Approached the origin of life

—— Science Popularization Voluntary Service Activities

Planning book

Organizer: Xiamen Science and Technology Museum

Committee of the College of Chemical Engineering, Xiamen University

XMU-China iGEM team

目录

I. Theme

2020 XMU-China iGEM Team Science Popularization Activity.

II. Introduction of the team

International Genetically engineered machine competition (iGEM), founded by the Massachusetts Institute of Technology, is the top international competition in synthetic biology. Teams which take part in iGEM competition need to use standard biological modules (Biobricks) to build genetic circuits, build effective mathematical models, and implement sophisticated and complex artificial biological systems (artificial biosystem) prediction, manipulation and measurement, and social research, practice, field defense and wall presentation to complete the competition.

The iGEM team "XMU-China" of Xiamen University is composed of more than 20 undergraduate students from different departments, such as the College of Chemistry and Chemical Engineering, the College of Life Sciences, the School of Energy, the School of Public Health and the College of Art. Under the guidance of Professor Fang Baishan, engineered bacteria will be used to detect and degrade glyphosate in tea.

III. Background

Synthetic biology is a new interdisciplinary area that involves the application of engineering principles to biology. It aims at the (re-)design and fabrication of biological components and systems that do not already exist in the natural world. Synthetic biology combines chemical synthesis of DNA with growing knowledge of genomics to enable researchers to quickly manufacture catalogued DNA sequences and assemble them into new genomes.

Improvements in the speed and cost of DNA synthesis are enabling scientists to design and synthesize modified bacterial chromosomes that can be used in the production of advanced biofuels, bio-products, renewable chemicals, bio-based specialty chemicals (pharmaceutical intermediates, fine chemicals, food ingredients), and in the health care sector as well.

Therefore, it is extremely important to popularize the concept of synthetic biology and make the knowledge of synthetic biology understood and applied by the general public.

IV. Purpose of the activity

The purpose of this activity is to popularize the knowledge of synthetic biology to the public and arouse the public's interest and reflection on synthetic biology.

Through some lectures and sitcom activities, the XMU-China team would stimulate the interest of young people in the exploration of synthetic biology. Besides, the team also designed some interesting games to

interact with the audience and popularize the knowledge of biology.

V. Audiences

Visitors to the Science Museum

VI. Time of the activity

16 August 2020

VII. Location

Xiamen Science and Technology Museum

VIII. Organizers

Xiamen Science and Technology Museum
College of Chemistry and Chemical Engineering, Xiamen University
XMU-China iGEM Team

IX. Activities

(i) Introduction:

By using on-site projection equipment, we will hold two science popularization lectures on synthetic biology in morning and afternoon respectively, interspersed with some interactive games and sitcoms. Besides, the team will set up four showcases and arrange some basic games to popularize the knowledge of biology.

(ii) Interactive Games:

1) Happy Dragon:

Objective: There are countless gene circuits in our body, which are composed of promoter, RBS, target gene and Terminator. The promoter is responsible for opening the loop, RBS is the ribosome binding site, the target gene contains genetic information, and the Terminator is the end point of the loop. This game helps children understand the concept of genetic circuits.

Game props :4 characters sticker

Game rules: Invite children to play games on stage, assign different roles and corresponding stickers to each child, then let them paste stickers on their clothes. Within 30 s of the "Happy Dragon" command, the children should line in the order of "promoter →RBS →target gene → Terminator ", any group failure or order errors should be eliminated. After 2 rounds of the game, the remaining children will receive some small prizes.

Appendix:

Role 1: promoter; Role 2: RBS; Role 3: target gene; Role 4: Terminator

2) Radish squat:

Invite four children to squat for a group of radish interaction, about 2-3 rounds.

Optional roles: glyphosate, tea, detection, degradation

Possible situations	**Response measures**
Children don't understand the rules	Staff try a round.
Children react too slowly, the game ends too fast	Try to choose older ones and relax game standards.
The last two kids were deadlocked	Let both win at the same time.

(iii) Basic games:

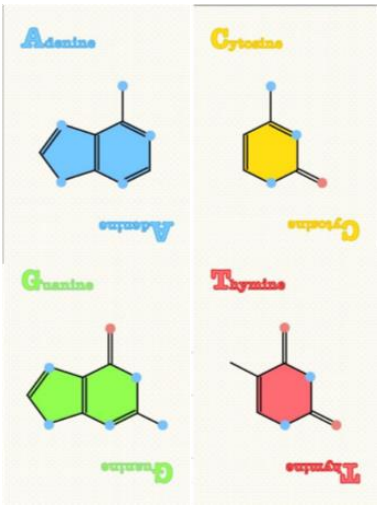
The team members designed a kind of stamp card named circuit jigsaw. Four stamps which should be taped on the card represent four basic elements in the genetic circuit: promoter, RBS, target gene and terminator. The children needed to gain all four stamps by participating in four games to make the circuit express unimpededly. This game, visually displaying the genetic circuit, helps children and their parents better understand the thoughts of engineering and modularization.

1) The Matching of Base Pairing:

Objective: The complementarity of base in DNA molecules can be simulated by matching corresponding cards.

Game props: base map, A、T、C、G (two each), U (one).

Game rules: Players could find the two sets of cards, “A & T” or “C & G”, to win this game. The game can pretend to have a time limit, increase the tension of the game.



2) Breaking the code:

Objective: Protein is generally composed of 20 kinds of common amino acids, during the protein translation process, three base sequences on mRNA form a codon corresponding to one kind of amino acid. Give children some base sequences, let they correspond to the codon table and decipher the amino acids corresponding to the base sequence, so that children have a preliminary impression of the rules of this translation process.

Game props: codon table, card written sequence

Game rules: By given a sequence of bases, the children can infer the corresponding amino acids from the codon table. The amino acid sequence will eventually form a word. Staff could explain that this is a step in protein synthesis in the human body.

Appendix:

Codon table:

	U		C		A		G	
U	UUU	F	UCU	S	UAU	Y	UGU	C
	UUC	F	UCC	S	UAC	Y	UGC	C
	UUA	L	UCA	S	UAA	STOP	UGA	STOP
	UUG	L	UCG	S	UAG	STOP	UGG	W
C	CUU	L	CCU	P	CAU	H	CGU	R
	CUC	L	CCC	P	CAC	H	CGC	R
	CUA	L	CCA	P	CAA	Q	CGA	R
	CUG	L	CCG	P	CAG	Q	CGG	R
A	AUU	I	ACU	T	AAU	N	AGU	S
	AUC	I	ACC	T	AAC	N	AGC	S
	AUA	I	ACA	T	AAA	K	AGA	R
	UAG	M	ACG	T	AAG	K	AGG	R
G	GCU	V	GCU	A	GAU	D	GGU	G
	GUC	V	GCC	A	GAC	D	GGC	G
	GUA	V	GCA	A	GAA	E	GGA	G
	GUG	V	GCG	A	GAG	E	GGG	G

Example:

密　　码：ACU GAA GCU

破译结果：

To form a word:

TEA：ACU GAA GAG

ACC GAG GCC

ACA GAA GCA

ACG GAG GCG

……

T：ACU ACC ACA ACG

E：GAA GAG

A：GCU GCC GCA GCG

ANTI：GCU AAU ACU AUU

GCC AAC ACC AUU

GCA AAC ACG AUA

GCG AAC ACA AUA

……

A：GCU GCC GCA GCG

N：AAU AAC

T：ACU ACC ACA ACG

I：AUU AUC AUA

3) Happy jigsaw puzzle:

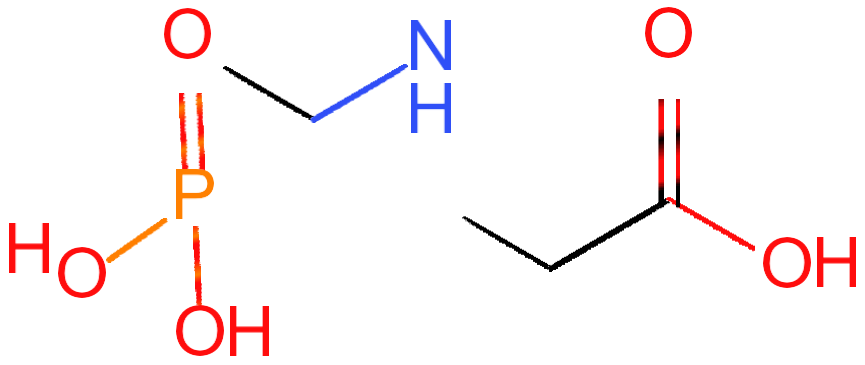
Objective: Let children (as well as their parents) directly see the target molecule of our project, glyphosate, and understand how to degrade it; let children have a preliminary understanding of molecular and valence bond (using bat model), so as to achieve the purpose of public education.

Game props: bat model box,502 glue

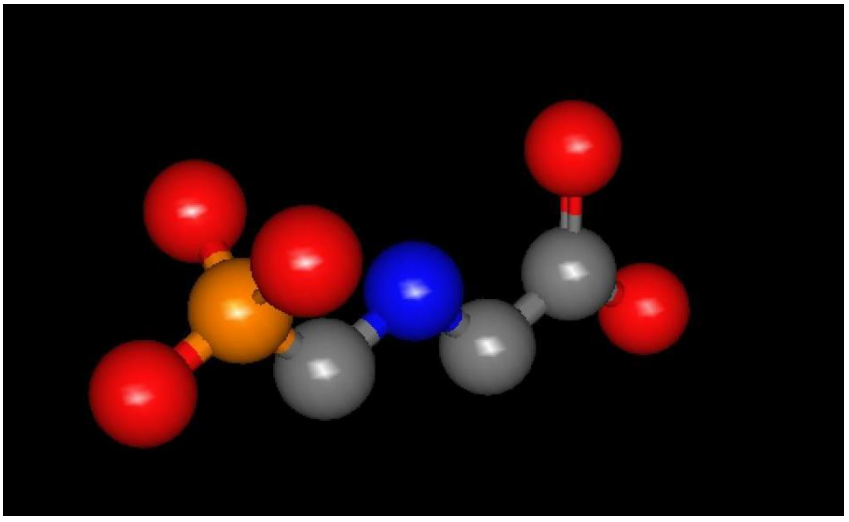
Game Rules: Put a glyphosate bat model finished product on the table as a display, and glyphosate bat model required parts in a small box for children. After the splicing, the GOX enzyme model was used to demonstrate the formation of new molecules AMPA and acetaldehyde by breaking off the corresponding chemical bonds in the enzymatic reaction, thus introducing the detection principle of glyphosate.

Appendix:

Molecular structure of glyphosate:



3D model of glyphosate:



4) Maze adventure:

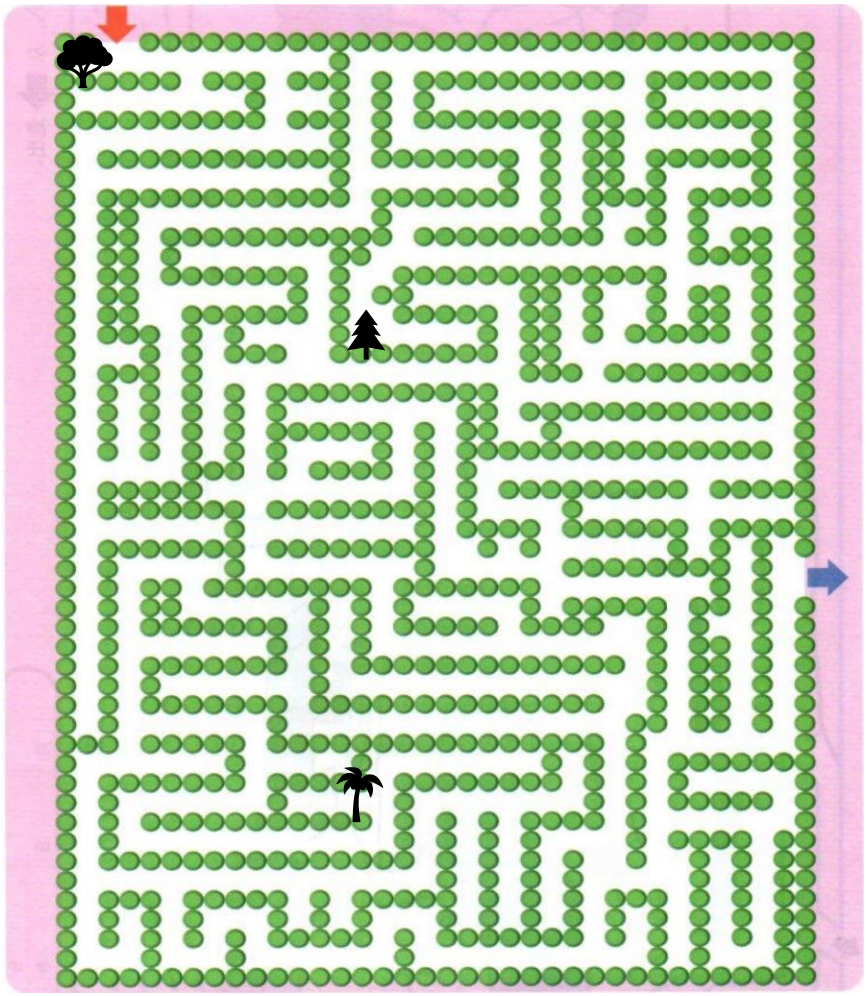
Objective: In the process of glyphosate detection and degradation, it need a variety of proteins or chemicals synergy. The purpose of this game is to let children have further understand of the principles of

biochemical reactions, and cultivate their interest of science.

Game props: Color pens, Maze maps

. Rule of the game: Guide children to choose their favorite maze to complete, maze has a variety of roads to go through, but only one line can pass through all the target points is correct. Staff or parents can guide children to complete the process. In principle, prizes are given to children who complete the maze according to the rules, but in fact, other small prizes can be given to children who have not completed the maze according to the situation (children's mood, number of prizes, etc.) according to the situation.

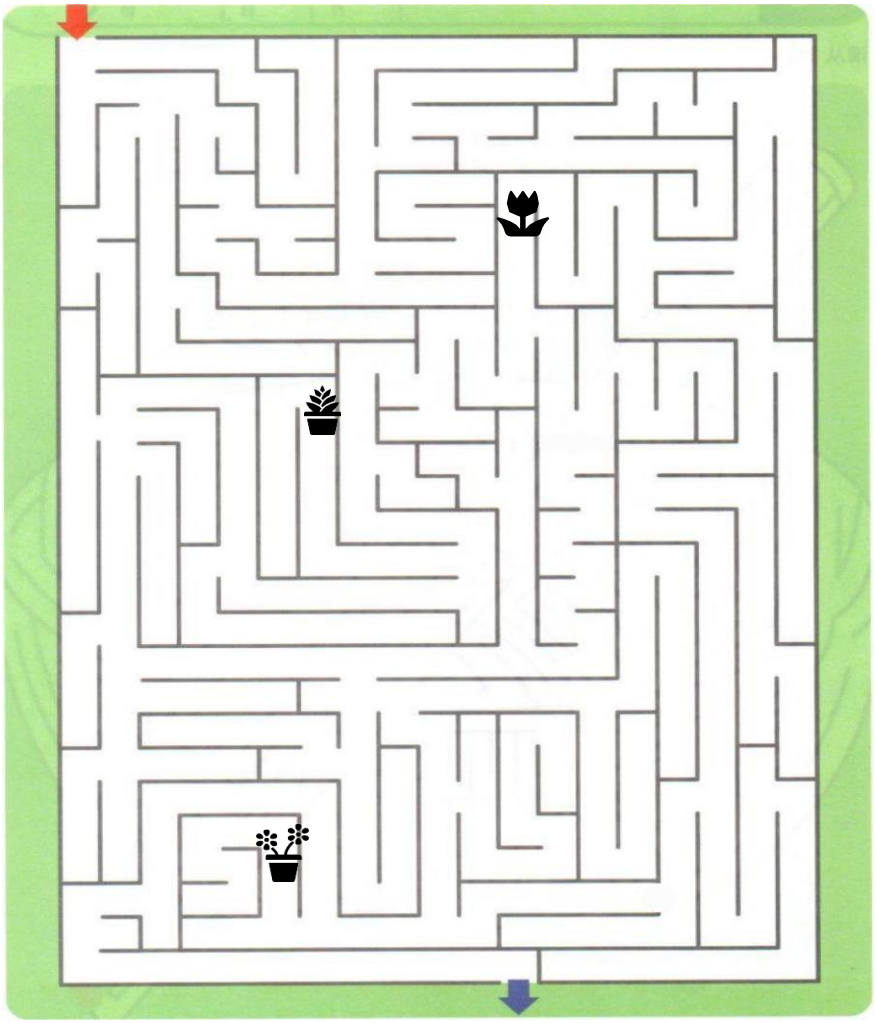
Appendix:



PhnCDE :1 

PhnO :1 

PhnJ :1 



GOX :1 

GRHPR :1 

mBFP :1 

X. Division of activities

Time	Content of activities	Responsible person
1 August-16 August	Preparation	
16 August	Mid-term implementation	All members of the team
16 August-19 August	Late finishing	All members of the team