

## A New Approach for Teaching Genetics

Le Dinh Luong \*

Centre for DNA Analysis and Genetic Technology, Hanoi, Vietnam

\*Corresponding author: Le Dinh Luong, Centre for DNA Analysis and Genetic Technology, Hanoi, Vietnam, Tel: 8448354514; E-mail: trungtame3@yahoo.com

Received: June 08, 2020; Accepted: July 27, 2020; Published: August 03, 2020

Copyright: © 2020 Luong LD. This is an open-access article distributed under the terms of the Creative Commons Attributions License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Citation: Luong LD (2020) A New Approach for Teaching Genetics. Genet Mol Biol Res Vol No: 4 Iss No: 2:26

### Abstract

At present Genetics is one of the sciences, which develops with extra - high speed and has become an exact science as physics and mathematics. Meanwhile, in Vietnam as in many other countries this subject is taught in classical way following historical sequence of concepts and don't distinguish reason - consequence relationship of concepts. This situation creates mismatches between the current tremendous content of genetics in the curriculum and teaching methodology. That's why we have decided to rewrite textbooks on the subject.

The subject was rearranged, basing on two principles:

- Replace the historical sequence which we have used up-to-now, with logical sequence;
- Place causing concepts before consequence concepts.

Thanks to the application of a new approach, the teaching volume as well as textbook content has been reduced substantially. The activity of pupils has changed very positively as they have to study consequence concepts (about 80%) by themselves relying on the causing concepts (20% left) without teacher's lessons. Furthermore, it is not necessary to re-educate teachers because the subject content was only rearranged, not modified nor added.

This new methodology has been applied to a simplified textbook for a project of European Union (EU) and recently fully applied to three books published in Vietnamese. The new approach has been presented at six national workshops across Vietnam and a trial teaching was done in three secondary schools in Hanoi.

**Keywords:** Genetics; Gene linkage

### Terminology:

- the sequence for presentation of genetic concepts in teaching, learning and writing textbooks is the sequence of time of discoveries .

- the sequence when principle concepts are presented first, the concepts which originate from principle ones, are following after .
- the concepts which are reason of causing other concepts, those are named as consequence concepts .
- the concepts which are formed from causing ones .

## Genetics at Present

Over half a century, science has developed with extra-high speed. Nowadays, it takes only two days to accumulate scientific data that used to take for all the past by scientists. Genetics is not exclusion. These data of genetics are big enough to express its systematic and logistics and make genetics become an exact science as physics and mathematics. However, at present in many countries including Vietnam genetics is taught the same way as half a century ago. It's simply impossible to teach present genetics with tremendous amount of genetic knowledge with above-mentioned classical way. So, it's necessary to find out some way to educate genetics much more easily and simply. It's just new approach for teaching genetics we are describing at the moment.

## Two Principles

### Experimental site

We rearranged the subject, basing on two principles:

- Replace the historical sequence which has been used up-to-now, with logical sequence
- Locate causing concepts before consequence concepts

**Table 1** show, historical sequence includes 1865, 1904, 1928, 1944, and 1953 - the years, when relevant concepts were discovered. That means historical sequence is the sequence of time when the relevant discoveries were done. The second part of table 1 (on the right) shows logical sequence of concepts, which means that the concept located above should be taught first, meanwhile the concept located below should be taught later. This is logical sequence. One can note that logical sequence is quite different from historical

one. As genetics is logical today it should be presented with logical sequence of its concepts. Certainly, this kind of genetics would be much easier and simpler to understand.

**Table 1** Historical sequence and Logical sequence.

No	Historical sequence	Logical sequence
1	Mendelian laws (1865)	Transformation (1928)
2	Linkage inheritance (1904)	Hereditary role of DNA (1944)
3	Transformation (1928)	The double helix of DNA (1953)
4	Hereditary role of DNA (1944)	Mendelian laws (1865)
5	The double helix of DNA (1953)	Linkage inheritance (1904)

**Table 2** shows causing concepts and consequence concepts. Mitosis and meiosis are the only two causing concepts. The rest nine items are consequence concepts. They all originate from mitosis and meiosis. For example, meiosis is a reason, which is leading to several consequence concepts as Mendelian laws, combinative variations, polyploidy. That is why mitosis and meiosis only must be explained carefully, focusing on natural movement rules of chromosomes, which lead to nature of all consequence concepts. In fact, consequence concepts can be studied by pupils themselves relying on the knowledge of mitosis and meiosis. So, there are 2 causing concepts only, and 9 consequence concepts. If we focus on 2 items and leave the 9 left ones for pupils to study themselves, it would reduce the teaching volume almost 5 times! That means at present chromosomal genetics can be taught almost 5 times less.

**Table 2** Causing concepts and consequence concepts.

No	The concepts	Types of concepts
1	Mitosis	Causing concepts
2	Meiosis	Causing concepts
3	Mendelian laws	Consequence concepts
4	Movement of genes	Consequence concepts
5	Cellular basis of inheritance	Consequence concepts
6	Gene linkage and sex linkage	Consequence concepts
7	Polyploidy	Consequence concepts
8	Chromosomal aberrations	Consequence concepts
9	Genetic mapping	Consequence concepts
10	Genetic equilibrium of population	Consequence concepts
11	Non-chromosomal inheritance	Consequence concepts

Following the new approach of genetics education, the pupil's inside classroom activities would be increased because they have to infer themselves all consequence concepts (about 80% teaching program) from causing ones. The new approach doesn't require teachers to learn additional knowledge as the subject is rearranged only, not modified nor added.

## Presentation & Trail Teaching of the New Approach

The new approach of genetics education was partly and successfully applied to a simplified textbook for a project of European Union (EU), which was published online and used by philosophers and law makers to issue international regulations on mordent biotechnology as protocols on biosafety of GMO - genetically modified organisms, moral aspects of IVF - In vitro fertilization. The link to the book is as follows: <https://fr.scribd.com/document/109724971/Background-of-Genetics>

And the new approach was fully applied to three books published in Vietnamese in 2018 and 2019 [6,7,8].

Author of the article has presented the new approach for genetics education at six national workshops:

- Hanoi University of natural sciences, 2017
- Hanoi National University of Education, 2018
- Quy Nhon University, 2018 in Phu Yen
- Hong Bang Intern University, HCMCty, 2018
- Workshop organized by Vietnam Nat. Assembly, 2017
- Vietnam Institute of Education, 2020

The author has made a trail teaching in three secondary schools in 2018 in Hanoi:

- Nguyen Hue Specialized School
- Nguyen Cong Chat School
- Ngoc Hoi School

## Conclusion

- The replacement of historical sequence of genetic concepts by logical sequence has made the subject much easier understandable.
- The division of genetic knowledge into two types of concepts - causing and consequence ones and their rearrangement afterwards in sequence causing concepts first, consequence concepts later, have reduced teaching volume as well as textbook content several times. Especially, the part of chromosomal genetics maybe reduced about five times.
- The learning activities of pupils have increased as pupils have to infer consequence concepts (about 80% teaching program) from causing ones (20% program).
- The reform of genetics by the described way doesn't require teachers to learn much because the subject is rearranged only, not modified, nor added.

## References

1. Bruce R. Korf (2004) Basic genetics. Prim Care 31: 461-478.
2. Glick BR, Pastearnk JJ (1998) Molecular Biotechnology - Principles and Applications of Recombinant DNA (2nd Edn) ASM Press, United States.
3. Luong LD (2001) Principles of Genetic Engineering. Science & Technique, Vietnam.
4. Luong LD, Thi QD (2003) Genetic Engineering & Applications. Hanoi National University, Vietnam

5. Luong LD, Nhan PC (2007) Basic Genetics (7th Edn). Education, Vietnam.
6. Luong LD (2018) Popular Genetics. Hanoi National University, Vietnam.
7. Luong LD (2019) Genetics - from new approach to education reform of the subject. Hanoi National University, Vietnam.
8. Luong LD (2019) Genetics - principles & applications. Hanoi National University, Vietnam.
9. Nicholl DST (1998) An Introduction to Genetic Engineering, Cambridge University Press, Cambridge, UK.
10. Tamarin RH (1999) Principles of Genetic (6th Edn). McGraw-Hill, New York.
11. Weaver RF (1999) Molecular Biology (1st Edn). McGraw-Hill, New York.
12. Luong LD Scientific Background of Genetics A - Basic Principles of Genetics. Background of Genetics pp 1-23.
13. Basic Genetics. Learn.Genetics Genetics Science learning Center.
14. Inge-Vechtomov SG (2010) Genetics with the basics of selection-SPb. Publisher NL, 718.
15. Hackett JK (2011) Science: A Closer Look (3rd Edn). McGraw-Hill, New-York, USA.
16. Inge-Vechtomov SG, Buzobkina IS (2016) System of Genetics Education. Vavilov Journal, Russia.