



NorthShore's Pharmacogenetics Program

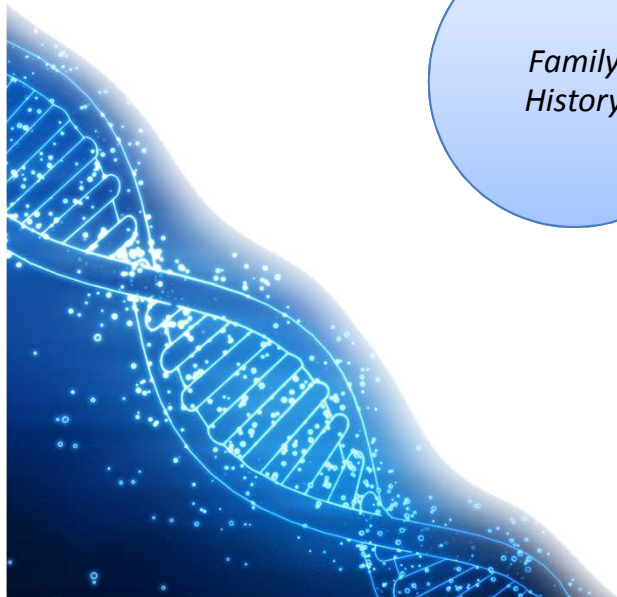
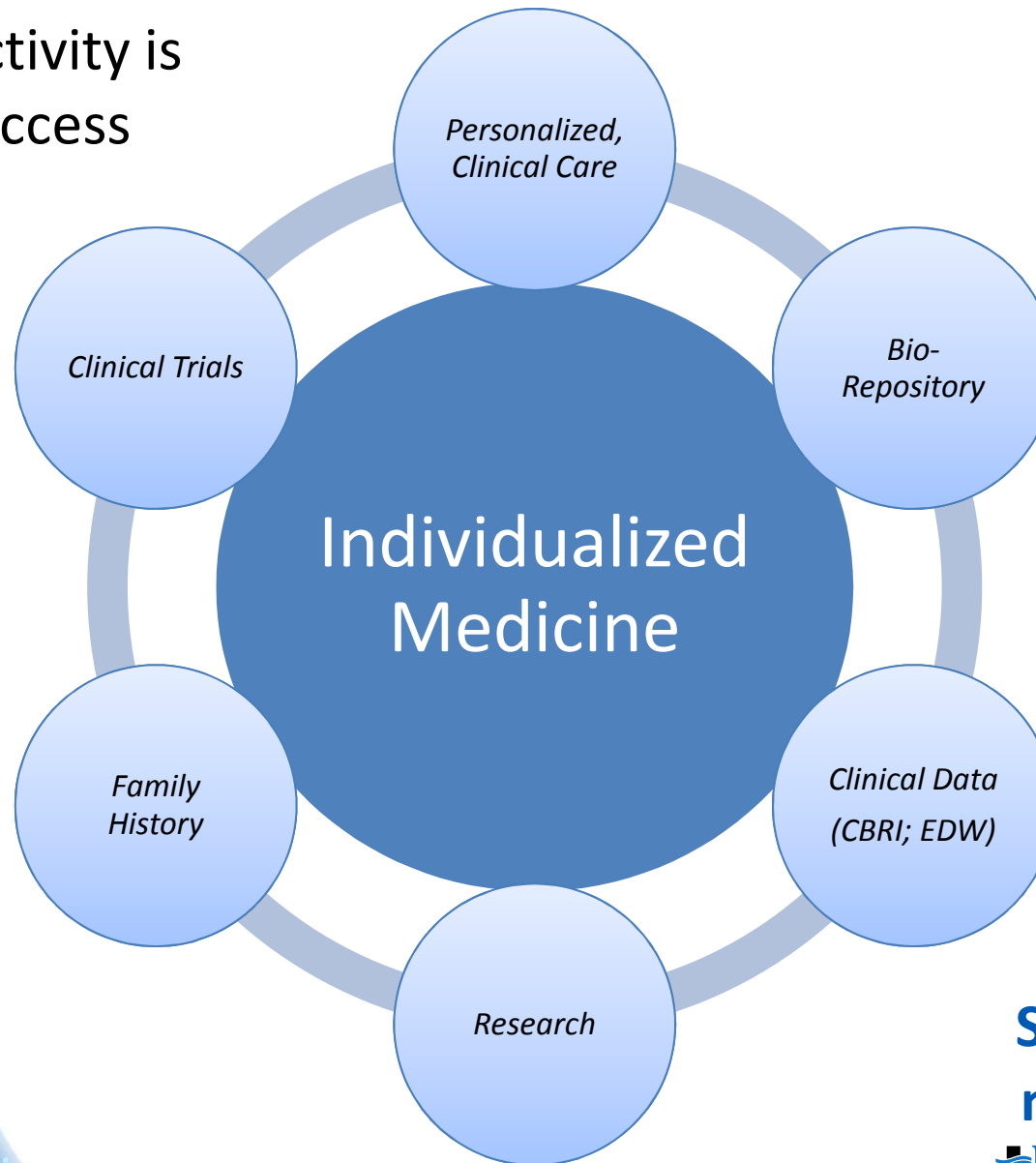
Mark Dunnenberger, PharmD, BCPS
Director of Pharmacogenetics
Center for Molecular Medicine
NorthShore University HealthSystem
January 7, 2016

About NorthShore

- Integrated Health System
 - Multi-Site
 - 4 Hospitals
 - 750+ Physician Medical Group; 75 Offices
 - Academics - University of Chicago (UC)
 - Informatics – EMR in 2003



Interconnectivity is
vital to success

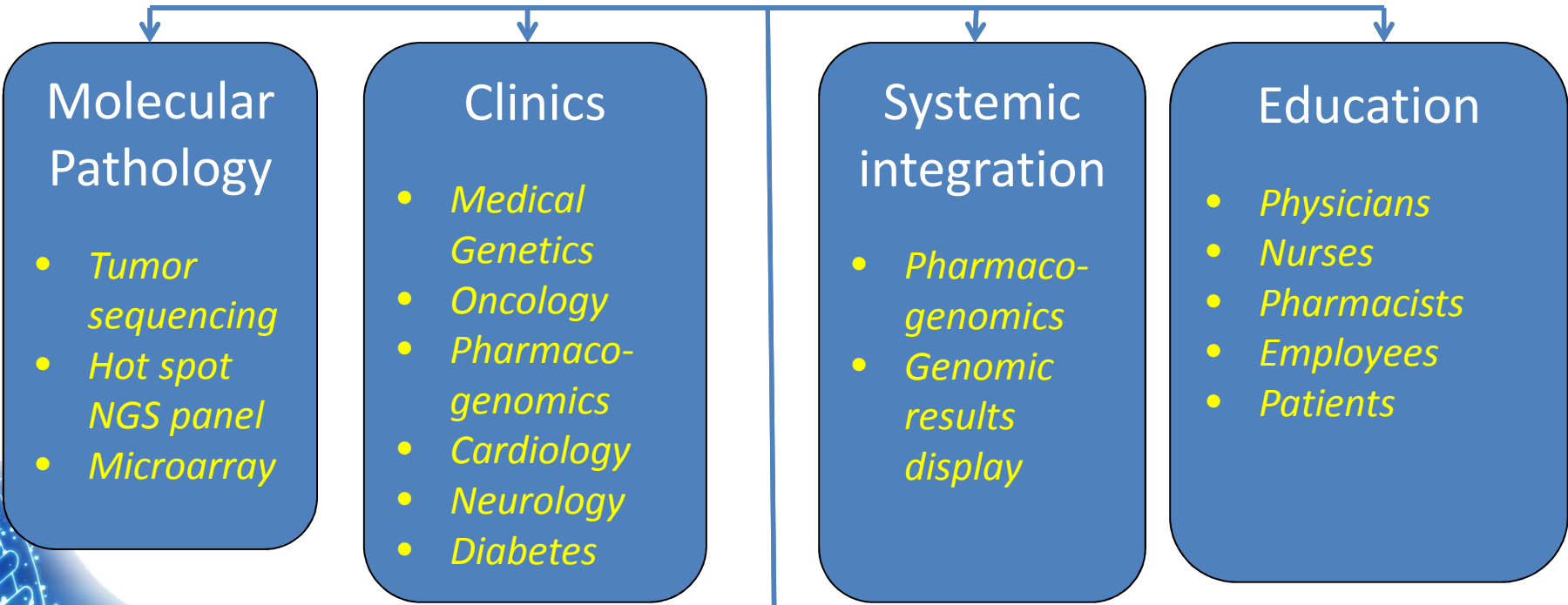


Synergistic...
not additive

NorthShore
University HealthSystem

Center for Personalized Medicine

Center for Personalized Medicine
*Coordinates predictive/diagnostic and therapeutic services
along with education & research*



Molecular Pathology

- Tumor sequencing
- Hot spot NGS panel
- Microarray

Clinics

- Medical Genetics
- Oncology
- Pharmacogenomics
- Cardiology
- Neurology
- Diabetes

Systemic integration

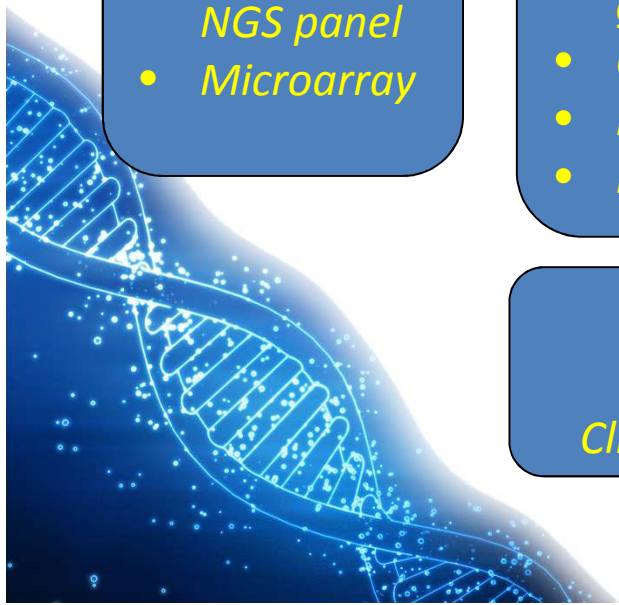
- Pharmacogenomics
- Genomic results display

Education

- Physicians
- Nurses
- Pharmacists
- Employees
- Patients

Research

- Clinical
- Biorepository
- Translational





PHARMACOGENETICS PROGRAM



STRUCTURE

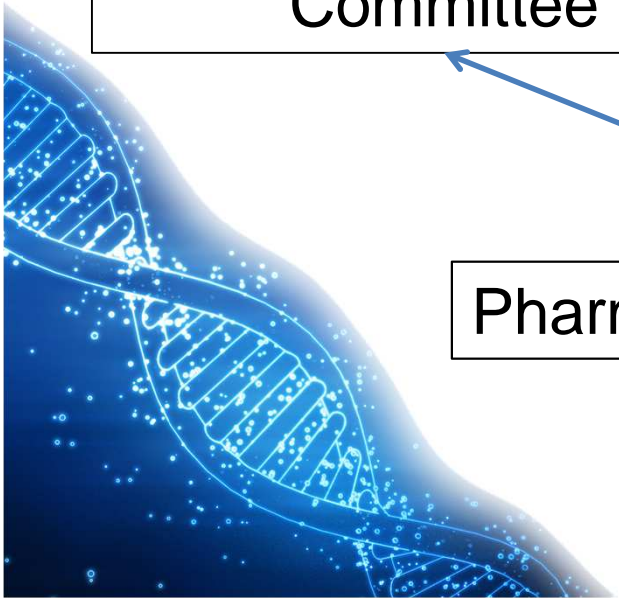
Medical
Executive
Committee

Administration

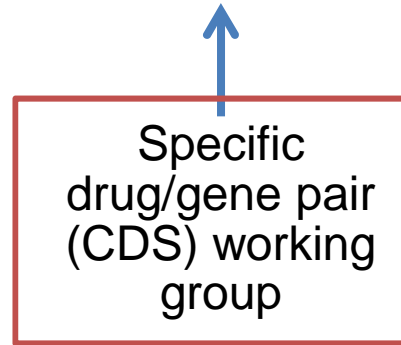
Pharmacy &
Therapeutics
Committee

Personalized
Medicine Steering
Committee

Pharmacogenetics Subcommittee



Pharmacogenetics Subcommittee

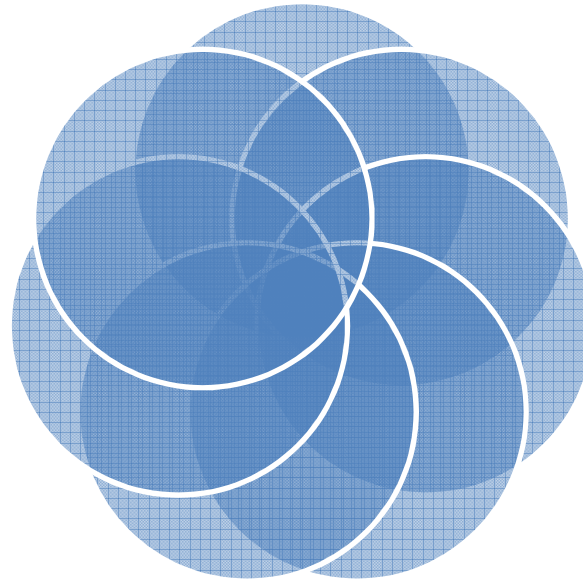


Clinical outcomes working group

Bioinformatics working group

Drug/gene prioritization working group

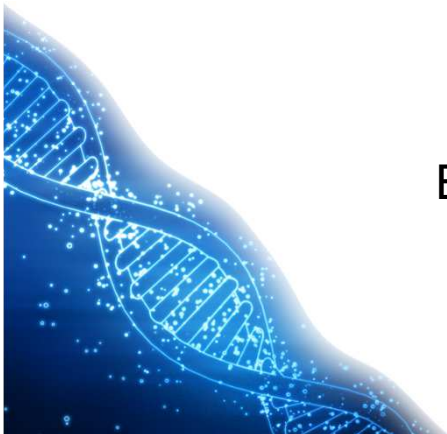
Genetic testing working group



Education working group

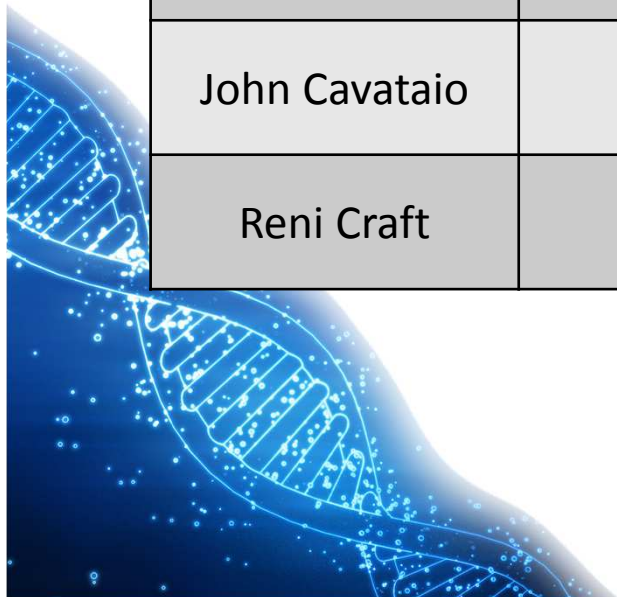
EPIC working group

Gene evaluation working group

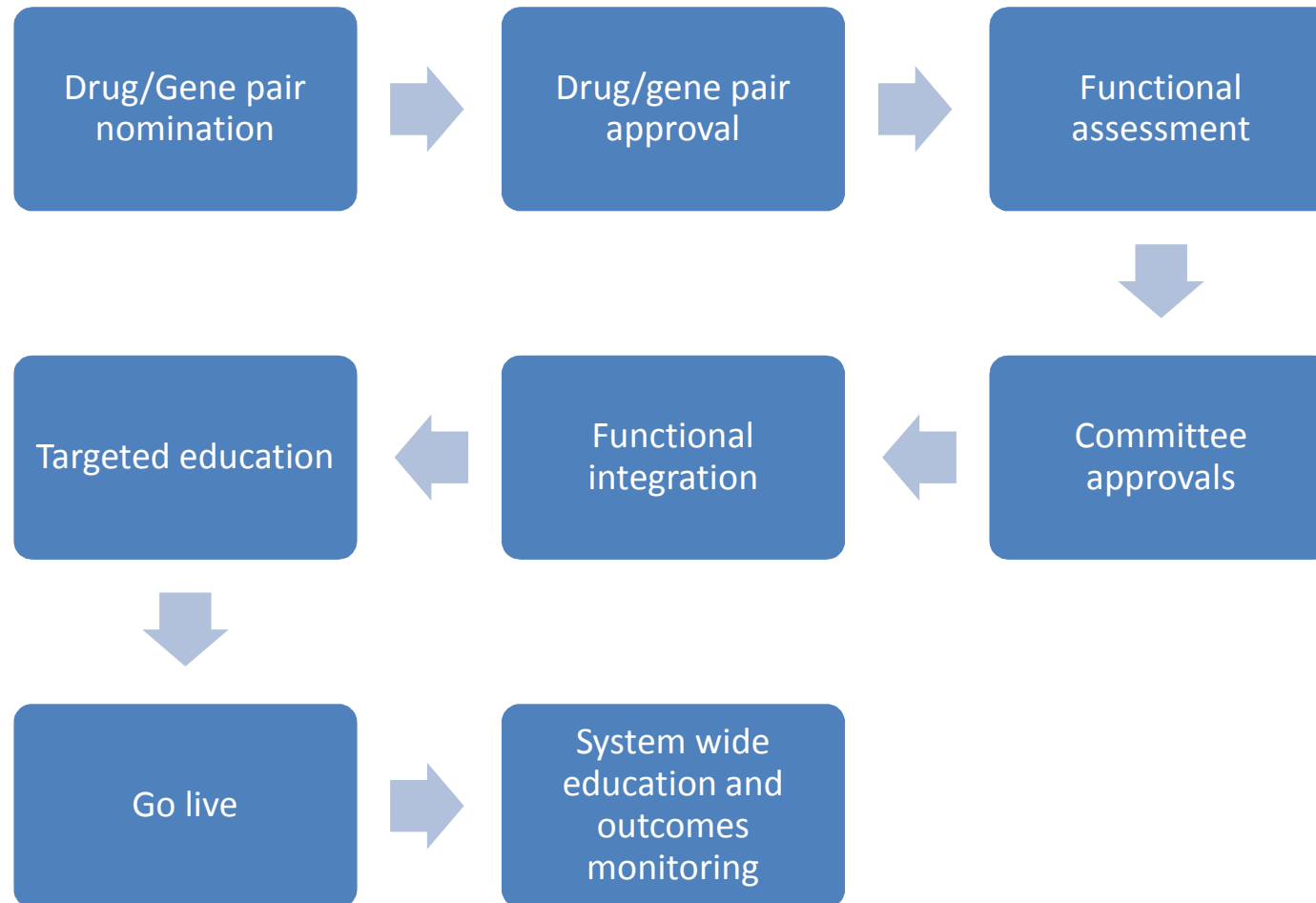


Pharmacogenetics Team at NorthShore

Liana Billings	Mark Dunnenberger	Karen Kaul	Nancy Ostrowski	Jonathan Silverstein
Lynn Boecler	Kamalakar Gulukota	Janardan Khandekar	Ari Robicsek	Joshua Straus
Justin Brueck	Larry Helseth	Emily Lachiewicz	Linda Sabatini	Mira Suseno
George Carro	Peter Hulick	David Lovinger	Meredith Sefa	Jeff Thiel
John Cavataio	Ashton Hullett	Holley May	Annette Sereika	Izabela Wozniak
Reni Craft	Nora Joseph	Anna Newlin	Jae Shin	



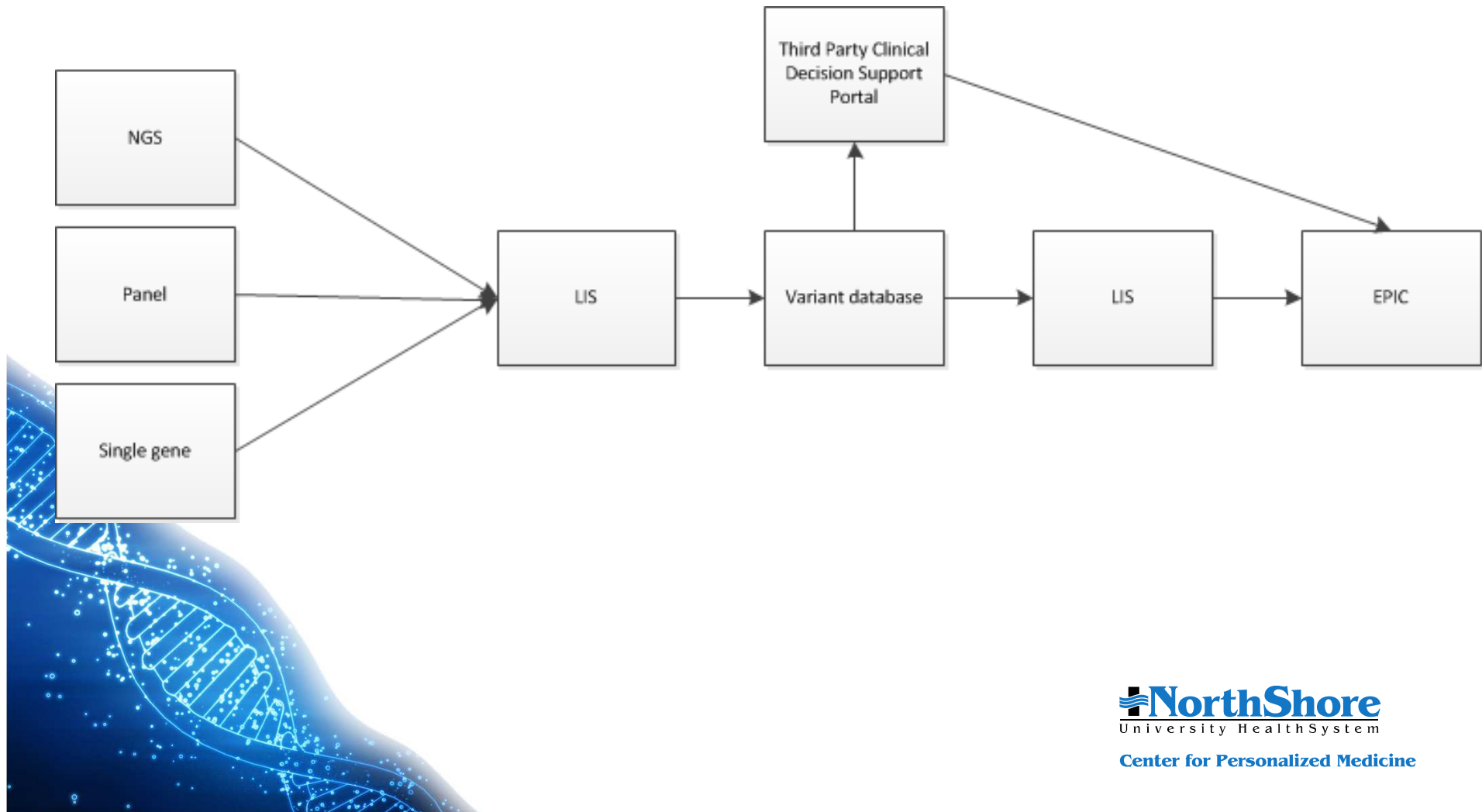
Pharmacogenetic Implementation





GENETIC TEST RESULTS

Results workflow





DISPLAY IN EHR

CDS

- **Passive**
 - Results all in one section
 - HUGO gene name plus interpretation
- **Active**
 - **Pre-test**
 - Account for clinical parameters such as:
 - WBC >1K
 - Recent blood transfusion
 - **Post-test**
 - Wording determined by clinicians most likely to prescribe
 - Built to handle enzymatic results if available

Drug/Gene Pairs implemented

- TPMT/Thiopurines
- HLA-B/Abacavir and Carbamazepine
- More than 30 different rules to create these pre and post test alerts
- Needed a better solution for scalability and sustainability



Third Party CDS Solution

- ActX
- Integrated in EHR
- Customizable rules engine for post test alerts
 - Genotype specific
- Patient genome profile
 - Searchable by drug





EARLY METHOD TO BRING PERSONALIZED MEDICINE TO CLINICAL CARE

Pharmacogenetics Clinic

- Goal
 - Provide NorthShore with a service to meet the current pharmacogenomics needs of the community
- Structure
 - Clinic appointments occur over two days, about 14 days apart
 - Uses existing infrastructure at the Center of Medical Genetics
 - Multidisciplinary team: GC, MD, APN and pharmacists
 - Patient be self/physician referred to Pharmacogenomics Clinic
 - Third Party genotyping with a 14 gene panel (PGXL)
- Cost
 - Gene panel ~\$400 if not covered by insurance
 - Office visit co-pay



14 Gene Panel

<i>CYP2D6*</i>	<i>VKORC1*</i>	<i>SLCO1B1*</i>
<i>CYP2C19*</i>	<i>CYP3A4</i>	<i>Factor V*</i>
<i>CYP2C9*</i>	<i>CYP3A5*</i>	<i>Factor II*</i>
<i>COMT</i>	<i>MTHFR</i>	<i>CYP1A2</i>
<i>SLC6A4*</i>	<i>OPRM1*</i>	

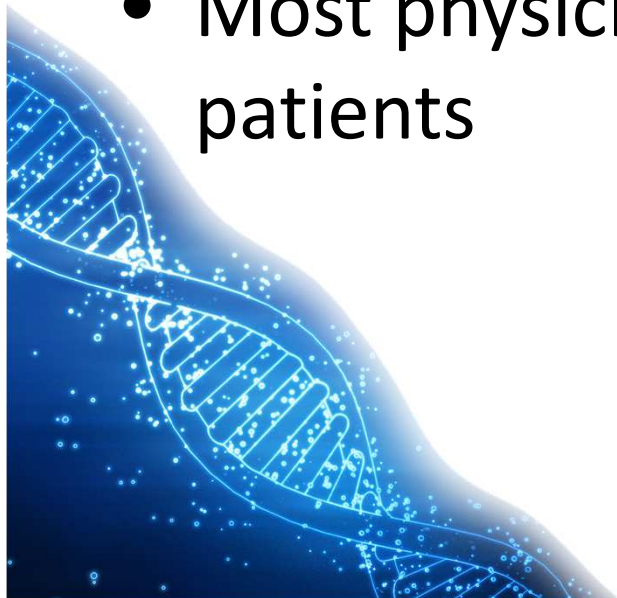
* Genes with pharmacogenomically actionable variants

- 3 components
 - High-risk variants
 - Drug recommendations tailored to individual patients
 - Other genes tested
 - Medication list
 - Tells patients if there was genomic data available for the drugs on their current list



Data from clinic

- Most patient have clinically actionable variants
- Psychiatry most common referring group of physicians
- Most physicians have referred multiple patients



Conclusion

- Three ways we are using CPIC guidelines at NorthShore
 - Drug/Gene pair nomination
 - Third party CDS solution
 - Pharmacogenomics clinic



Questions?

Mark Dunnenberger

Mdunnenberger@northshore.org

