

Trends and Future Directions in Biomedical Informatics

Office of the Vice Chancellor for Research
Research & Innovation Month



Objectives

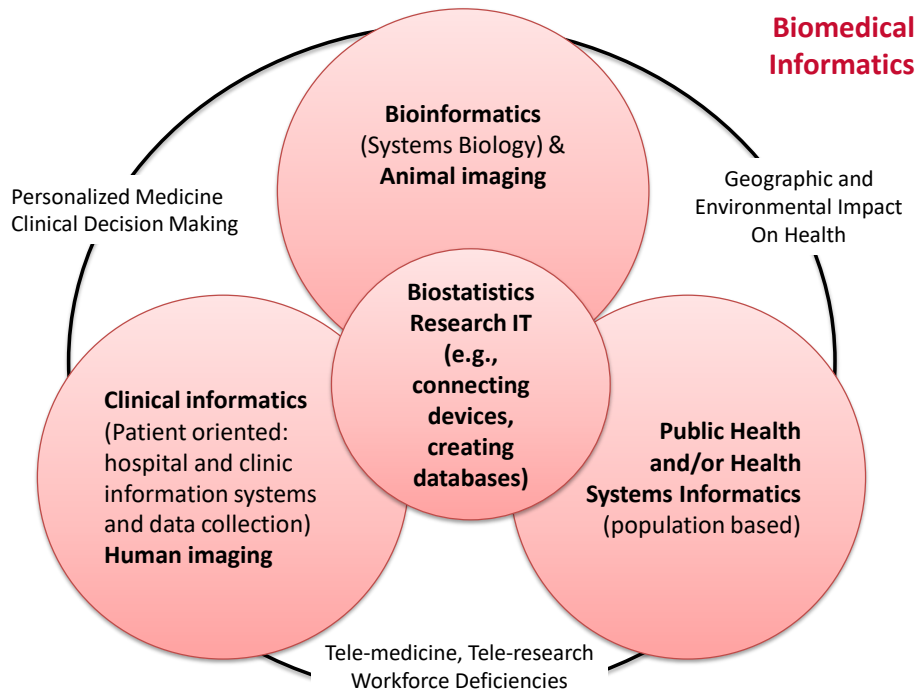
- Understand the breadth of biomedical informatics
- Know the biomedical informatics tools, resources and expertise available at UNMC (+ UNO and UNL)
- Understand how to better collaborate with a biomedical informatics expert



Biomedical informatics

Definition: the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving and decision making, motivated by efforts to improve human health.

(American Medical Informatics Association)



Addressing the challenges of biomedical informatics

- **Workforce development.** Hiring and “developing” biomedical informatics and research IT expertise through the biomedical informatics training track.
- **Computing power.** Upgraded connection speeds, increased access to computer clusters and regional/national resources.
- **Navigating access to resources.** Developed a new position to help investigators find the right expertise for the job
- **Computation and analytics.** Developing a computational core to assist investigators with machine learning algorithms.



Biomedical informatics resources at UNMC

Data/Databases

- Clinical Trial Management System (see Clinical Research Center)
- Database architecture development (see Research IT Office)
- Data storage, in general: Box, a server, Office 365, not on your computer solely without a backup

Cores

- Bioinformatics and Systems Biology
- Electronic Health Record Access Core
- CRANE: de-identified health information (requires training)
- CCORDA: biostatistics
- Proposed new computational core
- Bioimaging resources: human MRI, small animal MRI, MEG

Biobanks

- Nebraska Biobank (DNA, serum, plasma)
- Fresh frozen or paraffin blocks (Cancer tissue bank/Pathology)
- Disease specific samples (Cancer, rheumatoid arthritis, transplant)

Research IT Office for other services

- Bringing data/servers/technology to campus
- Research Electronic Data Capture (REDCap)
- Orientation to REDCap

Software: see IT, RITO and Bioinformatics and Systems Biology websites



Panelists



Babu Guda, Ph.D.

Professor,
Genetics, Cell Biology and
Anatomy

Chief Bioinformatics and
Research Computing Officer



Bioinformatics and Systems Biology Core

Director: Babu Guda, PhD

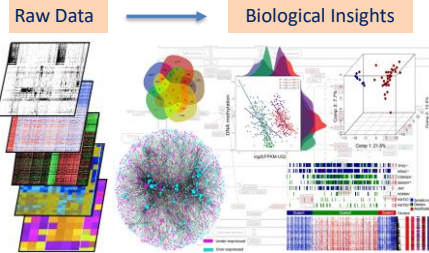
Major Services

- Next-Gen Sequencing (NGS) Data Analyses
 - ✓ Multi-omics data (WGS, WES, RNA-seq, ChIP-seq, Methyl-seq, etc.)
 - ✓ Metagenomics data (16S, Whole Genome)
 - ✓ De novo genome assembly, mixed NGS read analyses
- Array-based data analysis (transcript, SNP, protein)
- Functional characterization and pathway analysis
 - ✓ IPA, GSEA, DAVID, KEGG, ClueGo, etc.
- Web application and database development
- Machine learning and big-data applications
- Grant/manuscript support, custom tech. dev'mnt.

Infrastructure & Resources

- High-performance cluster (HPC) computing platform
 - ✓ Include development, production, storage and test servers
 - ✓ Combined 500+ cores for processing demanding jobs
 - ✓ Combined shared RAM of 3 TB (node-based, up to 1 TB/node)
 - ✓ 500 TB of network-based storage connecting all servers
- Public-domain bioinformatics tools and databases
- Licensed software tools
 - ✓ Ingenuity Pathway Analysis (IPA), CLC Genomics Workbench, Vector NTI, Schrodinger small molecule drug discovery suite, MetaCyc, EndNote, GraphPad Prism, Partek.

How to integrate us into your research?



How to use our services?

- Core website (<https://www.unmc.edu/bsbc>)
- Core service request form for initial consultation
- Initial 1-hour free consultation per project
- Service charges vary from \$50 - \$65/hour
- Turnaround time is approximately 2 weeks
- Consultation on experimental design for grants and support letters are provided at no charge
- Contact: babu.guda@unmc.edu or peng.xiao@unmc.edu

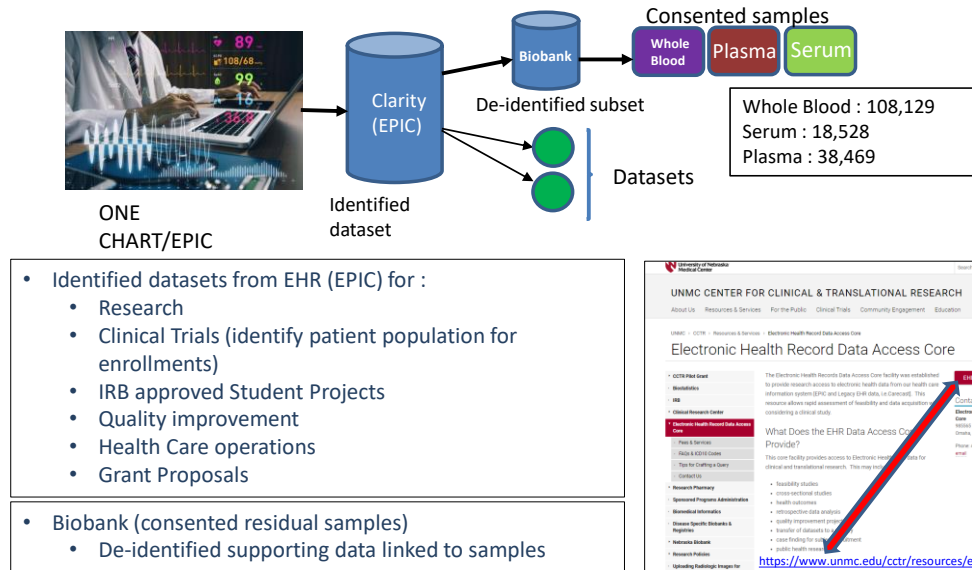


Purnima Guda, Ph.D.

Director,
Electronic Health Record
Access Core



Electronic Health Record Data Access Core



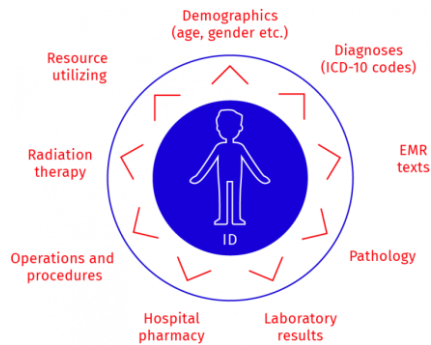
Purnima Guda, Ph.D; purnima.guda@unmc.edu

James McClay, M.D.

Professor,
Emergency Medicine



Real World Data ...



...Real World Evidence

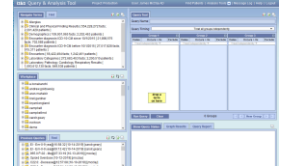
UNMC Biomedical Informatics
James McClay, MD
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UNMC CRANE: Clinical Research Analysis Environment



Comprehensive clinical data
warehouse

- IRB approved
- Standardized
- De-identified
- Linked



Nationally scalable



pcornet
The National Patient-Centered Clinical Research Network



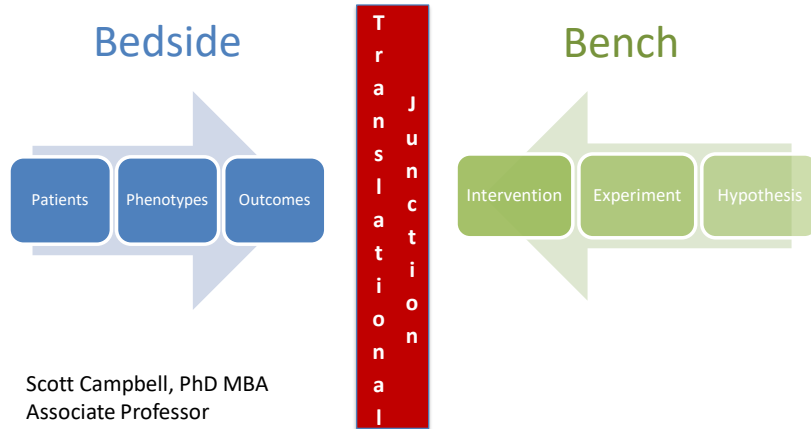
Scott Campbell, Ph.D.

Associate Professor,
Pathology and Microbiology

Senior Director of Research
Technologies



Data – Bridge the Gap



Scott Campbell, PhD MBA
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