

Improving skill competence and
research outcomes in China
through BIOS, an authentic
research experience

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BIOS is not the firmware to boot the computer, but stands for

The Biology Intensive Orientation Summer

BIOS is designed primarily for 1st and 2nd year science majors through the School of Life Sciences, Fudan University.

Challenges in teaching (**instructors**).

- Huge social demands
 - One Belt One Road – Talents with global vision
 - Made in China 2025 – Creative talents
 - Hsue-Shen Tsien's Quest – Talents could lead to original discoveries
- Decreased students' enrollment intention
- Desire to have high quality graduate students
 - Grad-students, not postdoc, are the main force of research
 - Undergraduates tend to have their Ph.D. abroad

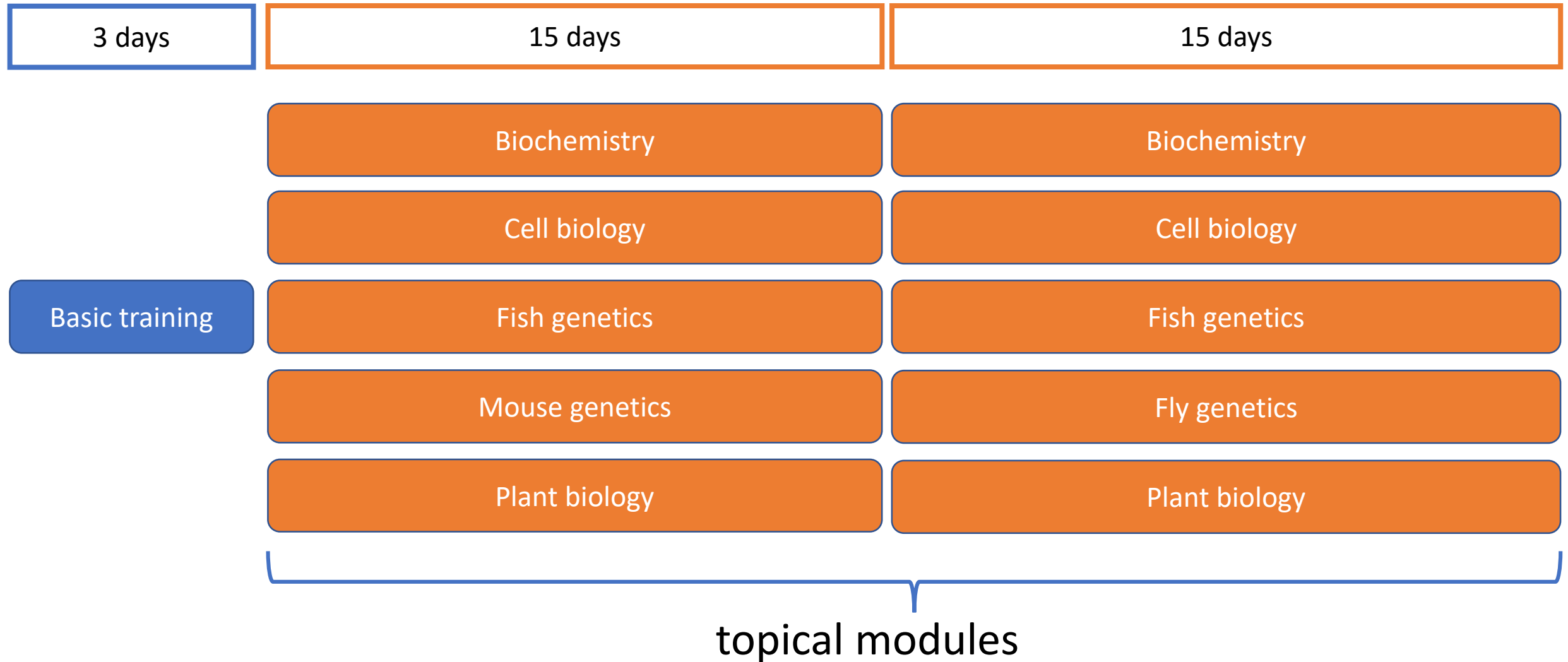
Challenges in teaching (**students**).

- The growing material and cultural needs
 - Research is hard
 - Scientists are poor
- Biological research has no challenge
 - False impression due to high school teaching, we cannot change
- Lack confidence and competence to do research
 - Minimal prior authentic research experience
 - No direct contact with research group leaders

Goals for the BIOS program.

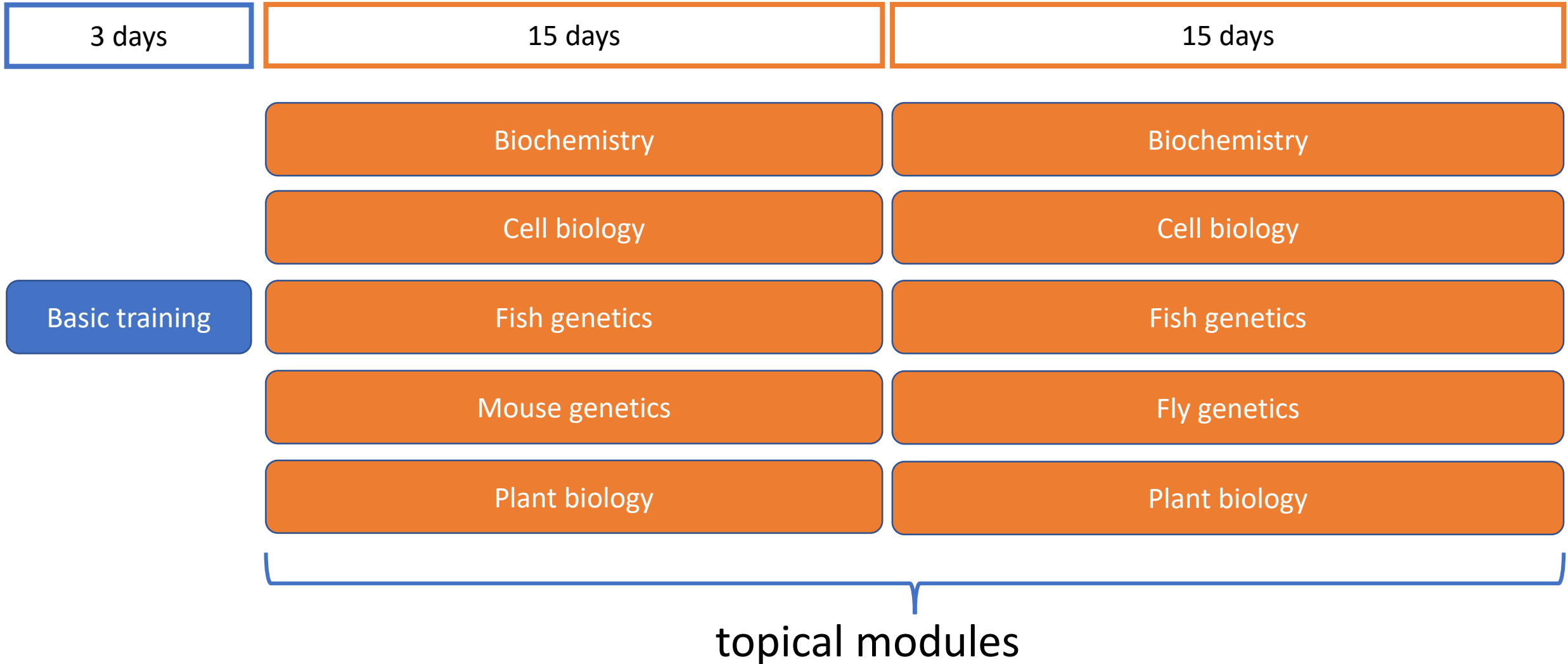
- Curriculum geared specifically towards biology research
- Create a significant learning experience
- Empower the students with skills to apply for research group intern positions
- Be collaborative

The structure of BIOS.



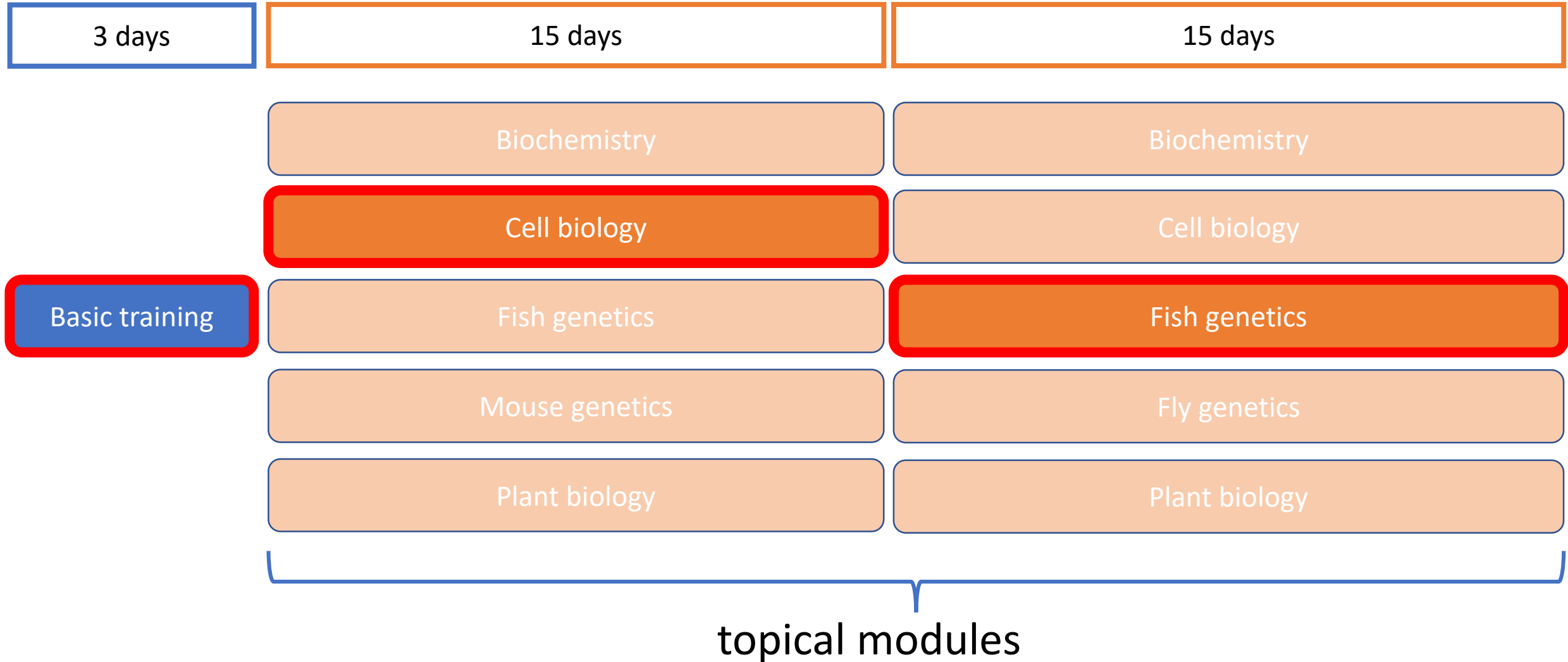
The structure of BIOS.

Authentic research experience.



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Authentic research experience.



The structure of a module (biochemistry).

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
7 AM							
8 AM	Discussion	Experiment	Experiment	Experiment	Report	Experiment	Discussion
9 AM							
10 AM							Discussion
11 AM	Proposal						
12 PM							
1 PM				Workshop			
2 PM	Experiment	Discussion	Experiment			Proposal	Experiment
3 PM							
4 PM							
5 PM		Proposal					Proposal

Assessing skills is different from assessing knowledge.

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What is the capital of Georgia?

- a) Athens
- b) Atlanta
- c) Columbus
- d) Savannah

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HR → home runs allowed

K → strikeouts

IP → innings pitched

BB → walks allowed

HB → hit batters

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1. Preparing growth media
2. Inoculating media with cells, without contamination
3. Growing under appropriate conditions, again without contamination

How to assess competence in growing bacteria?

1. Preparing growth media

2. Inoculating media with cells, without contamination
3. Growing under appropriate conditions, again without contamination

1. Correctly calculate media components.

Mix them together in the right way.

Sterilize the solution.

Handle the solution aseptically.

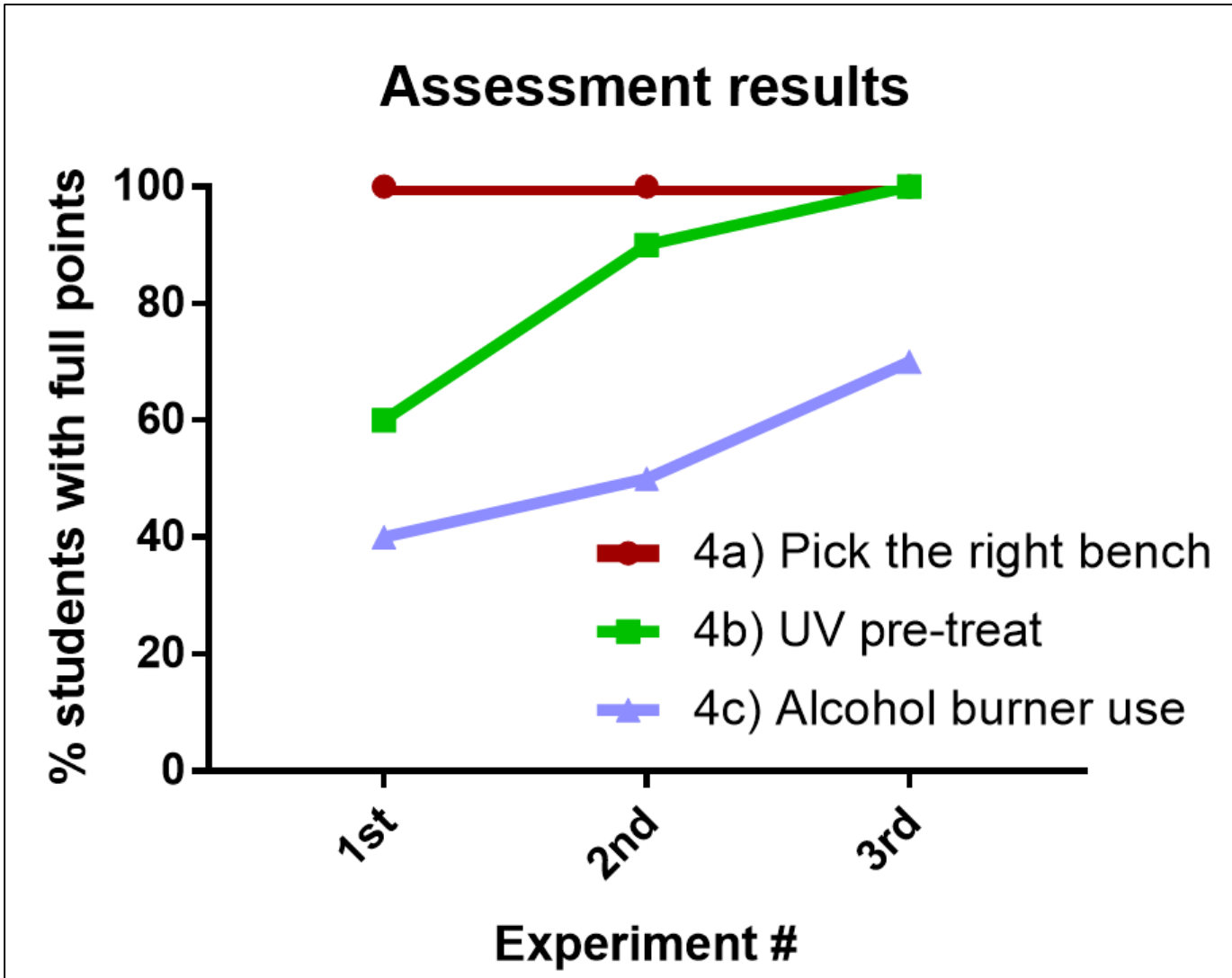
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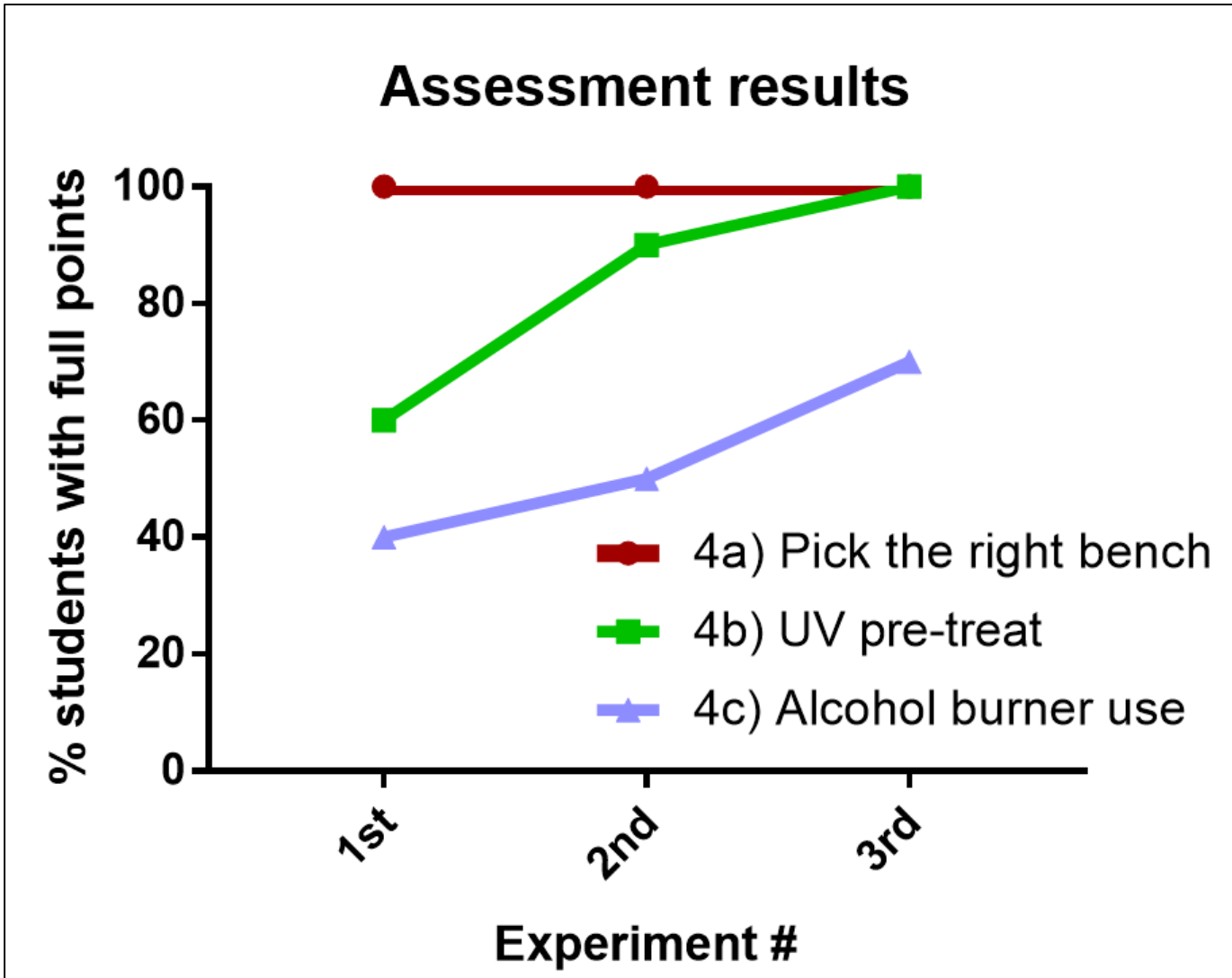
4a:work in the clean bench	Yes(1)
4b:UV pretreatment of the clean bench	Yes(1)
4c:Operate close to the alcohol burner	Yes(1)
4d:Wearing gloves during operation	Yes(1)
4e:Calculate the volume of the needed reagent accurately	Yes(1)
4f:Choose the proper pipettor and set to the right scale before using	Yes(1)
4g:Change tips when necessary	Yes(1)
4h: Tip contaminated	No(1)
4i:keep tubes closed when not using	Yes(1)

How to assess competence in growing bacteria?



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How to assess competence in growing bacteria?



Evolving, self-regulated process.

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Non-science topics work too!

Assessing skills is different from assessing knowledge.

Our BIOS
team:



Dr. Pi



Dr. Zhang



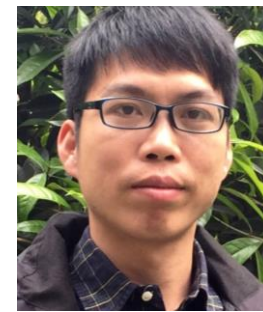
Dr. Lu



Dr. Li



Dr. Yan



Dr. Ren



Dr. Ma



Dr. Lu

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<http://bio-elite.fudan.edu.cn>