Syllabus

GENOMIC SEQUENCING AND ANALYSIS

ISC 5935, Spring 2010

Purpose:

The purpose of this course is to introduce students to modern and emerging methods of DNA sequencing and to give them some experience in both preparing samples and analyzing the resulting data.

Rooms:

Lecures: Dirac 152
Wet Lab: BRF 215
Computer Lab: Bio1 201

Times: See calendar below

Evaluation: 25% Midterm Exam 50% Participation 25% Lab Assignment

Course Schedule:

(1/11 – 3/5) READING ASSIGNMENTS FROM PRIMARY LITERATURE:

1/11…….**454** Margulies et al. 2005. Genome sequencing in microfabricated high-density picolitre reactors. Nature 437:376-380.

1/18…….**Solexa** Bentley et al. 2008. Accurate whole human genome sequencing using reversible terminator chemistery. Nature 456:53-59.

1/25…….**Solid** Mardis 2009. Next-Generation DNA Sequencing Methods. Annu. Rev. Genomics Hum. Genet. 9:387-402.

2/1……...**Other** (Read websites and watch demo videos)

Helicos (tSMS): http://www.helicosbio.com
http://www.helicosbio.com/Technology/TrueSingleMoleculeSequencing/tSMStradeHowItWorks/tabid/162/Default.aspx

Pacific Biosciences (SMRT): http://www.pacificbiosciences.com
http://www.pacificbiosciences.com/video_lg.html
See paper on blackboard:
Eid et al. 2009. Real-Time DNA sequencing from single polymerase molecules. Science 323:133-138.

IBM (DNA Transistor)
http://www.youtube.com/watch?v=pKi30ai35mU
http://www.youtube.com/watch?v=wvclP3GySUY

Complete Genomics (DNA Nano-ball) *See papers on blackboard:*
Drmanac et al. 2010. Science. Human genome sequencing using unchained base reads on self-assembling DNA nanoarrays.

Technical Document.

2/8……**Multiplexing**

Meyer et al. 2008. Parallel tagged sequencing on the 454 platform. Nature Protocols 3:267-278.

2/15…….……**Enrichment (Sequence Capture)**

Albert et al. 2007. Direct selection of human genomic loci by microarray hybridization. Nature Methods 4:903-905.

Hodges et al. 2007. Genome-wide in situ exon capture for selective resequencing. Nature Genetics. 39:1522-1527.

Ng et al. 2009. Targeted capture and massively parallel sequencing of 12 human exomes. Nature 461:272-276.

2/22……**Enrichment (SNPs)**

Ingman and Gyllensten. 2008. SNP frequency estimation using massively parallel sequencing of pooled DNA. Eurpean Journal of Human Genetics. 2008:1-4

VanTassel et al. 2008. SNP discovery and allele frequency estimation by deep sequencing of reduced representation libraries. Nature Methods 5:247-252.

Optional additional reading:

Wegner 2009. Massively parallel MHC genotyping titanium that shines. Molecular Ecology. 18:1818-1820.

Babik et al. 2009. New generation sequencers as a tool for genotyping of highly polymorphic multilocus MHC system. Molecular Ecology Resources. 9:713-719.

Stiller et al. 2009. Direct multiplex sequencing (DMPS)—a novel method for targeted high-throughput sequencing of ancient and highly degraded DNA. Genome Research. 19:1843-1848.

(3/8 – 3/12) **SPRING BREAK**

(3/15-3/18) **LECTURES/DISCUSSION:**

M	3/15	10a-11a:	**454**
		5p-6p:	**Solexa**
T	3/16	5p-7p:	**Solid, PacBio, IBM, GE, Halcyon, Complete Genomics**
W	3/17	10a-11a:	**Fragmentation**
		5p-7p:	**Multiplexing**
R	3/18	5-7p:	**Enrichment (COT, Mito/Chlor, mRNA, Sequence Capture)**
F	3/19	10a-11a	**EXAM** in Dirac 152

(3/22-4/16) **Wet Lab Students:**

M	3/22	5p-8p?	Fragmentation, Quantitation
T	3/23	5p-8p?	*(Troubleshooting / Reruns)*
W	3/24	5p-8p?	Multiplexing I
R	3/25	5p-8p?	*(Troubleshooting / Reruns)*
F	3/26	5p-8p?	Multiplexing II
M	3/29	5p-8p?	Multiplexing III
T	3/30	5p-8p?	*(Troubleshooting / Reruns)*
W	3/31	5p-8p?	Quality Control I
R	4/01	5p-8p?	*(Troubleshooting / Reruns)*
F	4/02	5p-8p?	Quality Control II
M	4/05	5p-8p?	Introduction to 454 data / Quality Control
W	4/07	5p-8p?	Denovo 454 read Assembly
F	4/09	5p-8p?	Output Interpretation
M	4/12	5p-8p?	Introduction to Solexa Data
W	4/14	5p-8p?	Solexa Mapping Assembly with Reference
F	4/16	5p-8p?	Output Interpretation

(3/22-4/2) **Other Students:**

M	3/22	5p-8p?	Introduction to 454 data / Quality Control
W	3/24	5p-8p?	Denovo 454 read Assembly
F	3/26	5p-8p?	Output Interpretation
M	3/29	5p-8p?	Introduction to Solexa Data
W	3/31	5p-8p?	Solexa Mapping Assembly with Reference
F	4/02	5p-8p?	Output Interpretation

4/23 **<u>COMPUTER LAB EXERCISES DUE</u>**

NO FINAL EXAMINATION