The ICBR- Recent efforts, upcoming initiatives and ongoing challenges

SENATE COUNCIL ON RESEARCH & SCHOLARSHIP MEETING
April 17, 2018

Steven J. Madore, Ph.D.

ICBR Associate Director for Science

UFHCC Associate Director for Core Technologies

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your pursuit is what drives us.

Talk Outline

- The ICBR – *an introduction and historical overview*
- Recent efforts
- Ongoing challenges
- New initiatives

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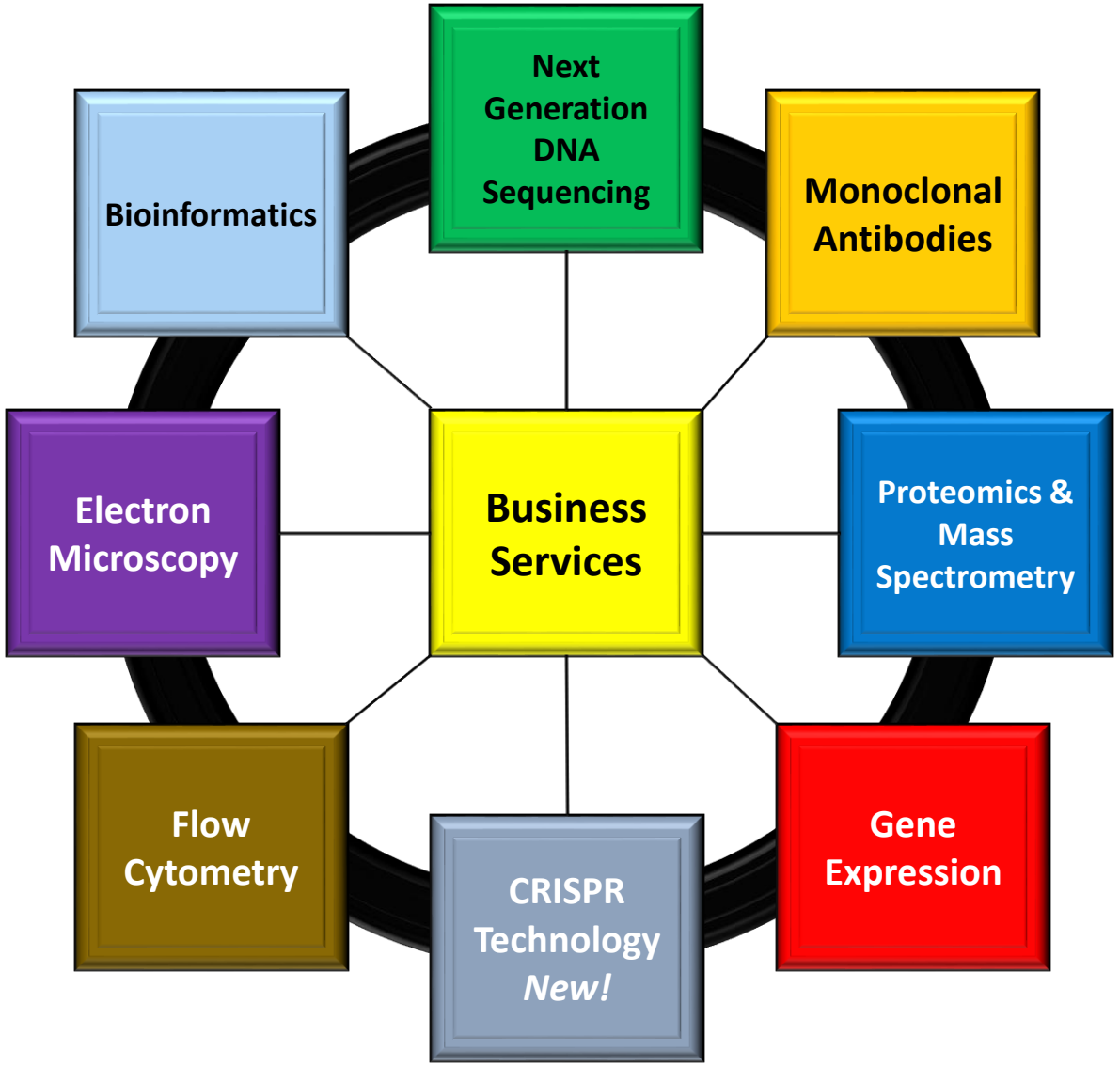
Introduction

- Founded in 1987 by the Florida Legislature as a research support organization to develop biotechnology resources to support the UF research community.
- State of Florida and UF provide funding to support administration, scientific directors and technical personnel.
- Main facility located in Cancer & Genetics Research Complex with satellite locations in MacKnight Brain Institute and Microbiology and Cell Sciences.
- Mission is to enable, strengthen and energize all aspects of molecular life science research by providing scientific and technical instrumentation and expertise.
- Long term aim is to jump start research for technology transfer and accelerate molecular biology research success from concept through to data that advances science.
- Organized under the Vice President for Research, Dr. David Norton and led by Dr. Robert Ferl.

Organization

Rob Ferl, Ph.D.
ICBR Director

- Heather Voet
  Assistant Director
  Business Services
  - Finance Manager
  - Cyberinfrastructure
  - Communications
  - Human Resources
- Steven Madore, PhD
  Assoc Dir for Science
  - Brad Barbazuk, PhD
    BI, Fac Dir, BI
  - Chris Vulpe, PhD
    CTC, Fac Dir
  - Andria Doty, PhD
    Cytometry, Sci Dir
  - Sixue Chen, PhD
    Proteomics, Sci Dir
  - Paul Chipman, MA
    EM, Sci Dir
  - Angel Sampson, PhD
    mAb, Sci Dir
  - Yanping Zhang, PhD
    GEG, Sci Dir



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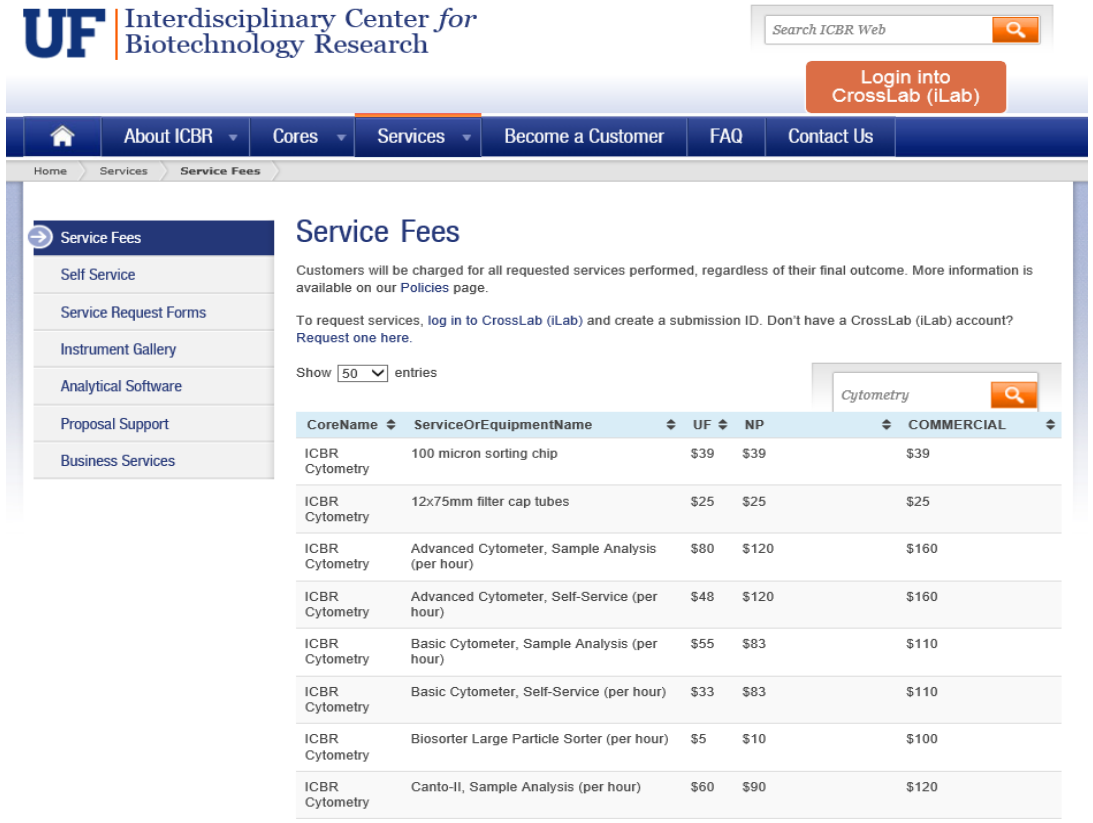
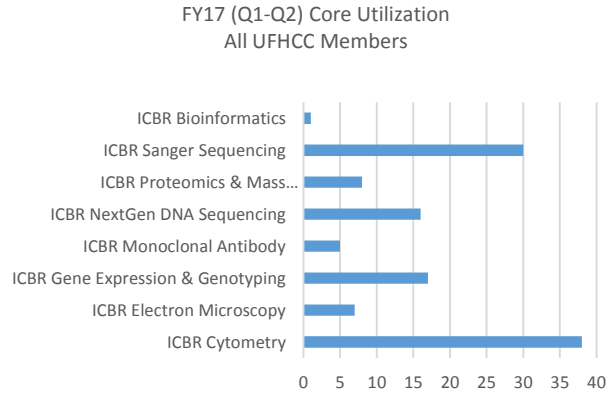
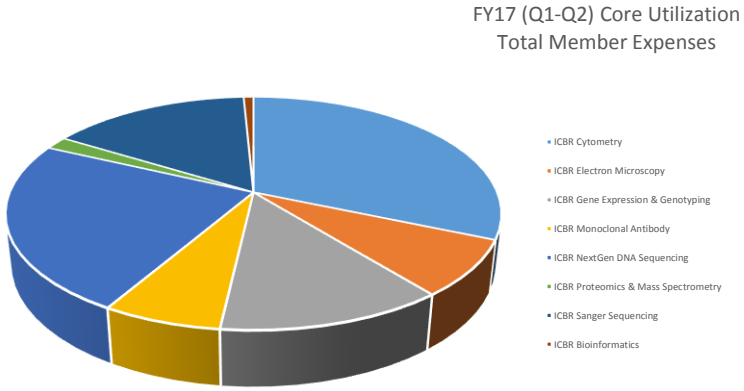
Recent Efforts

- Launch of iLAB



CoreName	ServiceOrEquipmentName	UF	NP	COMMERCIAL
ICBR Cytometry	100 micron sorting chip	$39	$39	$39
ICBR Cytometry	12x75mm filter cap tubes	$25	$25	$25
ICBR Cytometry	Advanced Cytometer, Sample Analysis (per hour)	$80	$120	$160
ICBR Cytometry	Advanced Cytometer, Self-Service (per hour)	$48	$120	$160
ICBR Cytometry	Basic Cytometer, Sample Analysis (per hour)	$55	$83	$110
ICBR Cytometry	Basic Cytometer, Self-Service (per hour)	$33	$83	$110
ICBR Cytometry	Biosorter Large Particle Sorter (per hour)	$5	$10	$100
ICBR Cytometry	Canto-II, Sample Analysis (per hour)	$60	$90	$120





Recent Efforts

- Branding

Recent Efforts

- Gauging Customer Satisfaction

Overall ICBR Customer Satisfaction

	Frequency	% (N=75)
1 ("very dissatisfied")	1	1.3%
2	4	5.3%
3	9	12.0%
4	25	33.3%
5 ("very satisfied")	35	46.7%
Not sure	1	1.3%

What did the ICBR do really well?

Angel Sampson was great about getting information to us at the start
Came up with good suggestions and helped interpret the results
Communicate
Communication (especially David Moraga) - Accommodate tight schedule.
Communication when working through a project.
Customer service, quality of training and data
Easy requesting, timing
EM core
Expert advice on SEM use
Fast service, constant updates, quality

What could the ICBR do better?

Better maintenance of instruments
Bring back Sanger Sequencing
Communication regarding technical issues
Data analysis education
Easier access/location to the college of medicine
Fewer password requirements to access scheduling calendars

Recent Efforts – Faculty Recruiting

➢ ICBR coordinates with hiring departments for faculty recruit tours

- Highlights value of ICBR services, existing technologies/instrumentation
- Establishes valuable connections with on campus experts
- Facilitates acquisition of new instrumentation as part of start up package that can be used by all UF research
  - Important to eliminating purchase of expensive equipment in start up packages
  - Discussions with ICBR and Gavin Naylor, recent hire in Museum of Natural History, resulted in acquisition of state of the art PacBio DNA sequencer SEQUEL
  - ICBR led instrument purchase process
  - Located in ICBR, staffed by ICBR experts, covered by service contract & accessible to UF research community

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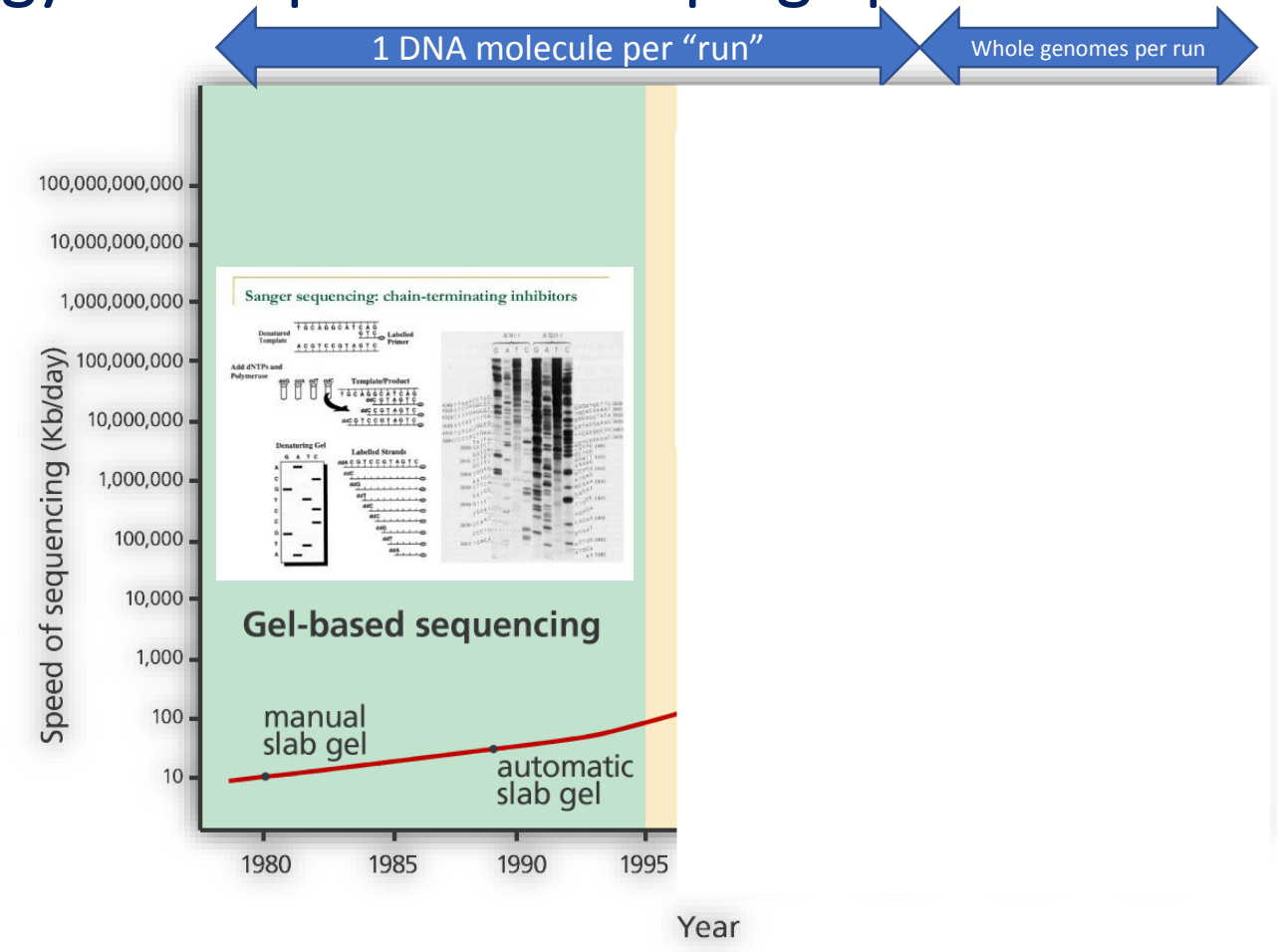
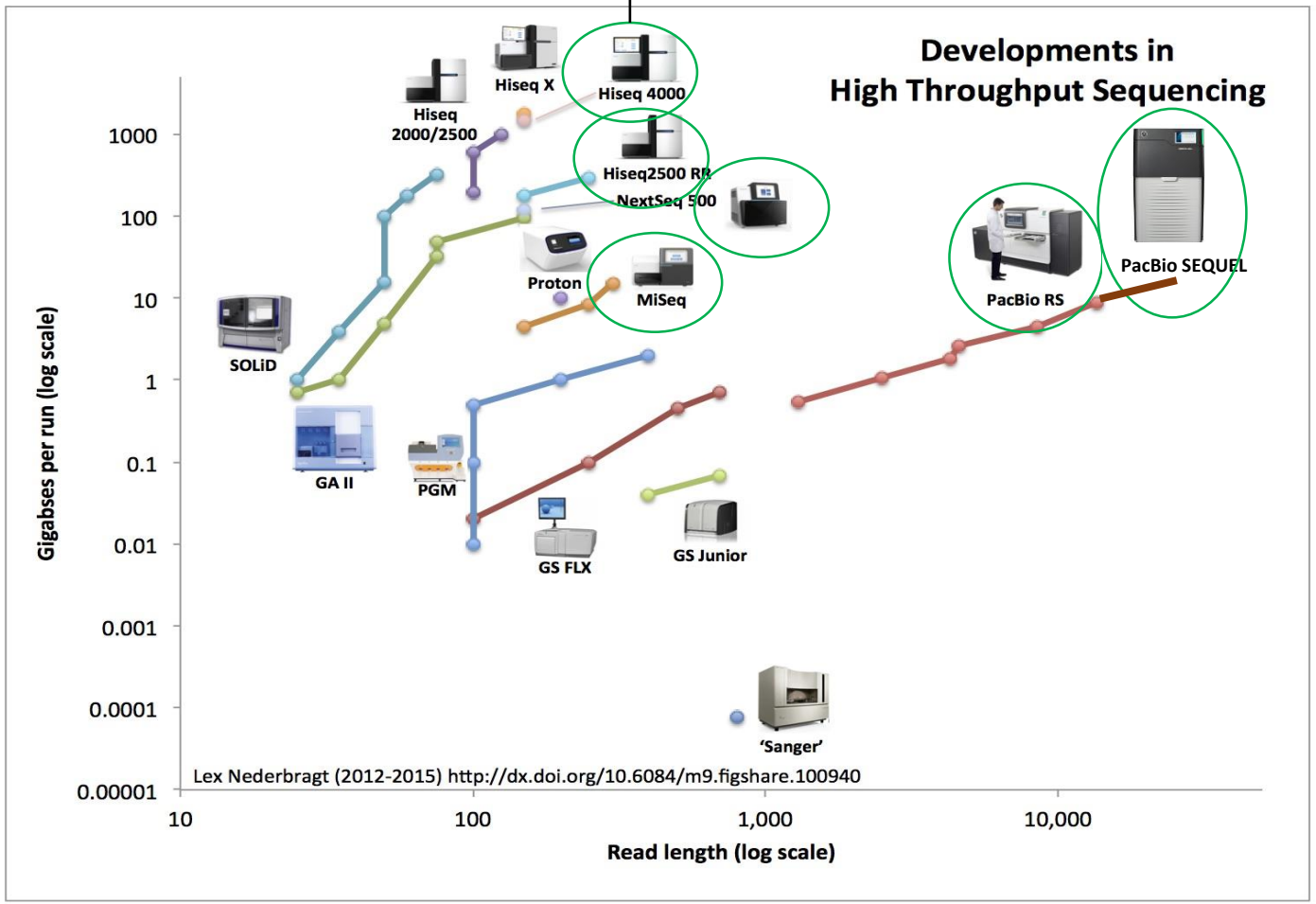
Ongoing Challenges

Rapid Technology Developments – Keeping up with the Jones'

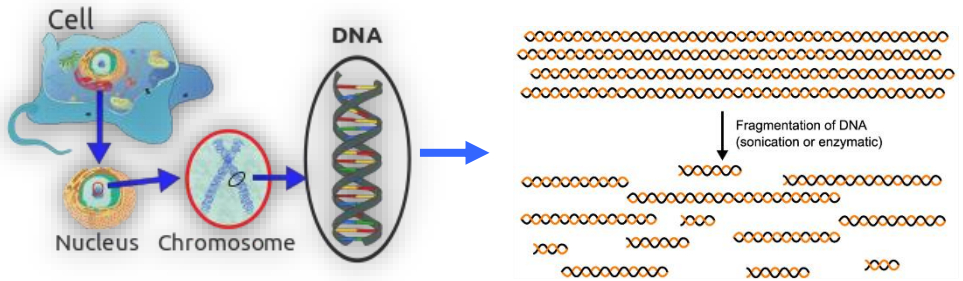


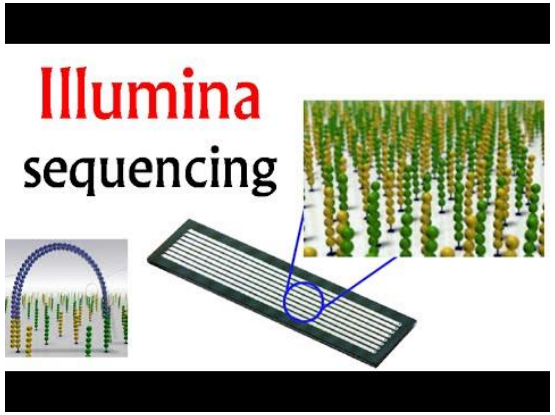
Ongoing Challenges

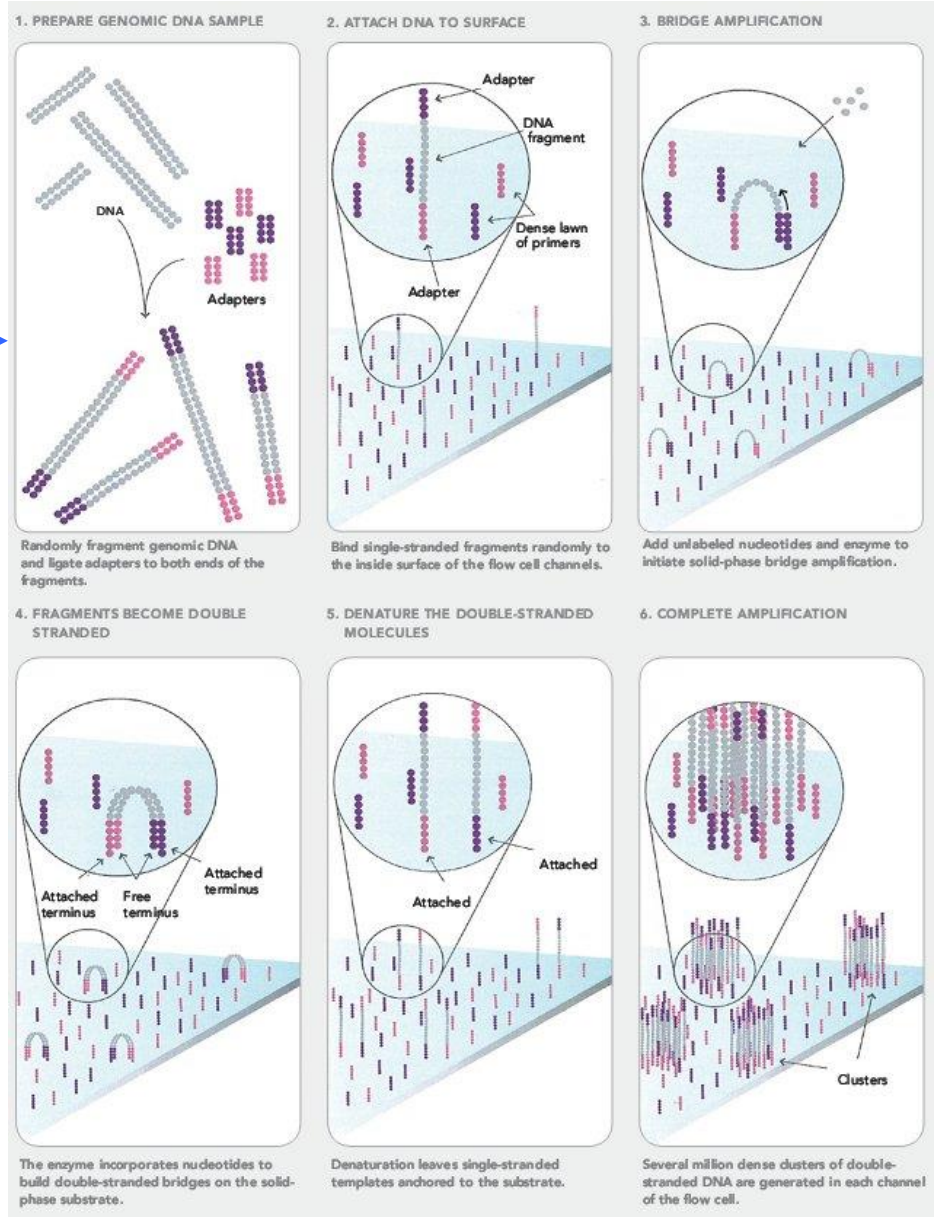
HiSEQ3000
6 human genomes @ 30X coverage per day!

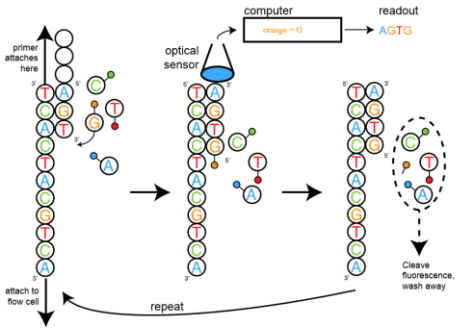


Illumina

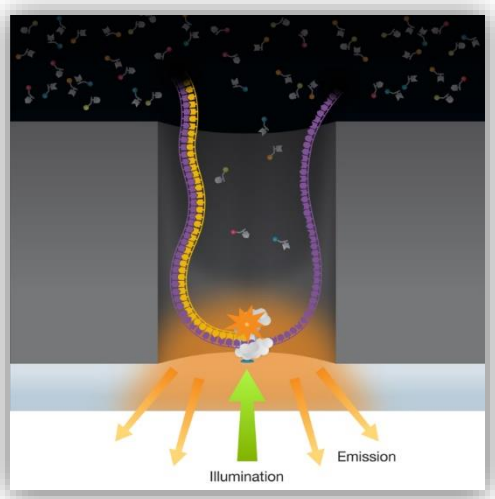

Cell
DNA
Nucleus
Chromosome
Fragmentation of DNA
(sonication or enzymatic)

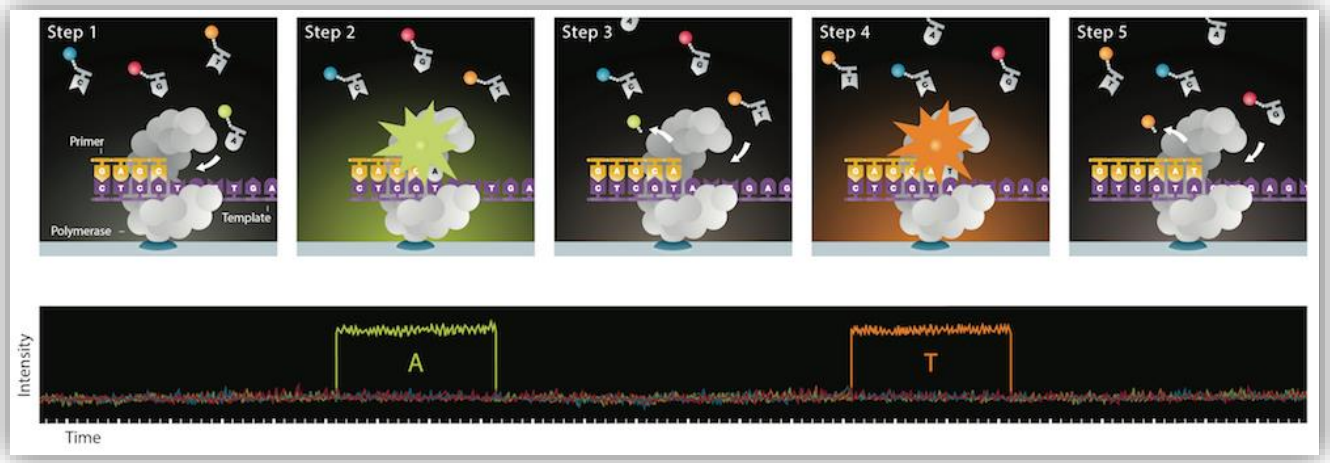

Illumina
sequencing


1. PREPARE GENOMIC DNA SAMPLE
DNA
Adapters
Randomly fragment genomic DNA and ligate adapters to both ends of the fragments.
2. ATTACH DNA TO SURFACE
Adapter
DNA fragment
Dense lawn of primers
Adapter
Bind single-stranded fragments randomly to the inside surface of the flow cell channels.
3. BRIDGE AMPLIFICATION
Add unlabeled nucleotides and enzyme to initiate solid-phase bridge amplification.
4. FRAGMENTS BECOME DOUBLE STRANDED
Attached terminus
Free terminus
Attached terminus
The enzyme incorporates nucleotides to build double-stranded bridges on the solid-phase substrate.
5. DENATURE THE DOUBLE-STRANDED MOLECULES
Attached
Attached
Denaturation leaves single-stranded templates anchored to the substrate.
6. COMPLETE AMPLIFICATION
Clusters
Several million dense clusters of double-stranded DNA are generated in each channel of the flow cell.


primer attaches here
attach to flow cell
optical sensor
computer
readout
AGTG
Cleave fluorescence, wash away
repeat

PacBio –Single Molecule Real Time (SMRT) Sequencing



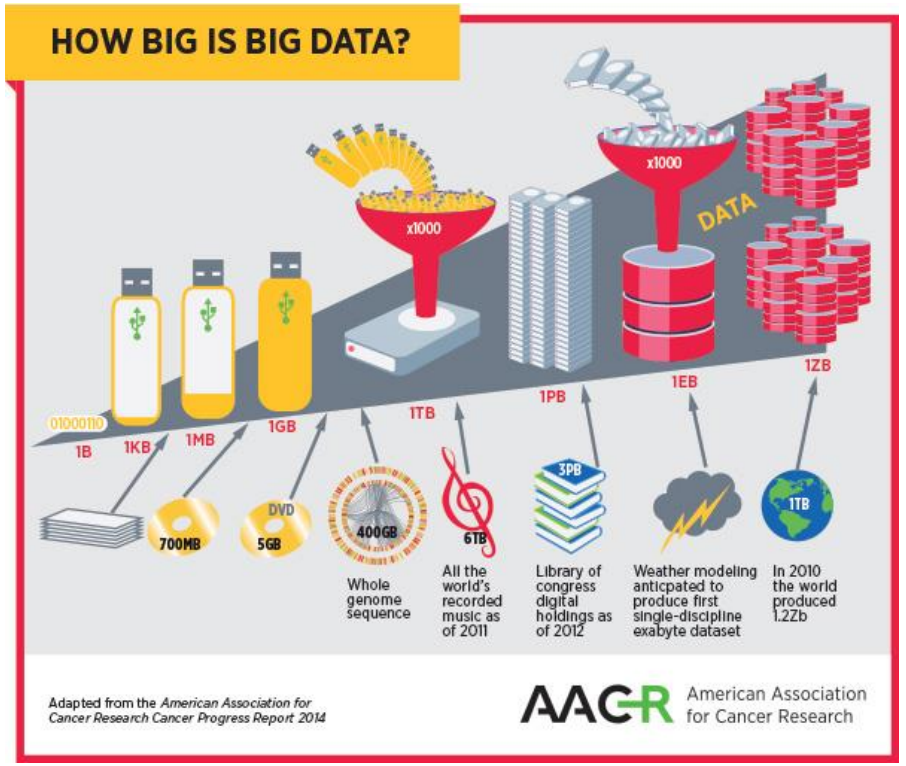


PacBio RS II System

Sequel System

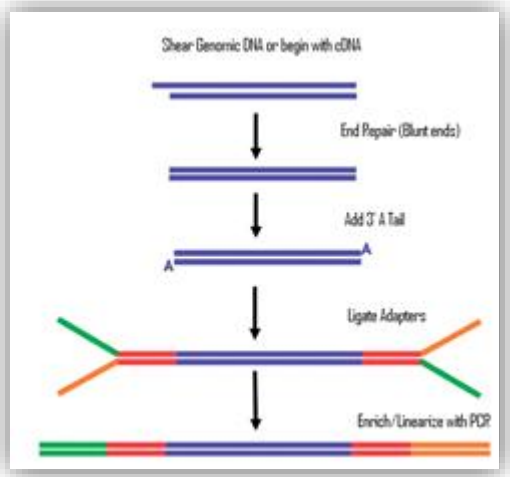
Ongoing Challenges

- Modern DNA sequencers generate very large data sets
  - *ICBR average sequencing read results in 1 Tb of data*
  - *Additional large files created from downstream data analysis*
- Bottleneck is moving and storing big data files
- Data archiving
  - *Who's responsible???*
  - *What format?*
  - *How long?*
  - *Who pays the bill?*
  - *How to ensure safe storage?*
- What are institutional policies??



Ongoing Challenges

Big Data - Sequencing Requires Shredding Chromosomal DNA…



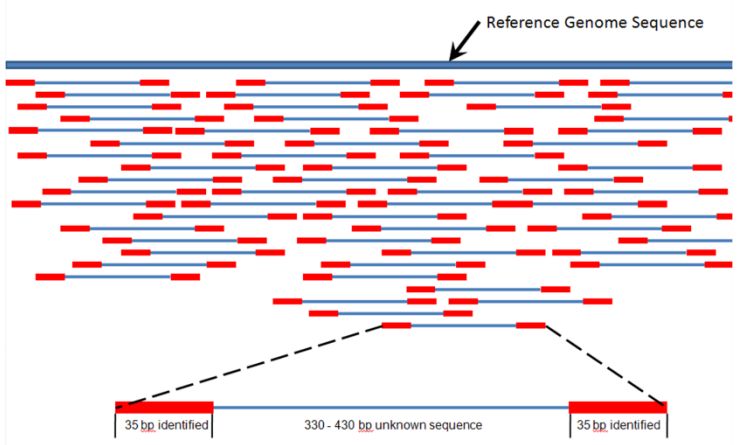
Sanger sequencing
one “piece” at a time!

This is the easy part!

– and then Putting the “ePieces” Back Together Again!

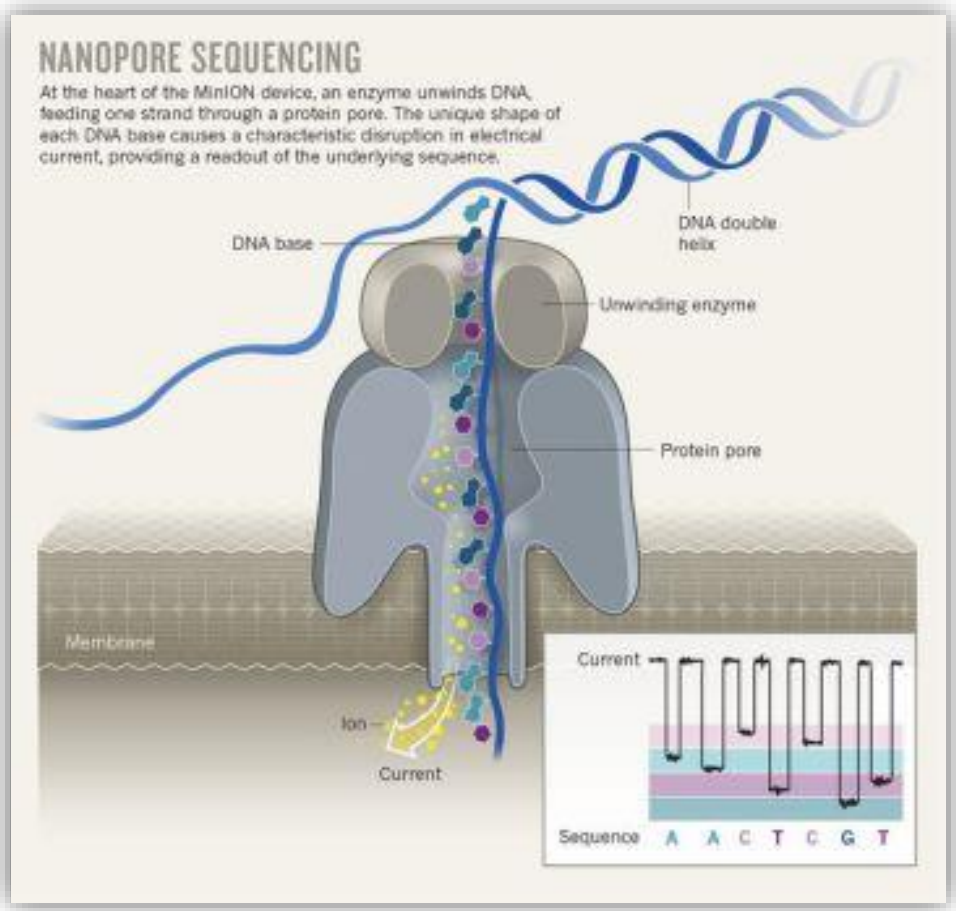
This is harder and requires substantial computing power!

Electronic raw data



Compiled from raw data

What's next in NGS?



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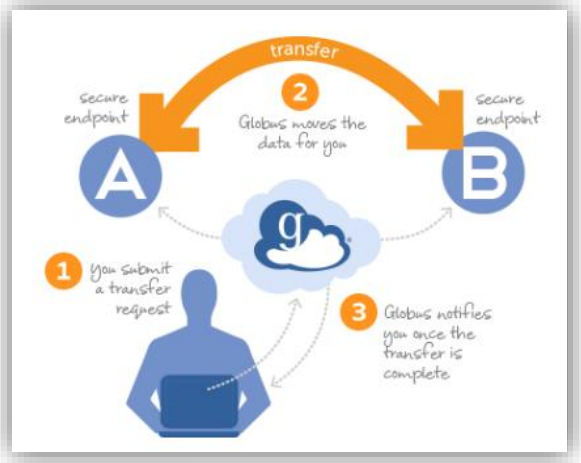
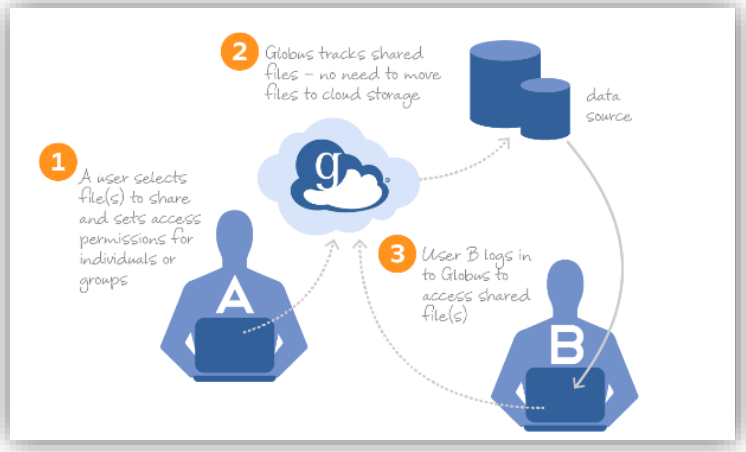
New Initiatives - Streamlining Big Data Delivery with GLOBUS

- Globus is a leading provider of secure, reliable research data management services
- Users can move, share, and publish data via a single interface
- Transfer files – efficient and secure data movement from kilobytes to petabytes, between users within an institution or across an ocean
- Sharing files – manages authentication and access of data between colleagues





New Initiatives - UFHCC and ICBR Partnerships

- ICBR AD for Science is UFHCC AD for Core Technologies

Responsibilities

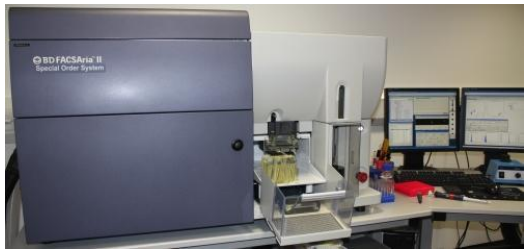
- Serve on UFHCC Executive Committee
- Regularly attend and participate in program meetings
- Charter and monitor activities and efficacy of Scientific Advisory Groups
- Establish metrics for assessing performance, quality standards, impact and ROI
- Monitor trends in utilization and conduct surveys to gather feedback
- Identify gaps in technology portfolio and develop new shared resources

UFHCC Investments in ICBR

- Illumina HiSEQ3000 (Next Generation Sequencing Core)

- Becton Dickinson FORTESSA Flow Instrument (ICBR Cytometry)

- Upgrade of ARIA II Sorter (ICBR Cytometry)

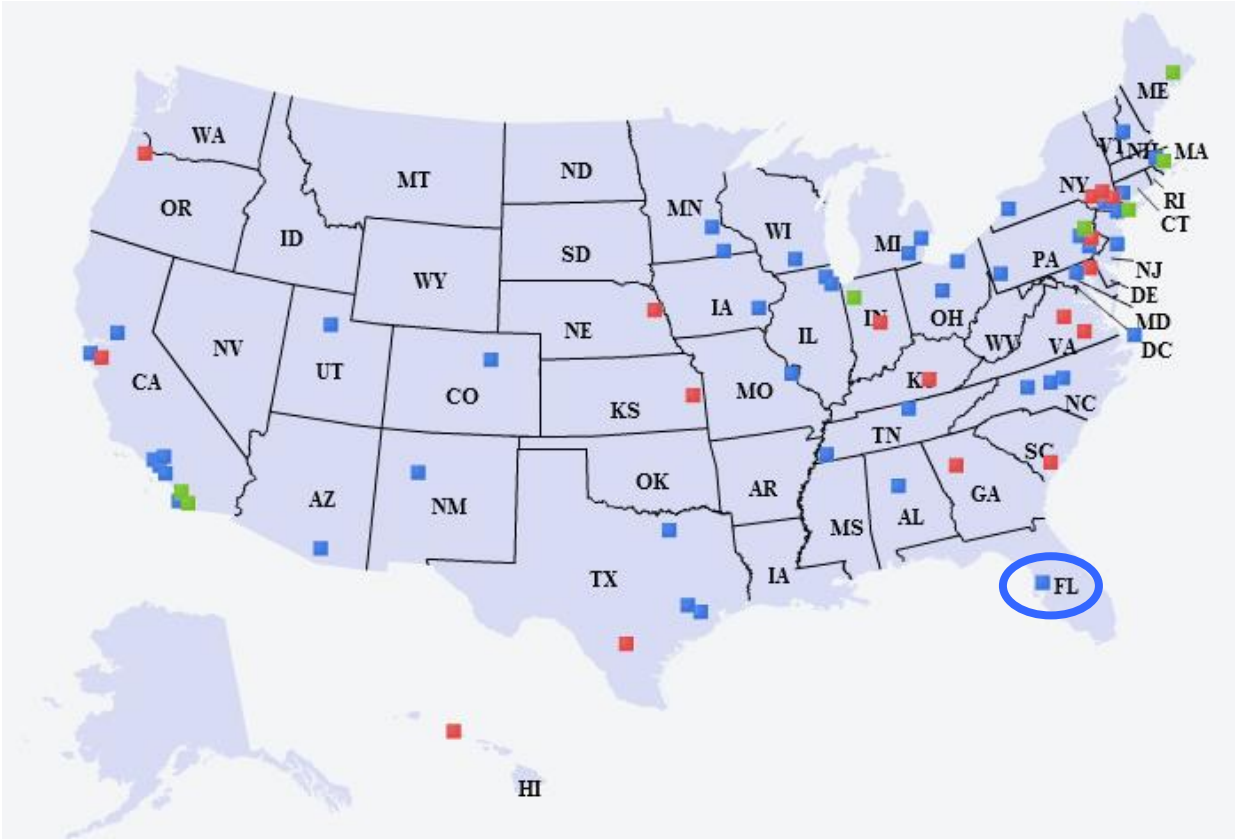


- Malvern NS300 Nanosight Microparticle Analyzer (ICBR Cytometry)

New Initiatives – The NCI Cancer Center Support Grant

NCI-designated Cancer Centers are characterized by excellence in scientific leadership, resources, and the depth and breadth of research in basic, clinical, and population science.

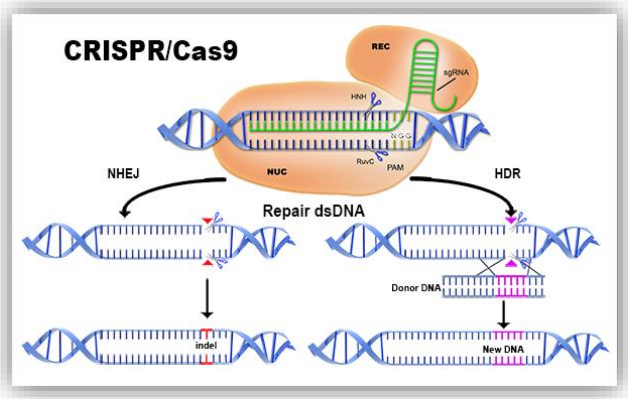
Each play a vital role in advancing towards the goal of reducing morbidity and mortality from cancer

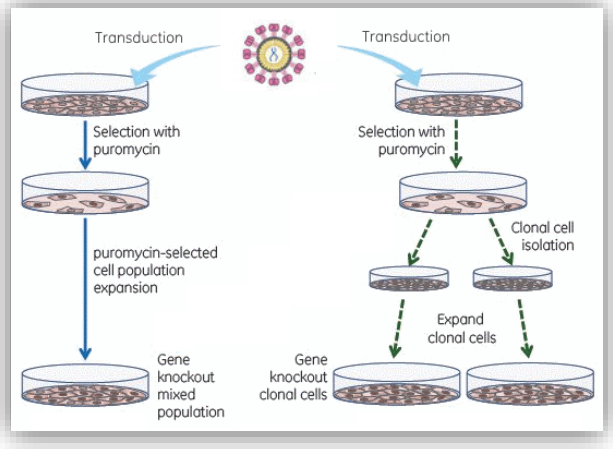


New Initiatives - ICBR CRISPR Technology Core

- Co-managed by UFHCC and ICBR
- Led by Dr. Chris Vulpe, UFHCC Faculty Director

- Clustered Regularly Interspaced Short Palindromic Repeats
  - Hallmark of a adaptive anti-phage immune system in bacteria first characterized in 1993 by Francisco Mojica, University of Alicante, Spain
  - Simple, sequence-specific, enzymatic process modified to easily work in mammalian cells
- Gene editing in mammalian cells
  - Generation of cell pools or clonal cell lines with targeted allele editing
- CRISPR-based whole genome and targeted screening





QUESTIONS?

- Thank you!

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