discovery. Life sciences are currently going through what we call a replication crisis (it even has its own Wiki page). Due to a combination of inadequate data capture practices and scientists being discouraged from reporting "bad results", there is an ongoing concern that part of scientific literature cannot be properly reproduced. One of the things that we are hoping to promote in the Challenge is state of the art practices that will make your work reproducible and trustworthy. Once again, we want to stress that the Challenge should be a fun and exciting competition that will improve your training experience at University, and we ask all participants and team leaders to keep this at the front of their mind when designing and running the team Challenge.

16. Rules and Guidelines

Rules

1. The project should **NOT** be a continuation of a Mentor's research program. The project can be related to research in the Mentor's lab but should have a novel component or branch into a new area.
2. Teams are to be collegiate, considerate and respectful with their own team members, other teams and Challenge participants and Executive.
3. Teams are to follow the instruction given by their team leaders as well as local requirements for working in their host university and facilities.
4. Teams are required to work openly to the best of their ability and contribute to the scientific community.
5. Teams must follow the appropriate staff and student Code of Conduct/s of your university.
6. Teams must follow applicable laws and regulations, including those from the Office of the Gene Technology Regulator (OGTR), and those involving biosafety and quarantine.
7. Teams must follow the Australian Code for the Appropriate Conduct of Research.
8. While the executive will make every effort to consult and ensure the Challenge program fits with each team's respective schedule, each team is expected to appropriately engage and correspond with requests and emails. This is to ensure that your voices are heard and the challenge works for you. If the Aus SynBio Executive team does not receive correspondence in a timely manner as laid out in the emails, a decision will be made on behalf of the team.

Guidelines and Values

Below are some questions that should be considered by each team as you progress through the Challenge. Use these questions to develop your project – they are a good reflection of the Aus SynBio Challenge values and will be used to judge projects for eligibility for any prizes, and feedback throughout the challenge. Don't worry if not all of them seem applicable to your project, it's not expected that every team will be able to address every item!

Design

Approach

- Is the project original in concept?
- Is the approach to the chosen topic innovative?

- Is this project an extension of the Principle Investigator/Lead Academic's research? In what ways has the project been developed for this Challenge?

Feasibility

- How appropriate are the chosen methods for achieving the outlined design?
- Has relevant literature on current scientific techniques and "state-of-the-art" been consulted? Has this been used to evaluate the likely success of the proposed approach?*
- How could this project be funded and why?
- Does the design consider how the proposed technology can be integrated with, or used in place of, existing systems, both scientific and cultural?
- Is this design an appropriate solution to the problem socially? That is, is the application of biotechnology in this way culturally sensitive?
- Has this design been ground-truthed in the intended application environment, with input from potential end-use stakeholders? That is, have social and ethical issues been considered and articulated as part of a feasibility assessment?

Build + Test

Genetic parts

- Have the parts been constructed in a way that complements existing genetic tools? Are the parts compatible within a global synthetic biology toolbox?
- How adaptable are the parts constructed? Are the parts modular?
- Has the raw data been communicated in a way that is clear and understandable?

Analysis

- Is the data presented valid? Have sufficient repeats, controls and analysis been carried out?
- Have appropriate statistical analyses been conducted?
- Was the method designed successful? What evidence is there of this?

Learn

Process

- Were any new technical questions identified during the process?
- Were any new social/ethical questions identified during the process?
- What parts of the initial design need improvement?
- Has sufficient evidence been gained to prove/disprove your hypothesis?

- In what ways could the methods be adapted to improve the delivery of the project outcomes?

Self-reflection

- What are the strengths and weaknesses in the vision? How can these be addressed?*
- In what ways could the team develop to better deliver the project outcomes?
- Have all members of the team been heard, and have all resources available been used to the best of your ability?*

Implementation

Human impact

- How will the proposed technology potentially impact those who use it, and those who do not?
- How accessible is this technology?
- Have a variety of end-users been considered in the development of this design? For example, different genders, races, socioeconomic groups, and ages.
- How have any ethical considerations identified throughout this project been addressed?

Sustainability

- Have considerations been made about how this technology could impact living systems? Are these impacts mostly positive, or mostly negative? Are there ways these impacts could be minimised?
- How resource-intensive is the proposed design? Consider water, feedstock, energy, labour
- What is the life cycle of the proposed product?

Safety

- Is there a chance that this technology could be harmful for human health or to living systems?
- What are the maximum impacts if there were an accident during product manufacture or application?
- Is there potential for the product to be misused or exploited by those with ill-intent?
- How have these safety issues impacted the design?

Engineering

- Is the design scalable?

- What engineering challenges might be faced when attempting to scale-up this technology?
- What techniques or technology might be required?
- Is scale-up feasible now, or is it likely to be in the future?

Strategic plan

- What are the next steps once the Challenge is finished?
- Is further scientific development required? Is the technology at a place where it could be brought to market?
- What actions need to be taken to find more investments?

PRESENTATION

Design Showcase presentation (8 mins + questions):

- Does the presentation clearly address: how the design functions, what problem it is addressing, how the science works and how it could be implemented?
- Are the slides engaging and informative?
- Is the project aim clear?/Is feasibility addressed?
- Are there any visual designs of the proposed technology?
- Is the problem clearly articulated and why a solution is needed?

Final Showcase formal presentation (10 mins + 5 minutes for questions):

- Does the presentation clearly address: how the design functions, what problem it is addressing, how the science works and how it could be implemented?
- Are the slides engaging and informative?
- Are there any visual designs of the proposed technology?
- Are the results clearly presented using appropriate and legible graphs, tables etc?
- Is it clear how the team arrived at their chosen topic? Is the source of inspiration clear?
- Has any speculation about their findings in broader contexts of the intent of concept been considered?
- Is there a clear path for the future direction of this project?
- Has the team reflected on what might be done differently if they had their time over?
- Has any feedback from intended users of the design, or other potential stakeholders, been received? If so, has this been incorporated into the project in any way?

Showcase Startup pitch (3 minutes):

- Does it meet the time restriction of three minutes
- Is the “What”, “Why”, “How” and “Who” clear?

- Is the presentation visually engaging?
- Is the language used appropriate for the format of the presentation?
- Is the business case clear?

17. Frequently Asked Questions

1. What support does the Challenge provide to Teams who enter?

The Challenge aims to support all its Teams and see them prosper! This is a major reason for the Design Review, which is not intended to seem like a formal assessment, but rather an opportunity to bring your ideas to the experts, get their feedback and advice, and help your Team deliver the best version of your idea as possible! Your Team Lead should be your main point of contact between your Team and the Challenge executive, who will be reaching out throughout the year to check on your Team and see how you are managing the Challenge. Please make sure you respond to our correspondence so you don't miss out on anything. In addition teams are supported with mentorship, reagents and synthetic DNA from our sponsors.

If your Team is having problems relating to expertise, guidance or advice, you are encouraged to contact our challenge email and the Challenge Executive will do their best to help you solve them.

2. How are teams/institutions rewarded for doing well?

The real reward of participating in the Challenge is the overall experience of participating in a team on a dynamic laboratory project, the opportunity to better connect with the synthetic biology community (including non-academic stakeholders), and the chance to showcase your work and ideas to a broad audience in an opportunity that currently does not exist in Australia. While there may be various awards, the overall aim of this Challenge is to foster a longer-term community of people and help to drive the translation of their bright and brilliant ideas into amazing scientific discoveries with real-life applications. Not every Team will have a project that should become a start-up, but this experience will hopefully encourage young researchers to continue down this path, gain confidence in their ability to create amazing projects, whilst gaining the opportunity to showcase their ideas and skills to people in the field, as well as venture capitalists, entrepreneurs and the broader public.

3. What happens if someone is no longer able to perform as a Team Lead or Assistant Lead?

Team Leads and Mentors are expected to commit to the role for the duration of the Challenge. However, there are cases in which these roles could be handed over to other academics who are fully aware of the Team's progress and capable to take over from an existing Lead or Mentor. Any changes to your Team's structure should be discussed ahead of time with the Aus SynBio Executive. If you are planning a handover, please let us know as soon as you do.

4. What are the responsibilities and expected time commitment of all Team members?

Because different Universities have integrated the Challenge into their education program in different ways, there are different time commitments and structures that you can choose to take on. We strongly recommend that students meet for a minimum of 5 hours a week with potentially more time commitment during university breaks. Team Instructors should be able to train, support and guide their students in the lab where needed, but should be available to the students for these 5 hours. The Team Lead should meet with the Team members for a minimum of 30 minutes per week. If you are having problems with support from your Team Lead or Team Mentors, you should speak to the Challenge Executive.