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AB MINI-PROJECTO: TEACHING MOLECULAR BIOLOGY AT AL-FARABI UNIVERSITY

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Summary

Mini-projects in current biology and biotechnology are being used as examination tools, accounts on ongoing or accomplished research programmes and for research popularization purposes. Current article is supposed to show how it is possible to focus students attention to molecular biology by inviting them to study it via investigating a genome or individual gene. Such opportunity would

enable the audience acquiring the course on molecular biology along with pioneer, “sprouting” skills of project management. Maximal scoring reaches 30 per student. Such maximal grading is thus reachable only in case of individual mini-project running or under the leadership in a team. However, there may be exclusions. For instance, one of the projects submitted was devoted to the overview titled: “From Dinosaurs to Birds”. This mini-project was presented by two students. It has impressed the instructor by a number of hypotheses and new views proposed on evolutionary issues of inter-relationships between ancient dinosaurs and modern birds to be used in future lecturing on paleobiology, molecular biology, and developmental genetics. So, both of the students were assessed equally high. Implication of mini-project approach to molecular biology and other biological courses is considered to be perspective for in-depth teaching, facilitating students independent and team works as the ability to search and retrieve required databases, undertake small-scale comparative studies and put forward hypotheses or conclusions.

Introduction

Molecular biology is essential course requiring a substantial off-class activity. Each topic or process including DNA structure and replication, following transcription and RNA exit to cytoplasm, gene and genome stability, organization of protein synthesis as translocation of the newly synthesized product to intracellular organelles is supposed to be traced by a number of special websites, PC software sources, research and online research communities and specific scientific journals. We have experienced half-an-year education process based on mini-projects tackling individual genes or whole genomes for specific organisms. This has enabled students extensive self-education on DNA composition and functions, genome properties and gene clustering, gene regulation and related protein production issues.

Generally, biological mini-projects are currently used both as examination tools [1], and accounts on ongoing or accomplished research programmes [2], or with research popularization aims [3]. Our purpose was to attract students to the course on molecular biology by inviting each of them to study the subject of own choice in line with related genome or individual gene studies. Such attitude would assist in acquiring the subject together with handling initial skills of project management.

Results and discussion

In 2015 there were 14 students of the 2-nd year of education in Biotechnology (Bachelor Studies) from Kazakh- and Russian-speaking groups which have been then transformed by the fusion into a joint English-speaking group. The instructor has posted the following guidelines to mini-projects to be predominantly focused on a range of relevant publications emphasized by the instructor:

Miniproject guidelines

The list of the sources:

Terence A Brown. Genomes. 2nd edition. Chapter 15. How Genomes Evolve

Oxford: Wiley-Liss; 2002.

ISBN-10: 0-471-25046-5

<http://www.ncbi.nlm.nih.gov/books/NBK21112/>

E. coli genome:

1) Microb Ecol (2010) 60:708–720

DOI 10.1007/s00248-010-9717-3

2) Proc. Nat. Acad. Sci. USA

Vol. 72, No. 6, pp. 2242-2246, June 1975

Fish genome:

1 Current Genomics, 2006, 7, 43-57

2 Jiang et al. BMC Genomics 2013, 14:780

<http://www.biomedcentral.com/1471-2164/14/780>

3 Genome Research 10:1890–1902 ©2000 by Cold Spring Harbor Laboratory Press ISSN 1088-9051/00

4 ARTICLE in BMC GENOMICS · NOVEMBER 2013

Impact Factor: 3.99 · DOI: 10.1186/1471-2164-14-780 ·

Bean genome:

1 Kalavacharla et al. BMC Plant Biology 2011, 11:135

<http://www.biomedcentral.com/1471-2229/11/135>

2 <http://www.beangenomics.ca/research/projects/view/draft-genome-sequence-for-common-bean-i-p-vulgaris-i>

3 <http://hudsonalpha.org/common-bean-genome-sequence-provides-powerful-tools-to-improve-critical-food-crop>

4 doi:10.1038/ng.3008

5 PhaseolusGenes

<http://phaseolusgenes.bioinformatics.ucdavis.edu/>

Primate genome:

1 Comparative genomics of higher primates, including humans and Neandertals (Svante Pääbo)

2 <http://www.genome.org/cgi/doi/10.1101/gr.3737405>.

3 ILAR Journal, Volume 54, Number 2, doi: 10.1093/ilar/ilt042

4 Nat Rev Genet. 2014 May ; 15(5): 347–359. doi:10.1038/nrg3707.

Dinosaurs genome:

<http://rspb.royalsocietypublishing.org/content/276/1677/4303>

<http://people.eku.edu/ritchisong/554notes1.html>

<http://news.ucsc.edu/2014/12/crocodile-genomes.html>

<http://www.icr.org/article/dinosaur-protein-sequences-dino-bird/>

http://jurassicpark.wikia.com/wiki/Dinosaur_DNA

<http://scienceblogs.com/notrocketscience/2009/06/21/dinosaurs-provide-clues-about-the-shrunken-genomes-of-birds/>

<http://www.reasons.org/articles/dinosaur-genome-size-estimates-lagerstatten-of-design>

<http://news.harvard.edu/gazette/story/2007/03/despite-their-heft-many-dinosaurs-had-surprisingly-tiny-genomes/>

http://www.world-science.net/othernews/070307_dinosaur.htm

<http://www.ucmp.berkeley.edu/diapsids/saurischia/theropoda.html>

<http://www.ucmp.berkeley.edu/diapsids/avians.html>

<http://10e.devbio.com/article.php?ch=16&id=161>

<http://www.enchantedlearning.com/subjects/dinosaurs/Dinobirds.html>

<http://www.enchantedlearning.com/subjects/dinosaurs/allabout/Evolution.shtml>

<http://www.enchantedlearning.com/subjects/dinosaurs/Dinobirds.html>

<http://www.membrana.ru/particle/11216>

<http://elementy.ru/news/430477>

<http://naked-science.ru/article/nakedscience/mozhno-li-vernut-dinozavrov>

<https://brodude.ru/mozhno-li-voskresit-dinozavrov/>

<http://www.ufolog.ru/publication/3480/>

Compiled by Z.G. Aytasheva

Then 5-6 weeks were given for seeking proper partnerships, teaming or independent exploration of the topics of choice. That work has followed up by intermediate discussion on the state of mini-projects and related presentations.

On 14-th week the instructor has received final presentations which have been defended by each team or a single student in accordance with their topics.

The list of presentations has looked as follows:

1. A. Tamshibay. *E. coli* Genome.
- 2 A. Baibulatova, Yu. Genievskaya. *Aspergillus niger* as a Model Organism for Molecular and Genetic Investigations.
- 3 A. Bertleuova, S. Mukhanbetzhanova, A. Sharipbay, G. Bekbaeva. Bean Genome.
- 4 R. Kozhakhmet, S. Tolesh, D. Salimzhanova. The Primates.
- 5 Yu. Pak, Abisheva A. From Dinosaurs to Birds.

Below is an itinerary content of mini-project:

- 1 Introduction
- 2 Genome characteristics
- 3 Application in biotechnology
- 4 Conclusion
- 5 References

However, some of the projects have appeared to include comparative studies. For instance, Ms. Aidana Tamshibay's *E. coli* mini-project has pointed out the comparison of *E. coli* and *Shigella spp.* genomes.

Evaluation of mini-projects and related maximal scoring have been composed of the following items:

- 1 Slide number in presentation (1)
- 2 Slide quality (3)
- 3 Quoting accuracy (2)
- 4 Number and quality of intermediate accounting. Number of versions (presentations editions) demonstrated to the instructor (5)
- 5 Quality of final defence (10)
- 6 Team work. Individual impact (5)
- 7 Leadership skills in running a mini-project (4)

Maximal scoring was 30 per student. It meant, the maximum would be reachable by individual mini-project holders or leaders of the teams. However, there might be exclusions. For instance, one of the last projects out of submitted was Mini-project 5 entitled: "From Dinosaurs to Birds". It was presented by Ms. Aigerim Abisheva and Mr. Yuri Pak. It has impressed the instructor by a range of hypotheses and new viewpoints on evolution of ancient dinosaurs to modern birds which may be used in future lecturing on paleobiology, molecular biology, and developmental genetics. That is why both students

were accessed equally high. Hence, based on all forementioned, implication of mini-project methodology to molecular biology and other biological courses is proposed for profound teaching, fostering student's independent and team work as the ability to search and retrieve required databases, undertake small-scale comparative studies and put forward own hypotheses or far going conclusions.

References

1 Mini-project examination

http://www.stats.ox.ac.uk/__data/assets/pdf_file/0003/5691/Data_IG_and_GF_12_10_9_.pdf

2 Mechanistic Insights into P53-CYPD Interactions. Mini Project Report by V. R. Yanamala, A. Mathew, Ch. Cherian, M. James. 25 March 2013. Natl. Inst. Tech., Calicut.

<http://www.slideshare.net/vijayrajnazzi/btech-mini-project-computational-biology-nitc>

3 Split RNA extraction

<http://www.sciencefairadventure.com/ProjectDetail.aspx?ProjectID=123>



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