SISSA PhD Course in Genomics: admission exam, written test

Sept 29th, 2016

PRIOR TO INITIATE YOUR TEST, PLEASE READ CAREFULLY THE FOLLOWING POINTS:

(a) Pick two (*and not more*) questions among the following ones and answer them

(b) Use one (*or more*) sheets per answer. Label each sheet with the corresponding question number: "Question N". DO NOT use the same sheet for different answers.

(c) To allow for fair and unbiased evaluation of your elaborates, DO NOT label them with your name and surname.

(d) You can answer questions in Italian or English. Your language choice WILL NOT affect the evaluation of your test at all. If you choose Italian and pass the written exam, you will be asked to document your knowledge of English, by translating a short paragraph from Italian to English upon your oral exam.

(e) You can write a rough draft and then make a fair copy of it. Alternatively, if you prefer, you can straightly write a "fair copy". Whatever your choice is, pay special attention to clarity and intellegibility of your handwriting. All sentences of your "fair copy" not fullfilling the requirement of clarity and intellegibility WILL BE IGNORED AND NOT EVALUATED. In this respect, feel absolutely free to write in block letters, even in CAPITOLS.

(f) You have three hours for your exam

(g) As you complete your elaborates, please put into the big envelope:
- the elaborates
- the small envelope, containing the stripe of paper with your name and surname
Both big and small envelopes MUST NOT report your name and surname at all.

PAY ATTENTION: FAILURE TO FULLY COMPLY WITH ISSUES (a), (b), (c), (d), (f) and (g) WILL CAUSE YOUR EXCLUSION FROM SELECTION

QUESTIONS

01. What is Junk DNA?

02. Horizontal transmission of genetic information

03. Examples and accomplishments of large international genomic projects

05. RNA therapy

06. Structure and function of long non-coding RNAs

06. Transposable Elements

07. Discuss drug screening strategies for the treatment of neurodegenerative diseases

08. Molecular mechanisms of neurodegeneration

09. Describe prion-like transmission of pathogenic tau protein and its involvement in AD

10. Prion protein structure and its molecular determinants in prion formation

11. Bioinformatics approaches for comparative genomics

12. How genes mediate adaptation to the environment

13. How transposable elements generate somatic variations in the brain

14. Evolution of long noncoding RNAs mediated by transposable elements

15. A cohort of patients harbors a heterozygous synonymous mutation in the middle of the coding region of the *A* gene, in a position corresponding to the N-term of domain 2 of its polypeptide product. This is specifically associated to a pronounced *A*-mRNA upregulation and - apparently - a reduced level of its polypeptide product, as assessed by qRTPCR and immunocytofluorescence, respectively. The remaining part of the *A* locus was sequenced and is perfectly identical to healthy individuals. Provide a *comprehensive* list of molecular mechanisms which may lead to this scenario. Propose a feasible experimental strategy suitable to identify the actual one.

16. Elaboration of positional information in the developing CNS: general principles and examples of their implementation.

17. Articulation and molecular control of a neural histogenetic process of your choice.

18. Conditional mutagenesis.

19. Host-parasite interaction: an unmatched source of powerful genetic tools.

20. siRNAs, miRNAs, piRNAs in mammals: biogenesis and molecular roles.