Master project 2020-2021

Personal Information	

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Project

Computational genomics

Project Title:

CRISPR, Cancer, Noncoding RNAs

Keywords:

CRISPR, cancer, lncRNA

Summary:

One of the biggest biological surprises of the last decade has been the discovery of a completely new class of genes in the human genome – long non-coding RNAs (lncRNAs). These RNA transcripts are not translated into protein, but instead seem to function as regulatory molecules that control the expression of other genes. As part of the international ENCODE consortium, our group has helped catalogue >10.000 of these genes, 99% of which remain completely uncharacterised. LncRNAs represent an extremely promising source of new drug targets. The objective of our lab is to develop a new generation of anti-cancer therapies based on designed lncRNA inhibitors. We identify lncRNA targets via in-house developed, interdisciplinary strategies combining bioinformatics with CRISPR-Cas9 genome-engineering tools. We can offer a variety of tailor-made projects to interested students. These may be, for example, integrative data analysis to make testable predictions about lncRNA functionality, or creation of pipelines for identification of cancer-causing lncRNAs from our CRISPR screens. Previous MSc students have gone on to publish first-author papers based on their MSc thesis, and have successful scientific careers with us and other groups (eg from UPF: Carlevaro-Fita, Pulido-Quetglas, Mas-Ponte, Lanzos – see Pubmed). Students in our lab get exposed to latest bioinformatic and experimental practices on a daily basis. They get closely mentored and have numerous opportunities to present their work internally. Our lab is involved in several international collaborations and consortia, including the International Cancer Genome Consortium (https://www.nature.com/collections/afdejfafdb) and we were recently awarded a prestigious Future Research Leaders grant from the President of Ireland (https://www.sfi.ie/research-news/news/president-higgins-honours/). If you are motivated to work at the forefront in computational cancer genomics and genome-engineering in a fun, supportive and motivated team, then contact us for more information! See also: gold-lab.org https://twitter.com/GOLDLab_Bern https://people.ucd.ie/rory.johnson

References:

Selected recent papers: Rheinbay E... PCAWG Consortium (including Johnson R, Carlevaro-Fita J, Lanzos A) Analyses of non-coding somatic drivers in 2,658 cancer whole genomes. Nature. 2020 Feb;578(7793):102-111. Bergadà-Pijuan J, Pulido-Quetglas C, Vancura A, Johnson R#. CASPR, an analysis pipeline for single and paired guide RNA CRISPR screens, reveals optimal target selection for long noncoding RNAs. Bioinformatics. 2019 (In Press) Carlevaro-Fita J, Polidori T, Das M, Navarro C, Zoller TI, Johnson

R#. Ancient exapted transposable elements promote nuclear enrichment of human long noncoding RNAs. Genome Research 2019 Feb;29(2):208-222 Joana Carlevaro-Fita, Rory Johnson#. Global Positioning System: Understanding long noncoding RNAs through subcellular localisation. Molecular Cell 2019 Mar 7;73(5):869-883 Roberta Esposito, Núria Bosch, Andrés Lanzós, Taisia Polidori, Carlos Pulido-Quetglas, Rory Johnson#. Hacking the cancer genome: Profiling therapeutically-actionable long noncoding RNAs using CRISPR-Cas9 screening. Cancer Cell 2019 Apr 15;35(4):545-557. Lagarde J, Uszczynska-Ratajczak B, Carbonell S, Pérez-Lluch S, Abad A, Davis C, Gingeras TR, Frankish A, Harrow J, Guigo R#, Johnson R#. High-throughput annotation of full-length long noncoding RNAs with capture long-read sequencing. Nature Genetics 2017 Dec;49(12):1731-1740 Uszczynska-Ratajczak B, Lagarde J, Frankish A, Guigó R, Johnson R#. Towards a complete map of the human long non-coding RNA transcriptome. Nature Reviews Genetics 2018 Sep;19(9):535-548.

Expected skills::

Unix, R, python

Possibility of funding::

No

Possible continuity with PhD: :

To be discussed