Social Practice Project: 
ideal lab imagination research

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Abstract
For the propose of advocating everyone to imagine future synthetic biology lab and helping us design a new lab, we established a research of "imagination of your ideal lab". Many iGEM teams took part in the activity, they offered us their planar graphs of their labs and descriptions of their ideal labs. From our analysis, we found that most teams want to have a more intelligentized and automated lab. Furthermore, they hope the partition of areas of lab can be more modularized and enriched. We hope our research makes sense.

Keyword
Ideal lab, future lab

Background
This year we had a new lab, so we had the opportunity to design a lab by ourselves. What's more, we hope our research will give inspiration to the future lab designers and teach people some tips of lab design. So we decided a research of "imagination of your ideal lab".

Analysis of research
Many iGEM teams took part in our research, and they offered us their planar graphs of their labs and descriptions of their ideal labs. We are here summarizing some typical ideas.

(A) The usage of lab
1. Application is required before use. The application should be signed by all the applicants, and the application form should be kept as a backup after the advisor’s signature. The experiment needs to be archived.
2. Students who participate in the experiment must have the experiment report (including detailed steps), and students who participate in the project need to have achievements.
3. The user should strictly abide by the experiment rules, and no illegal operation is allowed.

(B) Opening and management of the laboratory
1. We can conduct intramural competitions to improve our experimental ability.
2. Students who want to participate in SRDP (Student Research Developing Program) and college students’ innovation and
entrepreneurship competition can apply for long-term use, but they need to be cleaned regularly. The director of the experimental center is responsible for the management of the open laboratory.

(C) Three laboratory Computerized Numerical Control design and imagination
1. The laboratory is more intelligent. Some equipment for DNA analysis can be linked to NCBI and compared with the database. For example, the results of agarose gel were analyzed online and the errors were given.
2. It is more automatic. Some experiments with higher risk can be operated by professional robots, and it has a safety monitoring system to prevent possible risks, such as automatic sterilization of the leakage of some strains.
3. Set up drivers for laboratory instruments and equipment and a common platform with uniform standards. Since this platform can understand the products of all the manufacturers of laboratory equipment, it is possible to different test instruments and equipment to complete the test tasks when necessary and analyze the test results in a more diversified way. And through the Internet to achieve different laboratory results sharing and project cooperation.
4. The laboratory can collect and record the voice, analyze the information in the voice and extend the experimental process through big data. Sustainability laboratories, which produce far more waste water than any other type of building, are critical to waste management, modeling and monitoring waste water and waste gas accumulation to minimize its impact on the surrounding population. At the same time, there should be a set of water-saving facilities, such as efficient glassware cleaning system, circulation frozen water system.

Fig1: planar graphs of W&M iGEM team
(D) The ideal biochemical reaction laboratory should have some of the necessary instruments:

Except for some basic instruments, such as Refrigerator / ultra-low temperature refrigerator, balance, Incubator, air conditioner, microscope, pipette, thermostat water bath, autoclaves and centrifuge, there are still many necessary instruments. Our research shows that PCR Amplifier, clean bench, electrophoresis apparatus, gel imaging analyzer, enzyme-labeled instrument are recognized necessities, while cryo-electron microscopy, Nucleic Acid Extraction System and full-temperature oscillator are not so needed.

Depending on the type of laboratory, the following instruments are also necessary: homogenization / mixing series, freeze dryer, incubator series, biological safety cabinet /
ultra clean workbench, shaker, rotary bottle machine, colony counter, high performance chromatography series, bottle washer, ultrapure water series, pH meter, ultrasonic cleaning, vortex meter, timer, freeze vacuum dryer, ice machine, biochemical incubator, distilled water machine, sterile cell work room (with buffer zone outside), liquid nitrogen tank and etc.

**Conclusion**

The future synthetic biology lab should be intelligentized and automated, such as robotic liquid handlers, array of microfluidic devices, and 3D cell printers. In addition, the partition of areas of lab can be more modularized and enriched. For example, a dark room for fluorescent microscopy is needed by some iGEM team. And separate rooms have their own functions, which makes the lab well organized.