

Synthetic biology

A look through the Lens of Latin America

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Guidelines

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iGem Tec-Chihuahua



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Thanks to iGEM for promoting the conscience about the responsibility in science, and for keeping on being an organization that promotes intellectual curiosity, innovation and social dimensions in the next generation of scientists.

Infinite thanks to each and every person that made possible the final version of this pamphlet. Your work is very meaningful to us and will stay in our hearts forever!

- iGEM Tec-Chihuahua,
Human Practices Division



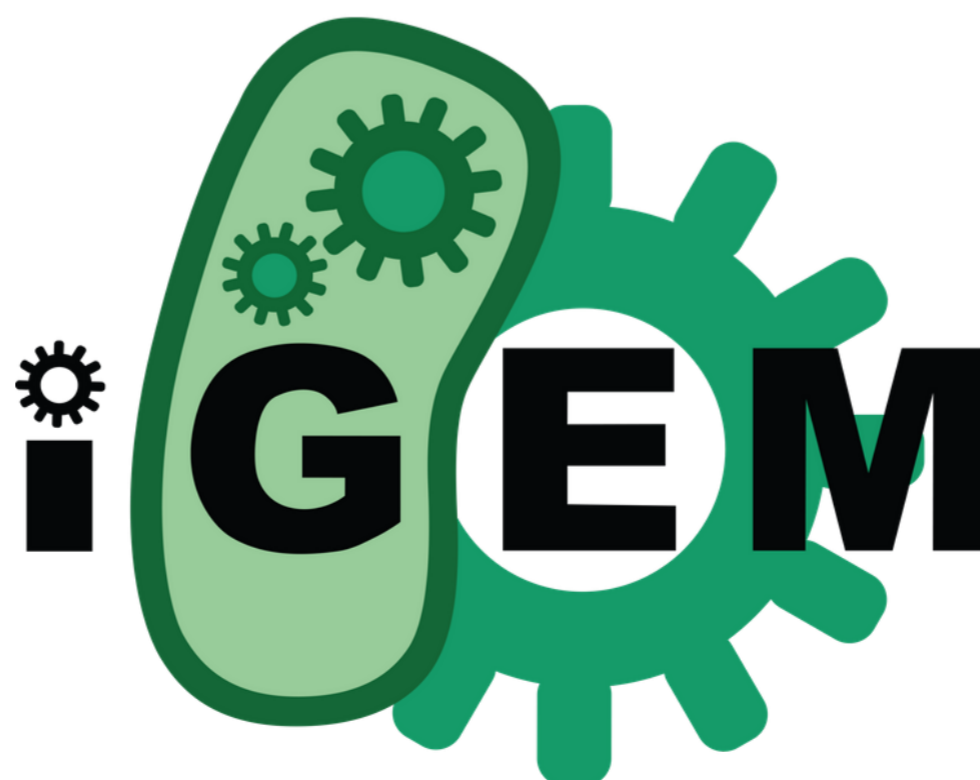
Synthetic Biology

Synthetic Biology (SB) is a science that mixes biology, chemistry, informatics, mathematics and other sciences in a biological engineering process (Schmidt, 2008). It implies the design and construction of parts, devices or systems, allowing the re-design of existing organisms for a useful purpose (Desplazes, 2009). This is achieved through the standardization of functional parts and their insertion in "living machines" (Pottage and Marris, 2012).



One of the most important Synthetic Biology competitions nowadays is iGEM (International Genetically Engineered Machine), the hugest participant based 'get' and 'give' competition in which students from all over the world have to develop an original project based on the methodological use of standard biological parts. The competition aims to teach open knowledge, biosafety, security and scientific curiosity, essential principles of SB.

iGEM's context is not limited to the laboratory work, but rather requires ethic and social considerations to evaluate the impact of the project (implemented in a real context). The discussion around SB leads to the questions: What kind of science is needed? And how shall it be regulated?



Context of Tec-Chihuahua team in iGEM

Latin American countries are some of the richest regions in natural resources in the world. Mexico is the third agricultural producer in Latin America with 31% of its population dedicated to this activity. Some of the main crops found in the country are corn, sugar cane, avocado, potatoes, chili and alfalfa. Alfalfa has a great impact locally, nationally and globally; the main producer in Mexico is the state of Guanajuato followed by Chihuahua, the big state, with 12% of the national production, making around \$1.2 thousand million pesos per year (CONAGUA, 2010).

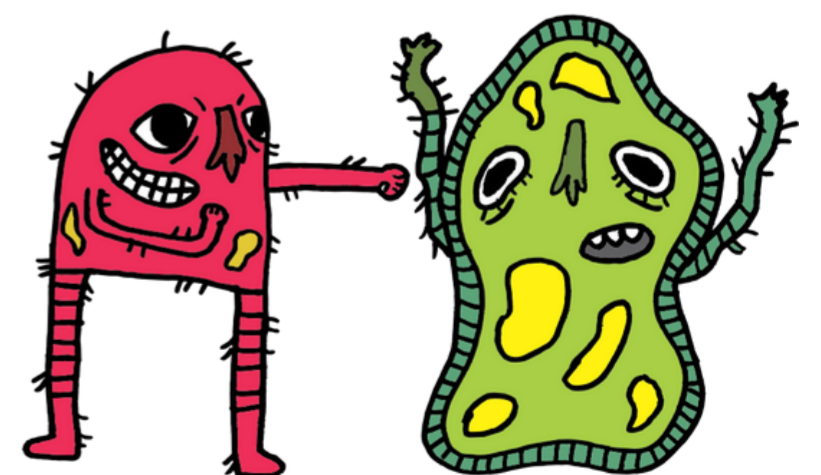


Big part of the Mexican crop fields is affected by pathogenic organisms, particularly fungi, which causes loss of cultivations. Fungi infections affect directly a particular crop we've focused on: alfalfa, and represent great economic losses. Due to the exposed problematic, the iGEM Tec-Chihuahua 2016 team decided to get into the competition with a project called *Myxobacteria* as biological control method for diseases in crops.

The aim of the project is to find a method of biological control, through genetic engineering techniques and synthetic biology to enhance the natural ability of a soil bacterium to inhibit the pathogenic fungi which causes diseases in crops.

For more information about our project don't hesitate on visiting our wiki:

<http://2016.igem.org/Team:Tec-Chihuahua>



Tec-Chihuahua team proposes the following Guidelines. They are a consensus of ideas that would be the most important points to be considered about synthetic biology and intend to be useful for international regulation of SB. Our aim is to prevent scientific work related to SB from being taken lightly. People who develop synthetic biology have in their hands a great responsibility that they should be aware of.

"We can never have a science that's outside the social, and science is clearly at the heart of what we call society" (Gaskell et al., 2008).



1

SYNTHETIC BIOLOGY AND PROJECTS DERIVED THEREFROM SHOULD NOT BE USED FOR CRIMINAL, HARMFUL PURPOSES OR BIOLOGICAL WEAPONS

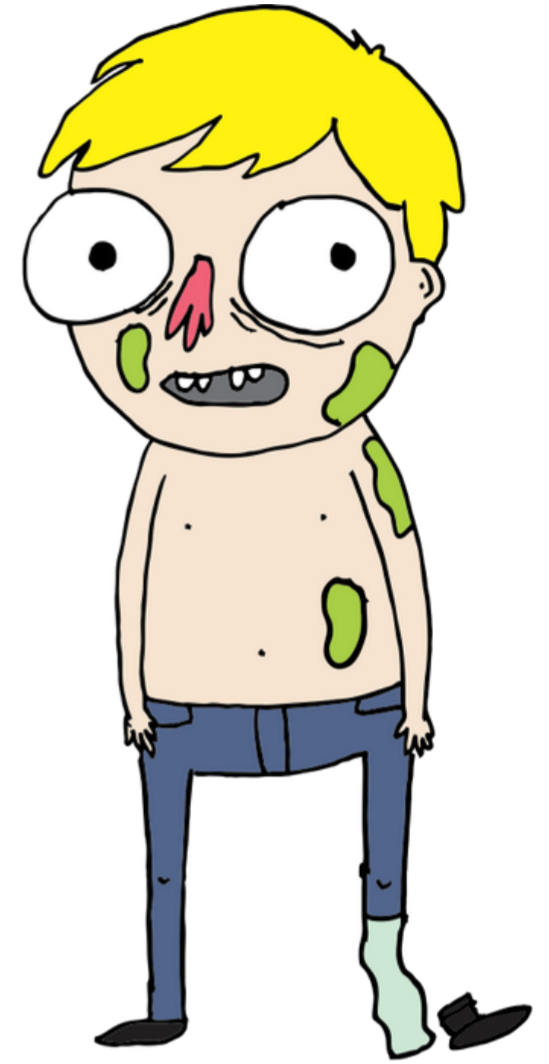


Synthetic biology should benefit mankind not be used for purposes that violate human rights or human dignity.

2

PEOPLE OR ORGANIZATIONS WHO USE PARTS AND BRICKS SHALL BE PERIODICALLY VERIFIED AND INCLUDED IN A REGISTER OF CONTROLLED AND SAFE SUBJECTS.

Researchers and developers should not have criminal records or ties to organized crime or terrorism.

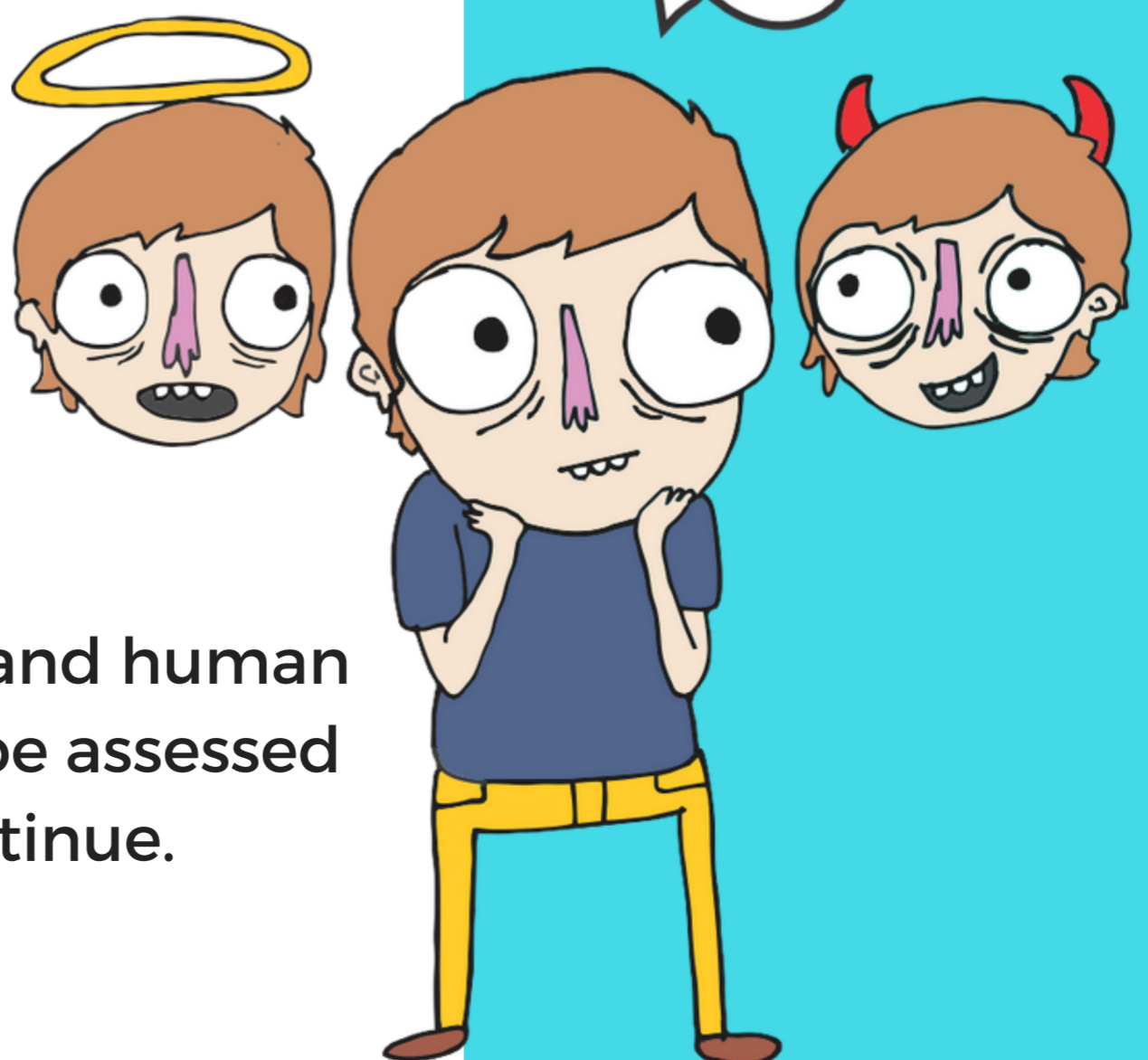


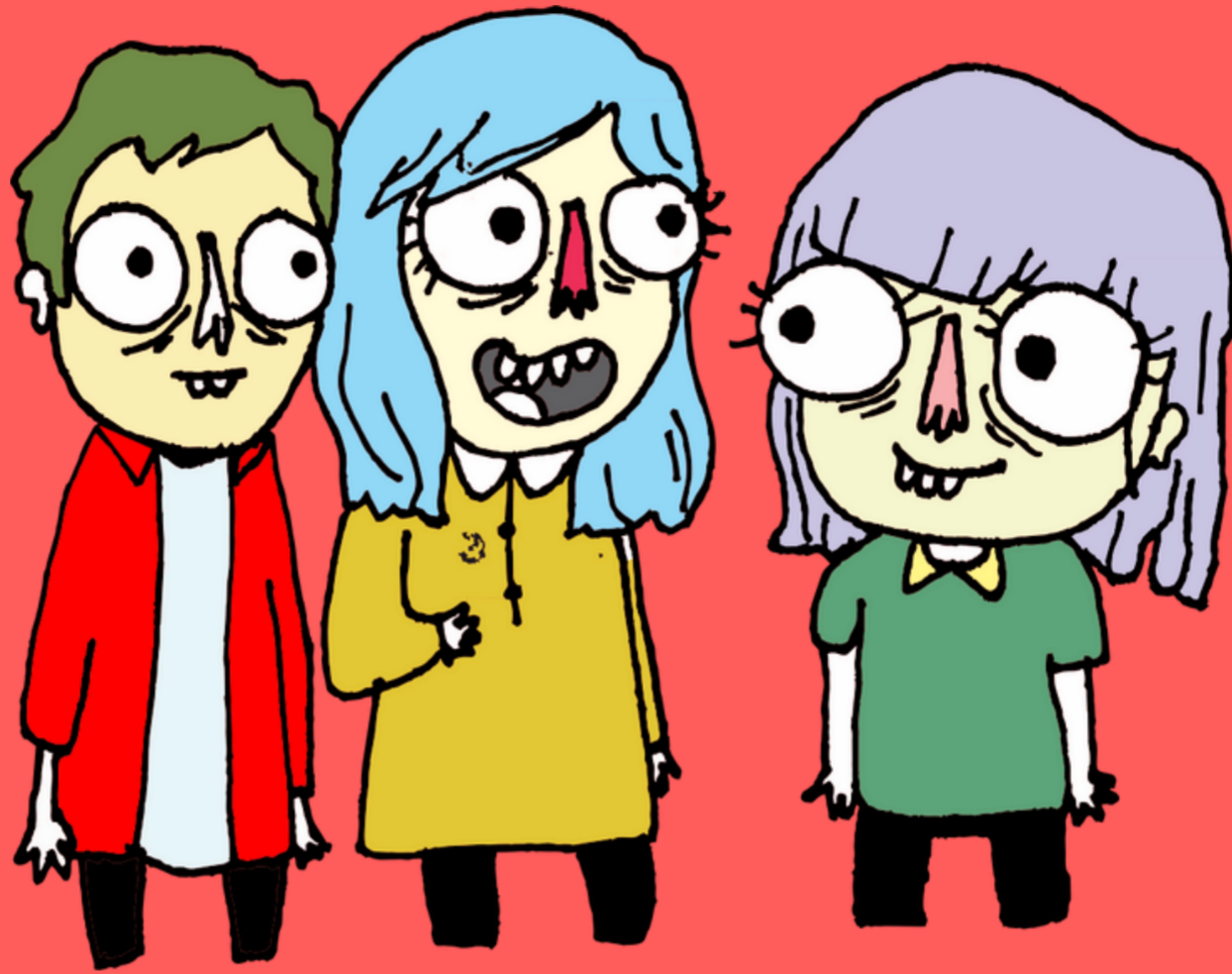
EVERY BIOTECHNOLOGY ADVANCE MUST BE AWARE OF ITS IMPACT ON THE ENVIRONMENT. PRODUCTS CAN NOT BE CONTRARY TO HUMAN HEALTH.

Any project derived from biology should be based on the principles of scientific ethics and environmental safety.

The impact on the environment and human health from each project **MUST** be assessed before it is approved to continue.

3





4

SYNTHETIC BIOLOGY SHOULD BE AN INCLUSIVE PROCESS

The consequences of any process related affects everyone equally. In the decision to establish criteria, synthetic biology must have an equal number of representatives per nation and these people must include both the scientific community and the agencies that regulate and manage a global consensus as the UN, as well as members of society in general.

5

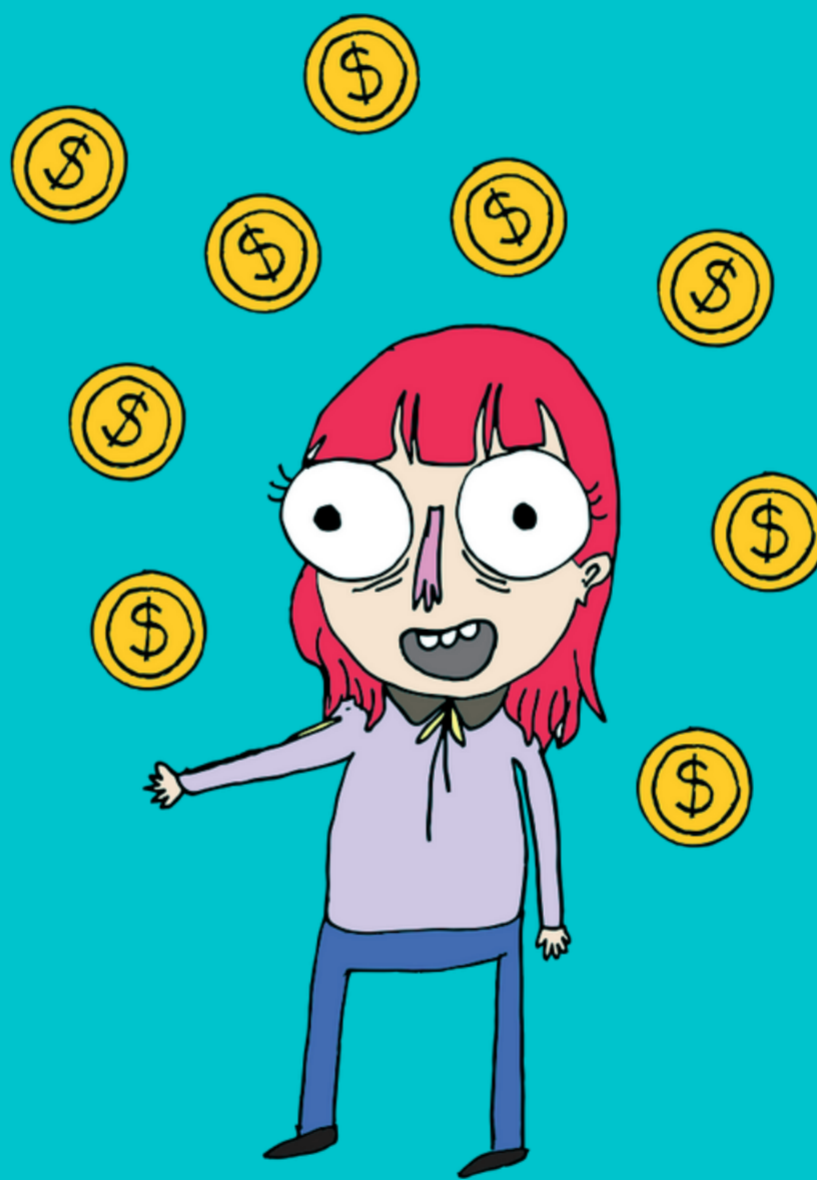
IGEM PARTS' MANAGEMENT FOR RESEARCH PURPOSES SHOULD BE PRACTICED UNDER A CONTRACT REGIME.



There should exist contracts with lock box date where the owner compromises to donate its parts to public domain after some fixed number of years. The contracts should have a duration according to the research process, said period must not be based in lucrative purposes.

6

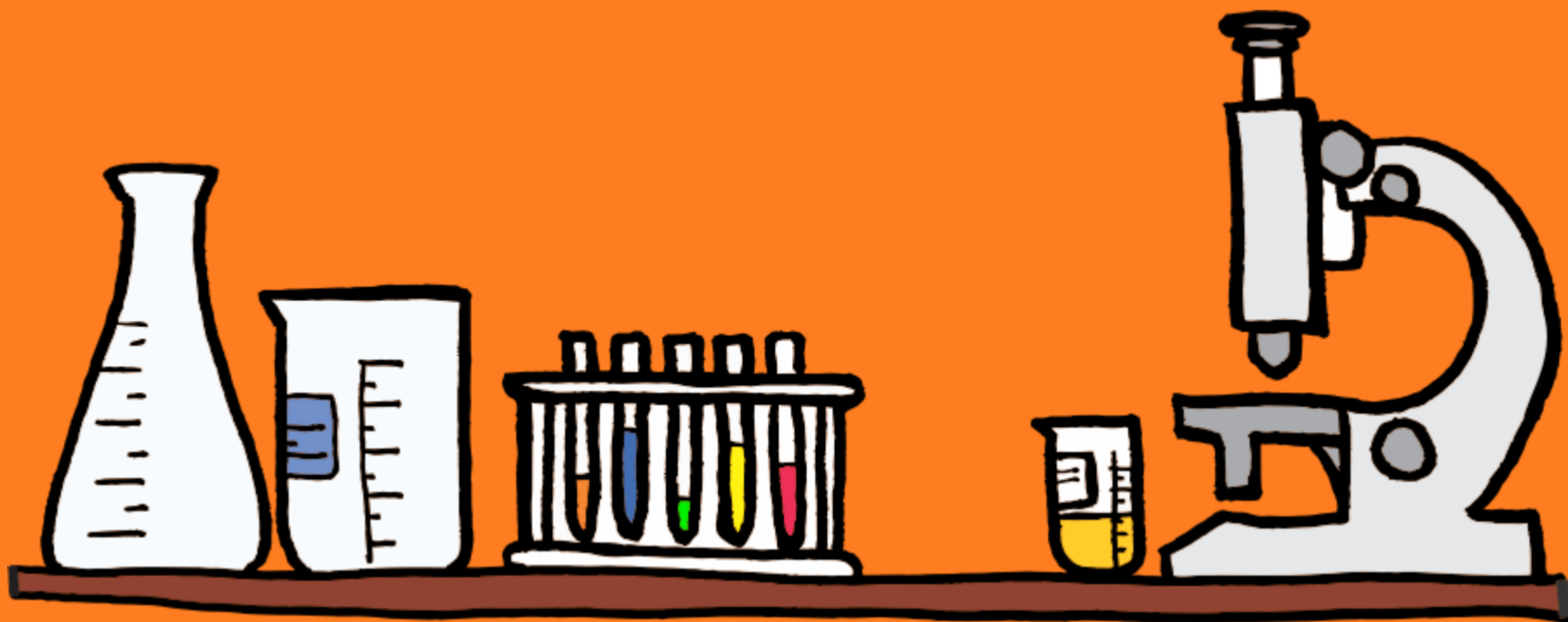
RESEARCHES SHALL BE FINANCED MAINLY BY PUBLIC FUNDS



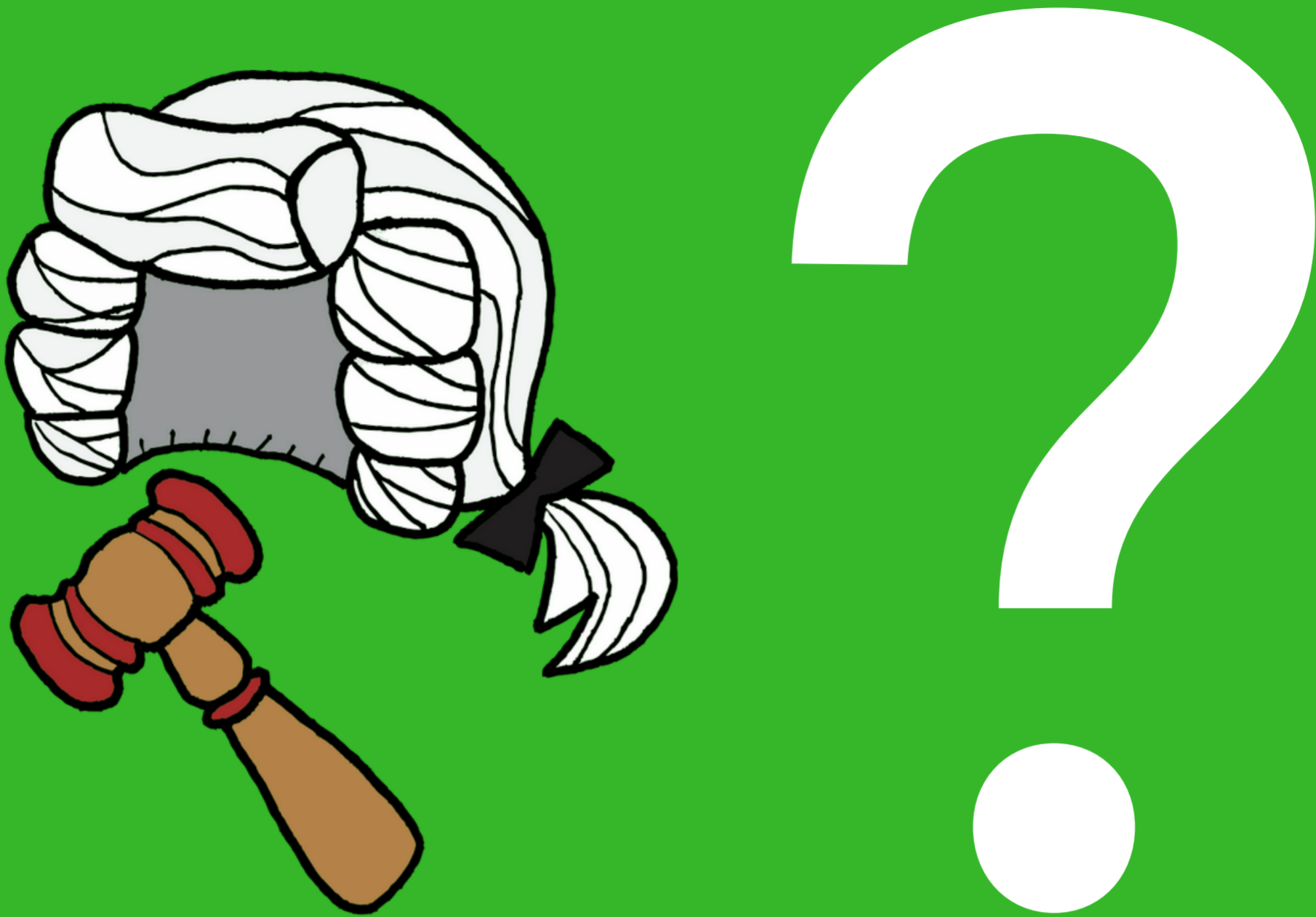
Public funding independent from government in order to avoid monopoly should be implemented. Such funds would be managed by an international organization and granted to research that would previously be evaluated in aspects such as its impact, quality and research process.

7

IT IS NECESSARY TO MAINTAIN QUALITY STANDARDS



The quality of both the process and the bioparts deriving from the process should be subject to international quality standards. An open biology allows information to improve and renew itself; this can be achieved by standardization and requirements' fulfillment. Parts shall be tested and added to the Registry depending on their stability, effectiveness and functionality.



**IF IPR ARE NECESSARY,
COPYRIGHT COULD
REPRESENT A VALID
ALTERNATIVE TO
PATENTS**

Copyrights are a great alternative form of intellectual property protection due to its relatively low cost compared to other forms, but they should be treated carefully. Length of duration of copyright protection in the field of synthetic biology should be adjusted to enough time for a researcher to obtain profits, but not to a long period of time that impedes scientific development.

9

SYNTHETIC BIOLOGY OUGHT TO BE OPEN IN ORDER TO:

- Allow the free circulation of knowledge and make information accessible
- Promote active participation and inclusion: Increasing dialogue, debate and public discussion, as well as sense of responsibility
- Reach universal standardization valid and applicable for everyone
 - Trigger a broader use of information and growing the community resource with contributions, sharing of skills and experiences

Benefits

- a) Innovation.* Freely available parts accelerate and facilitate development
- b) Encouragement of scientific curiosity.* Achieve technological progress by supporting the freedom to create
- c) Broader acceptance from society.* Diffusion engages the attention of people who might begin building.
- d) Economic growth and diverse economy.* Parts could be patented when used to produce novel materials and applications.





Tecnológico
de Monterrey

