Pakistan School
Kingdom of Bahrain

PAKISTAN SCHOOL, KINGDOM OF BAHRAIN.

Chapter : 2

Solving a Biological Problem.

RULES OF THE CLASS

1) Be on time for all your classes.
2) Respect all the participants of the class.
3) Do not create any disturbance.
4) Pay attention to your teacher.
5) Raise hand if you have a question.
6) Enter into the class with your actual name and CPR number.

ENGAGING STARTER

Objectives:

At the end of this lesson students will be able to:

- Revise the first three steps of biological method
- Analyze the last four steps of biological method

BIOLOGICAL METHOD

Biologists recognize some biological problem and go for its solution.

The scientific method in which biological problems are solved, is termed as **BIOLOGICAL METHOD.**

It provides data for public use

SOLVING A BIOLOGICAL PROBLEM:

Following steps are utilized by a biologist to solve a biological problem:

1. Recognition of biological problem.
2. Observations.
3. Hypothesis formulation.
4. Deductions.
5. Experimentation.
6. Summarization of results (create tables, graphs etc.)
7. Reporting the results.

1. RECOGNITION OF BIOLOGICAL PROBLEM:

A biological problem is a question related to living organisms that may be asked by someone, comes in the biologist's mind by himself or arises due to some change in the environment.

e.g. Some unknown respiratory disorder started to occur in a group of people in Wuhan, China.

2. OBSERVATIONS:

First recall the previous observations made and if necessary make new ones.

-Observations are made using the five senses of a human being i.e; vision(eyes), hearing(ears), smell(nose), taste(tongue) and touch(skin).

The data measured, collected, perceived, noticed or recorded during an experiment –

Observations also means reading and studying what other have done in the past.

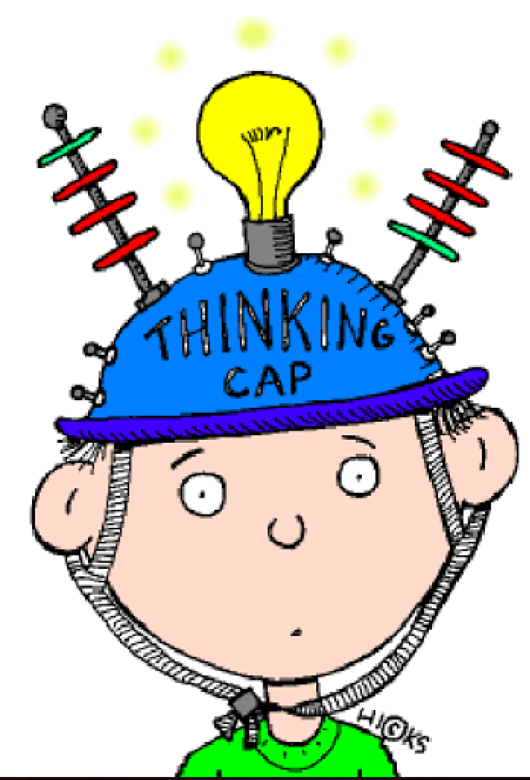
COMPARISON

Qualitative Observations	Quantitative observations
1. The freezing point of water is colder than the boiling point.	1. The freezing point of water is 0° C and the boiling point is 100° C.
2. A liter of water is heavier than a liter of ethanol.	2. A liter of water weighs 1000 grams and a liter of ethanol weighs 789 grams.

Qualitative Data	Quantitative Data
Overview: • Deals with descriptions. • Data can be observed but not measured. • Colors, textures, smells, tastes, appearance, beauty, etc. • Qualitative → Quality	**Overview:** • Deals with numbers. • Data which can be measured. • Length, height, area, volume, weight, speed, time, temperature, humidity, sound levels, cost, members, ages, etc. • Quantitative → Quantity

3. FORMULATION OF HYPOTHESIS:

- Observations should be organized into data form and related to or constructed into a question or statement that can be **true** or **false** until proven by experimentation.
- This tentative (possible) explanation of observations is called a **hypothesis.**
- Careful thinking, creative thinking and reasoning are used to formulate the hypothesis.



CHARACTERISTICS OF A HYPOTHESIS:

Should be:

- A general statement.
- A tentative idea.
- Agree with available observations.
- As simple as possible.
- Testable and potentially falsifiable (should have the characteristic of being false).

EXAMPLE:

Observation: Patients with the unknown respiratory disorder showed the symptoms like those of common flu.

It led to the formulation of **HYPOTHESIS**.

- **Flu virus is the cause of this respiratory disorder.**

4.DEDUCTIONS:

Deduction, starts out with a general statement, or hypothesis, and examines the possibilities to reach a specific, logical conclusion.

- Deduction is the act of understanding something based on evidence.
- Deductions are the logical consequences of hypothesis.
- Deduction involves the use of "**IF-THEN**" logic.
- Hypothesis cannot be applied in every situation so they generate deductions from the hypothesis.

For example :

“**All plant cells have a nucleus**” is a HYPOTHESIS.

“**If I examine cells from a blade of grass then each one will have a nucleus**” this is a DEDUCTION.

5.EXPERIMENTATION :

- Scientists perform experiments to see if hypotheses are true or not.
- The deductions that are drawn from the hypothesis are put under rigorous testing.
- Experimentation may prove the hypothesis **right** or **wrong**.
- The incorrect hypothesis is rejected and a new hypothesis is made and further experimentation starts.
- A **controlled experiment** is simply an **experiment** in which all factors are held constant except for one: *the independent variable.* A common type of **controlled experiment** compares a **control** group against an **experimental** group. All variables are identical between the two groups except for the factor being tested.

6.SUMMARIZATION OF RESULTS:

Biologist gathers actual, quantitative data from experiments. Data for each of the groups are then averaged and compared statistically. To draw conclusions, biologist also uses statistical analysis.

7.REPORTING THE RESULTS:

Biologists publish their findings in scientific journals and books, in talks at national and international meetings and in seminars at colleges and universities. Publishing of results is an essential part of scientific method. It allows other people to verify the results or apply the knowledge to solve other problems.

SCIENTIFIC JOURNAL SAMPLE

Norville *et al. Journal of Biological Engineering* 2010, **4**:17
http://www.jbioleng.org/content/4/1/17

JOURNAL OF BIOLOGICAL ENGINEERING

METHODOLOGY Open Access

Introduction of customized inserts for streamlined assembly and optimization of BioBrick synthetic genetic circuits

Julie E Norville[1,2,3*], Ratmir Derda[4,5,6], Saurabh Gupta[2], Kelly A Drinkwater[1,2], Angela M Belcher[2,3], Andres E Leschziner[7], Thomas F Knight Jr[1,8]

Abstract

Background: BioBrick standard biological parts are designed to make biological systems easier to engineer (e.g. assemble, manipulate, and modify). There are over 5,000 parts available in the Registry of Standard Biological Parts that can be easily assembled into genetic circuits using a standard assembly technique. The standardization of the assembly technique has allowed for wide distribution to a large number of users – the parts are reusable and interchangeable during the assembly process. The standard assembly process, however, has some limitations. In particular it does not allow for modification of already assembled biological circuits, addition of protein tags to pre-existing BioBrick parts, or addition of non-BioBrick parts to assemblies.

Results: In this paper we describe a simple technique for rapid generation of synthetic biological circuits using introduction of customized inserts. We demonstrate its use in *Escherichia coli* (*E. coli*) to express green fluorescent protein (GFP) at pre-calculated relative levels and to add an N-terminal tag to GFP. The technique uses a new BioBrick part (called a BioScaffold) that can be inserted into cloning vectors and excised from them to leave a gap into which other DNA elements can be placed. The removal of the BioScaffold is performed by a Type IIB restriction enzyme (REase) that recognizes the BioScaffold but cuts into the surrounding sequences; therefore, the placement and removal of the BioScaffold allows the creation of seamless connections between arbitrary DNA sequences in cloning vectors. The BioScaffold contains a built-in red fluorescent protein (RFP) reporter; successful insertion of the BioScaffold is, thus, accompanied by gain of red fluorescence and its removal is manifested by disappearance of the red fluorescence.

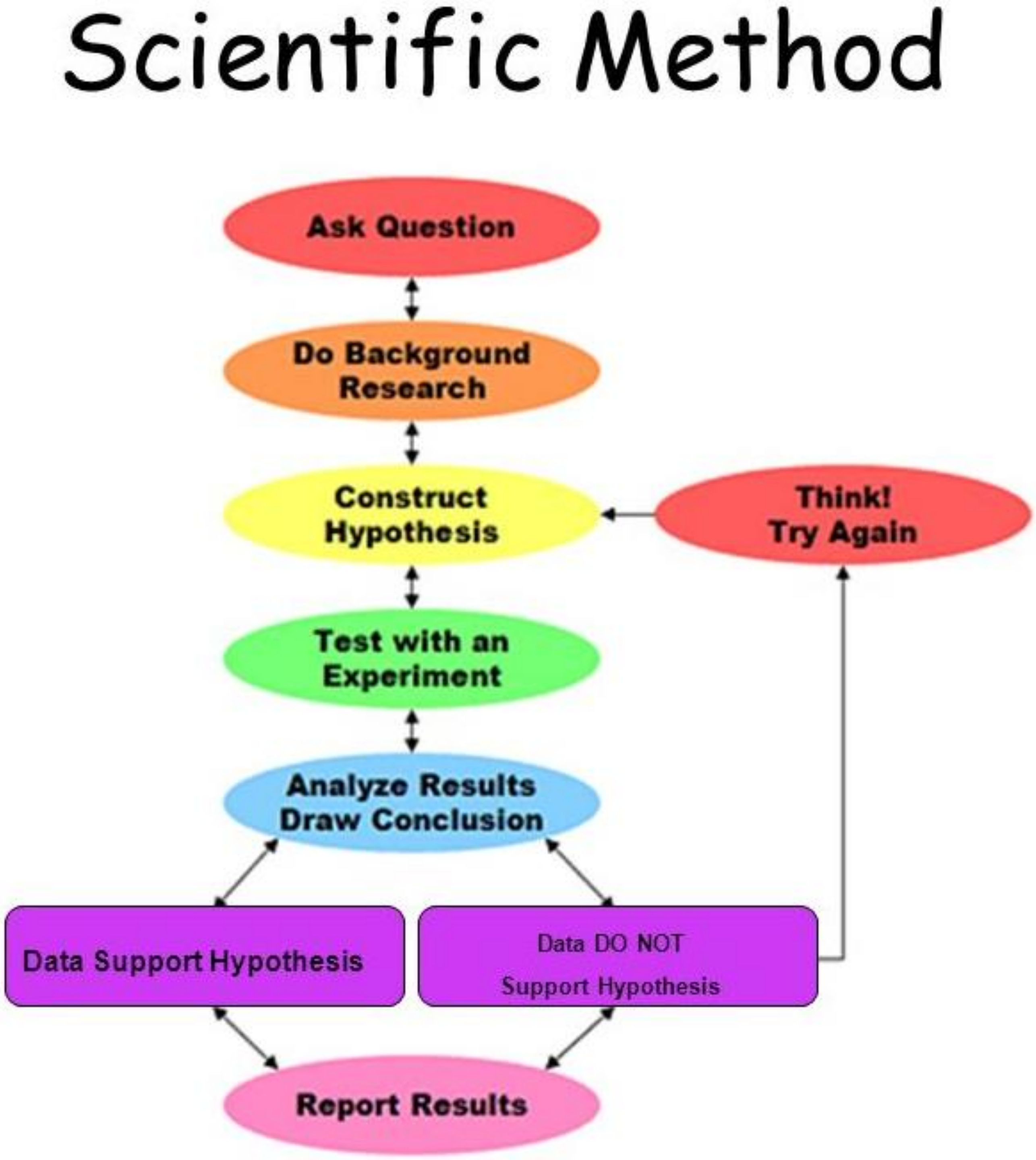
Conclusions: The ability to perform targeted modifications of existing BioBrick circuits with BioScaffolds (1) simplifies and speeds up the iterative design-build-test process through direct reuse of existing circuits, (2) allows incorporation of sequences incompatible with BioBrick assembly into BioBrick circuits (3) removes scar sequences between standard biological parts, and (4) provides a route to adapt synthetic biology innovations to BioBrick assembly through the creation of new parts rather than new assembly standards or parts collections.

Background

In traditional modification of organisms by cloning [1], the emphasis has been on single gene changes that improve the organism or make a single component easier to study. Construction of synthetic genetic circuits brings together many components [2,3] to accomplish novel tasks, creating functions unobtainable through single gene changes. *De novo* construction of genetic circuits encompasses the techniques that fall into two categories: techniques for construction and techniques for optimization. Gene synthesis, though decreasing in price [4], still remains prohibitively expensive for *de novo* synthesis of complete genetic circuits [5]. Instead, either newly synthesized, natural, or existing DNA fragments are pieced together using DNA assembly techniques. A variety of assembly methods now exist including idempotent methods [5-12], extensions to idempotent methods [13-18], ligation independent methods [3,19-21],

* Correspondence: norville@csail.mit.edu
[1]Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA 02139, USA
Full list of author information is available at the end of the article

Summarized flow chart of biological method



ALLAH HAFIZ

TAKE CARE

Teacher : Nusrat Idrees