TEACHING MOLECULAR BIOLOGY AT KAZAKH UNIVERSITIES IN ENGLISH: STRATEGY OF MINI-PROJECTS

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Summary

Mini-projects in current biology and biotechnology are being used as examination tools, accounts on ongoing or finished research programmes and for research popularization goals. Purpose of current paper is to show how it is possible to attract students while teaching molecular biology by means of inviting the students to study the subject of interest through the focus of studying the genome or an individual gene. Such offer would help the audience in acquairing molecular biology course besides experiencing initial skills in project management. Maximal scoring reaches 30 per student throughout the term. This maximum is therefore reacheable only by an individual mini-project holder or the leader of a teams. However, there may be exclusions. For example, one of the projects submitted was dedicated to the topic "From Dinosaurs to Birds" presented by two strudents. It has impressed the instructor by a range of hypotheses and new views on evolutionary issues regarding inter-relationships of ancient dinosaurs and modern birds to be used in future lecturing on paleobiology, molecular biology, and developmental genetics. That is why both of the students were accessed equally high.

Implication of mini-project approach to molecular biology and other biological courses is regarded to be perspective for profound teaching, fostering student's independent and team work as the ability to seach and retrieve required databases, undertake small-scale comparative studies and put forward own hypotheses or far going 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 separate 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 structure and functions, genome organization 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 is to attract students to the course on molecular biology by inviting each of them to study the subject of own choice in a sharpened focus of the genome or individual gene. Such attitude would assist in acquairing the subject together with handling initial skills in 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 groups which have been later fused into a joint English-speaking group. The instructor has suggested the following guidelines to mini-projects to be predominantly focused on a range of releavant 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, team subdivisions and independent explorations of the topics of choice. That work has ended 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 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 turned out to conclude comparative studies. For instance, Aidana Tamshibay's *E. coli* project has comprised the comparison of *E. coli* and *Shigella spp.* genomes.

Evaluation items for mini-projects and related maximal scoring have been composed of:
1 Number of slides in presentation (1)
2 Quality of slides (3)
3 Accuracy in quoting (2)
4 Number and qulity of intermediate accounting. Number of presentations editions presented to the instructor (5)
5 Quality of final defence (10)
6 Team work. Individual impact (5)
7 Leadership in running a mini-project (4)

Maximal scoring is 30 for each participant throughout the whole term. It means, it would be reacheable by individual mini-project holders or leaders of the teams. However, there may be exclusions. For instance, one of the last projects out of submitted was mini-project 5 "From Dinosaurs to Birds" presented by Yuri Pak and Aigerim Abisheva. It has impressed the instructor by a range of hypotheses and new views on evolutionary issues regarding inter-relationships of ancient dinosaurs and modern birds to be used in future lecturing on paleobiology, molecular biology, and developmental genetics. That is why both of the students were accessed equally high. Therefore, based on all forementioned, implication of mini-project methodology to molecular biology and other biological courses is obviously perspective tool for profound teaching, fostering student's independent and team work as the ability to seach 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 Mechnistic 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

Programme

Monday 12 December 2016

14:00	**Registration & refreshments**
15:00	**Welcome** Prof Graham Scott and Dr Sara Marsham, SEB+ Committee Members
15:15	**Prof Mark Langan (Manchester Metropolitan University, United Kingdom)** Adult play and learning: is it time to grow up?
15:45	**Dr Roy H J Erkens (Maastricht University, Netherlands)** Education that moves you: a standing approach to teaching and learning
16:05	**Dr Pam Megaw (James Cook University, Australia)** Instructor creativity in producing learning activities for a diverse cohort of first year anatomy and physiology students
16:25	**Dr Lucy Tallents (University of Oxford, United Kingdom)** Building ideas for student collaboration, together!
17:05	**Discussion**
17:20	**End of Day 1**

17:25 - 19:30 **Poster session and buffet dinner**

Tuesday 13 December 2016

08:30 Registration

09:00 **Welcome**

09:10 **Dr George R Littlejohn (University of Plymouth, United Kingdom)**
Aesthetics and choice in microscope-based biology teaching and research

09:40 **Dr Gemma Anderson (Falmouth University, United Kingdom)**
Drawing as a way of knowing in biology

10:10 Refreshment break

10:40 **Dr Mark J Feltham (Liverpool John Moores University, United Kingdom)**
Drones, bones and mobile phones: maker education and creative learning in science

11:10 **Dr John Wedgwood Clarke (University of Hull, United Kingdom)**
A poet in the lab: Creative writing and the biology student

11:40 **Mr John R A Smith (University of Westminster, United Kingdom)**
Art/Science collaboration: life in a new light

12:00 **Dr David E Whitworth (Aberystwyth University, United Kingdom)**
Beyond creation learning: enhancing students' creative self-efficacy

12:20 Lunch

13:20 **Dr Chris Willmott (University of Leicester, United Kingdom)**
Student-generated videos: an authentic assessment

13:50 **Dr Pam Megaw (James Cook University, Australia)**
Student creativity in assessment of an anatomy and physiology subject: the digi-explanation

14:10 **Prof Mark O Clements (University of Lincoln, United Kingdom)**
Unpredictable outcomes: when art and science collide

14:30 Refreshment break

15:00 **Dr Peter Lumsden (University of Central Lancashire, United Kingdom)**
Staff find their creative spark through digital tools which increase student engagement

15:20 **Ms Erin A McKenney (Duke University, United States)**
Student-centred course design leverages creativity for effective, enhanced education

15:40 **Dr Anne M Tierney (Edinburgh Napier University, United Kingdom)**
You call THAT a big class? Teaching large biology classes creatively

16:00 End of day 2

18:30 Conference dinner

Wednesday 14 December 2016

08:45 Registration

09:00 **Welcome**

Mrs Jane C Gurman (Sheffield Hallam University, United Kingdom)
09:10 A creative approach to enabling student creativity in the biosciences through an entrepreneurial challenge

Mr Nieky Van Veggel (Writtle University College, United Kingdom)
09:30 Teaching animal nutrition through product development and design

Prof Norman J Jackson (Creative Academic, United Kingdom)
09:50 Creativity and learning ecologies: what value does this idea have for higher education teaching and students' creative development and achievement?

10:10 Refreshment break

10:45 **Summary discussion and action planning**

12:00 Close of meeting