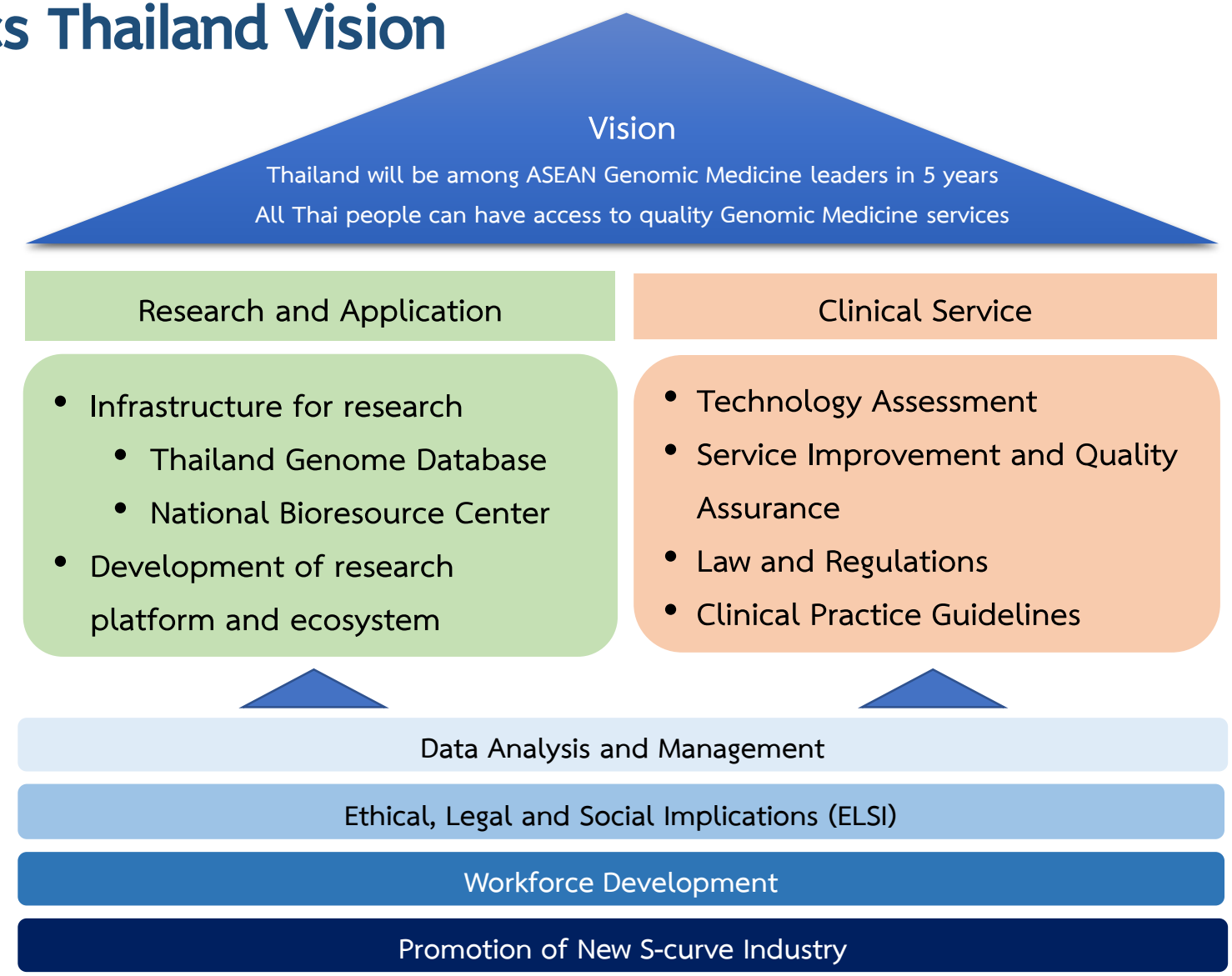
NAC2019
15th NSTDA Annual Conference
การประชุมวิชาการประจำปี สวทช. ครั้งที่ ๑๕

GENOMICS THAILAND

Implementing Genomic Medicine in Thailand's Healthcare System

Cancer Precision Medicine

Genomics Thailand Vision



Draft version, Do not disclose

Rare diseases

Pharmacogenomics

NCD

Other conditions, Healthy cohorts

Cancer

Biobank

Whole Genome Sequencing

Genome Data

Bioinformatics

Aggregation of Genome Data

Bioinformatics

Pool Data together to create **Population-level Genome Database** of Thai Population

Analysis of Genomic Association in Specific Conditions (Cancer, NCD, Autoimmune Diseases, Infectious Diseases, etc)

Bioinformatics

Frontier Research

Reference Database of Thai Population and Implication to ASEAN

Bioinformatics

Translational Research

Output:
-**Polygenic risk score**
-**Specific gene panel** for diagnosis, to determine risk of disease, complication, treatment response, prognosis
-Further research on **new genetic information of each disease** >> new tests, new drugs, new treatment

Thai (and region) specific gene panel, diagnostic test, databases for further research and clinical trials

Healthcare

Actionable/Pathogenic Variants

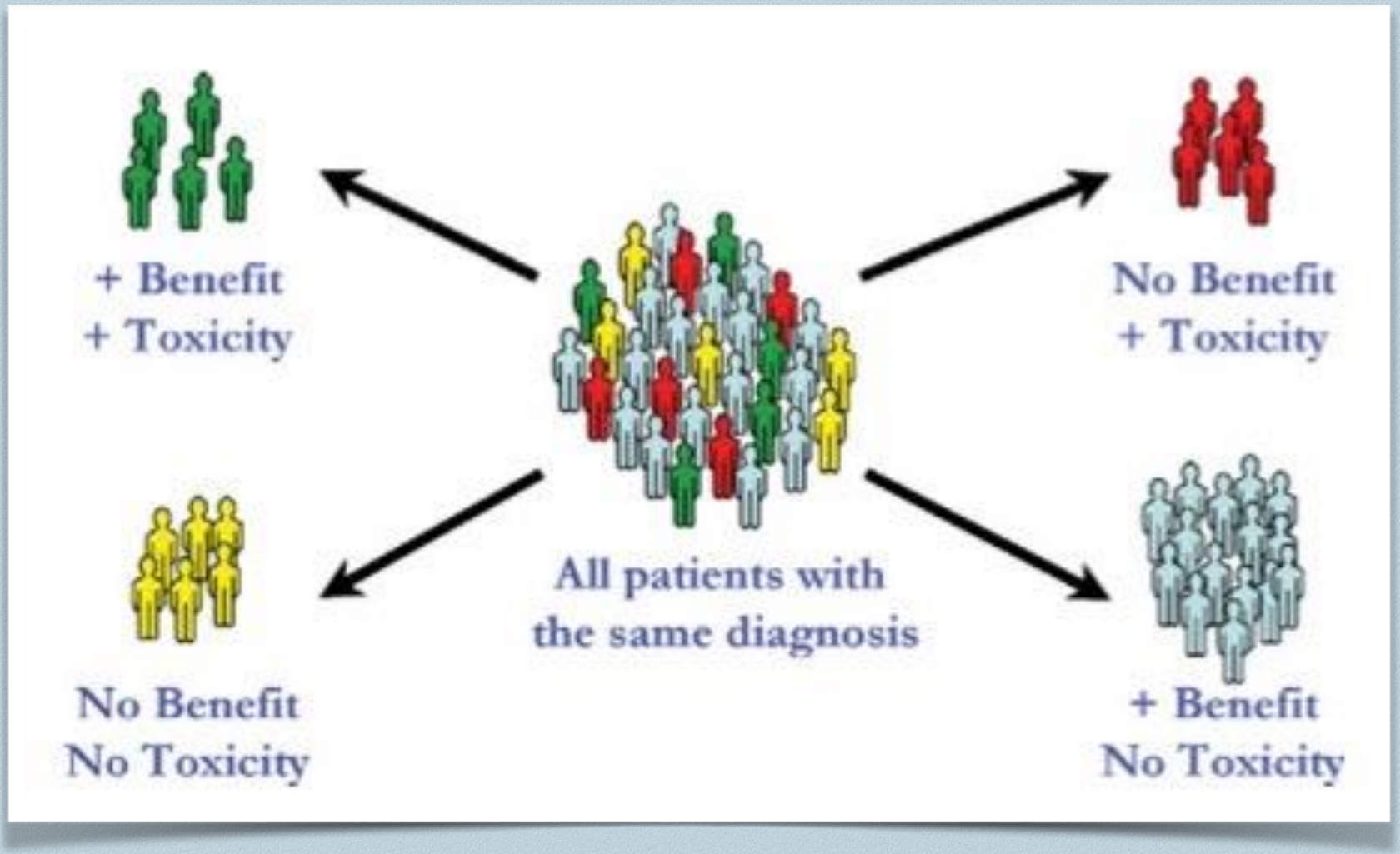
Immediate/Short Term Benefit (diagnosis, treatment, prevention, screening)

Cancer (familial cancer)
Rare diseases
Pharmacogenomics

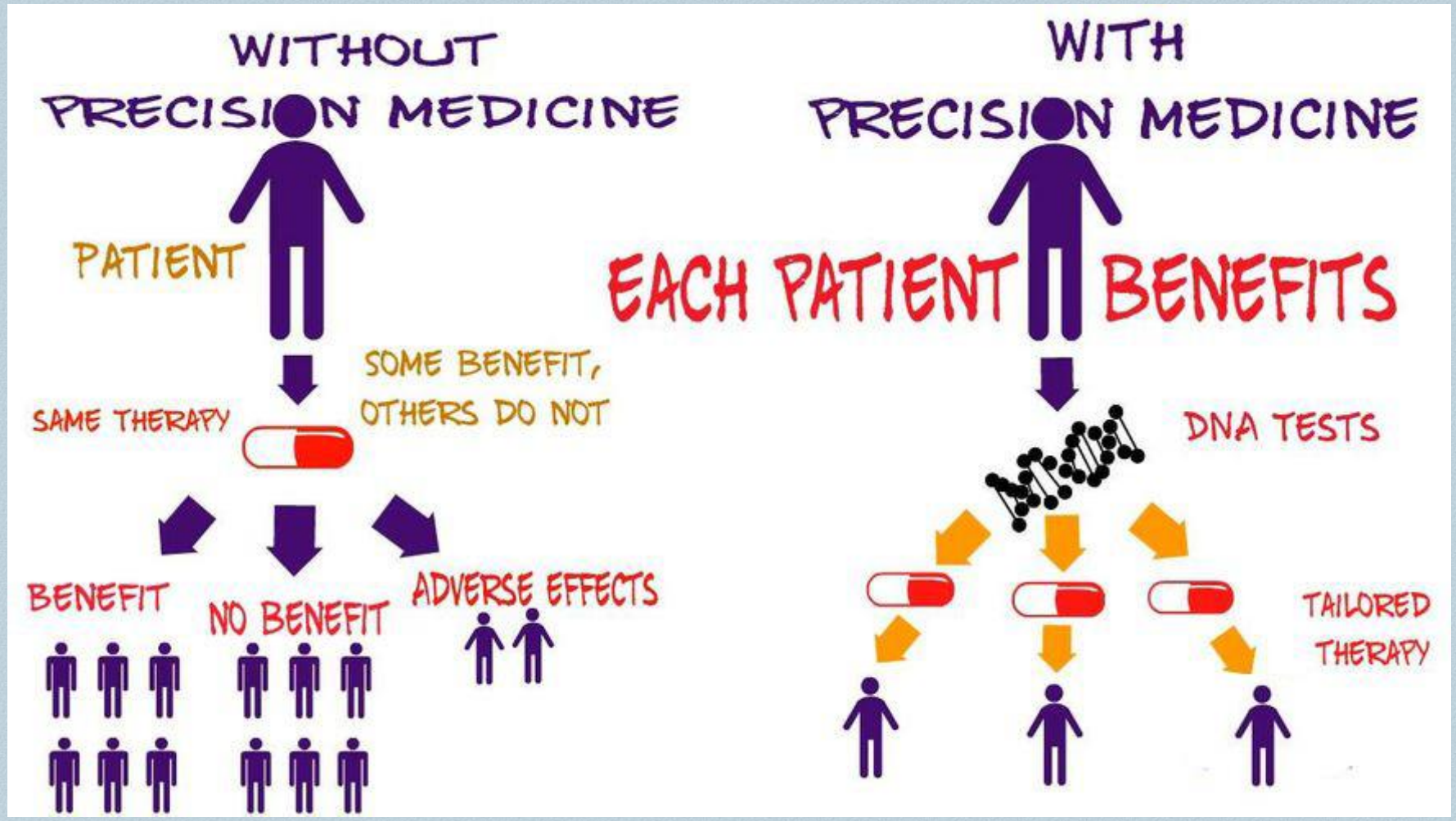
Guidelines for diagnosis and treatment
Integrate into healthcare system

Draft version, Do not disclose

Conventional medical treatment



Precision Medicine



Precision Medicine

WHY NOW?

The **time is right** because of:

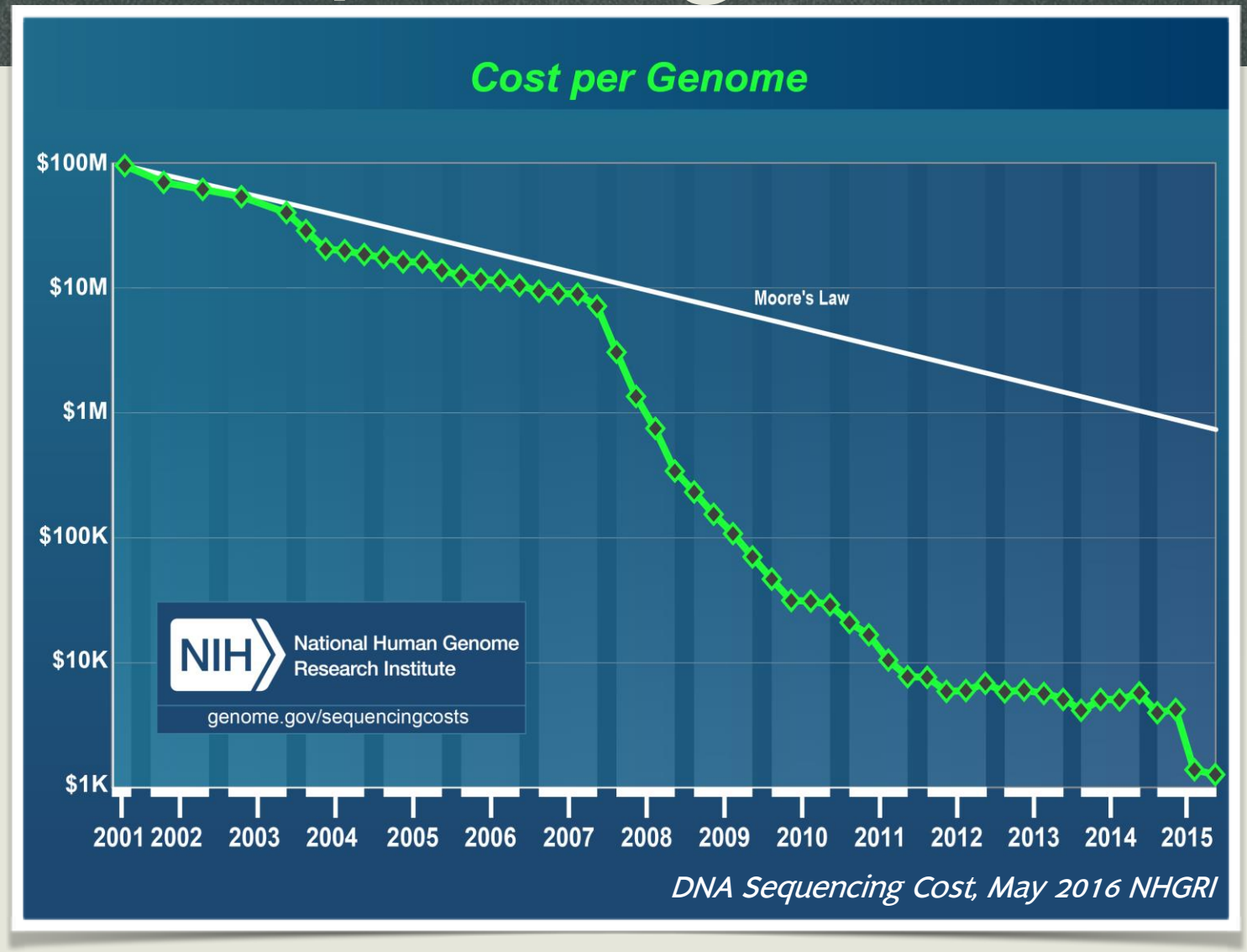
Sequencing of the human genome

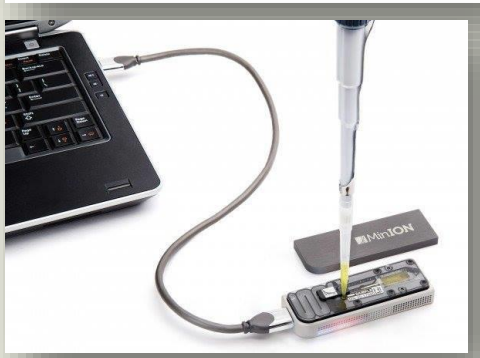
Improved technologies for biomedical analysis

New tools for using large datasets

The Precision Medicine Initiative 2015

DNA Sequencing Cost





Diagnostic Area

Rare diseases

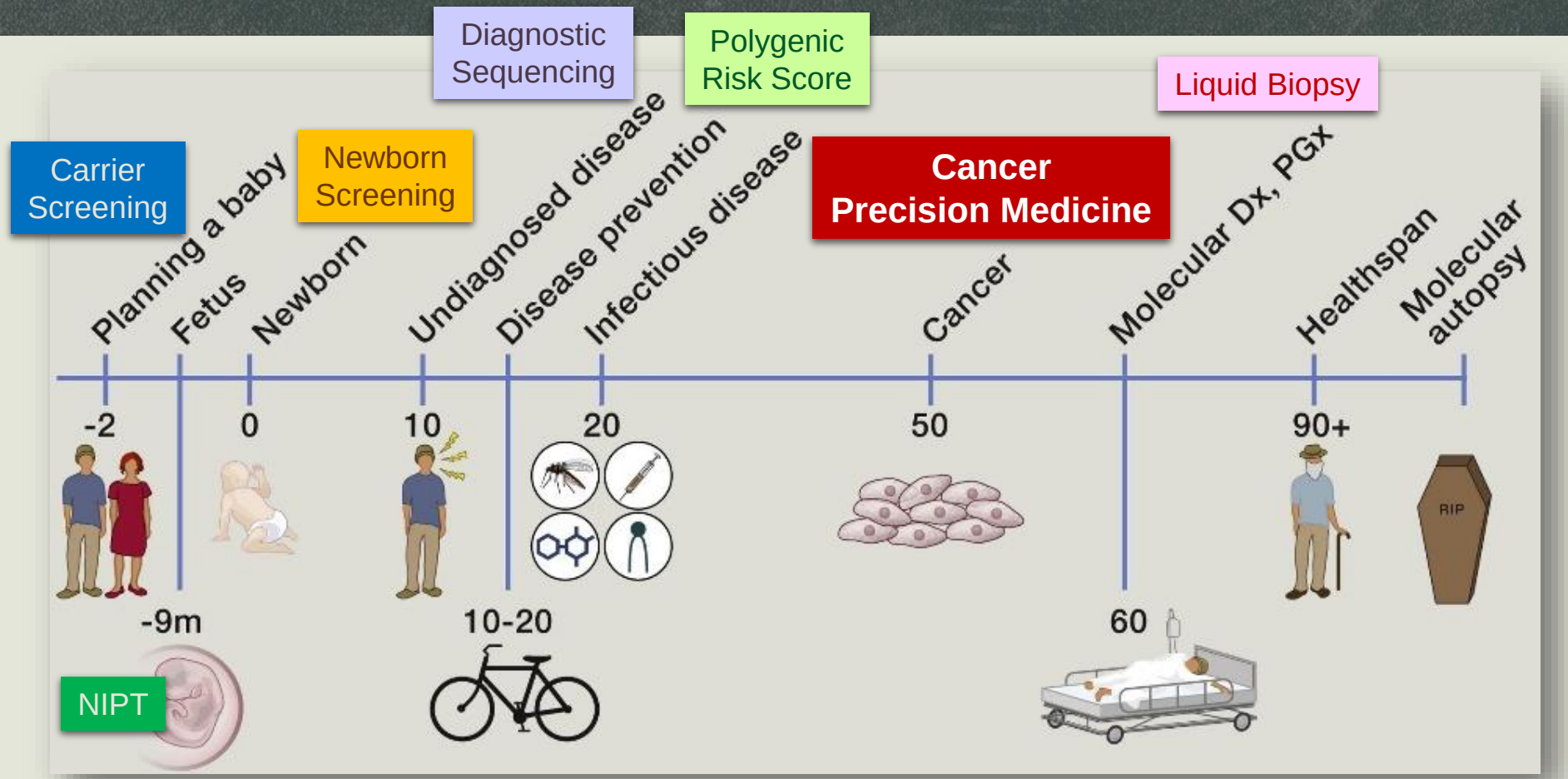
Cancer

NIPT

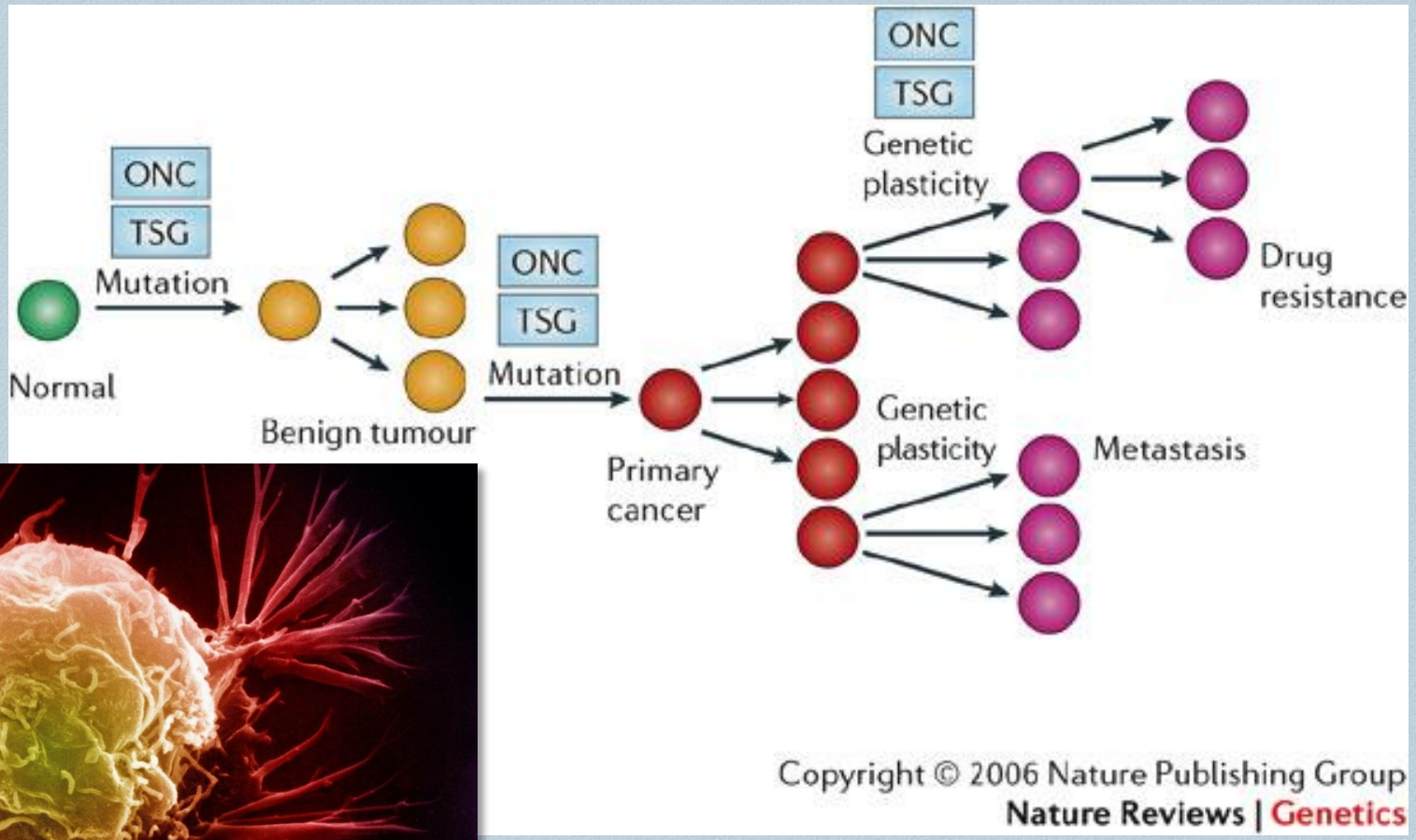
Pharmacogenomics

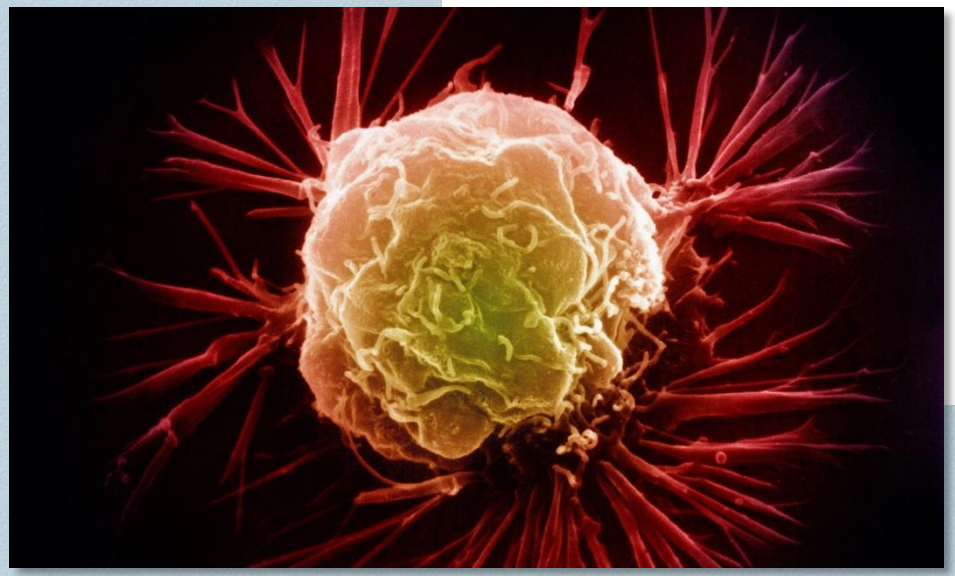
Other conditions

Precision Medicine : Across Our Lifespan



Cancer is a genetic disease

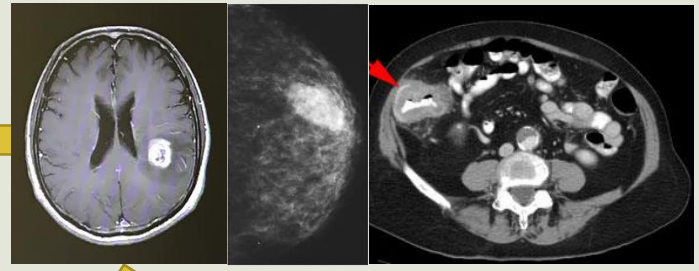




Feinberg AP, et al Nat Rev Genet 7, 21-33, 2006

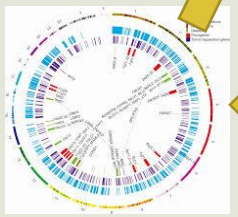
Databases/AI

REDCap
Research Electronic Data Capture



Patients

GENOMICS THAILAND



Genome Landscape

Bioinformatics

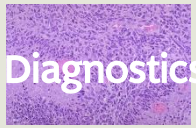
Blood test

Surgery/Biopsy

Frozen specimens

Biobanking

Pathologist



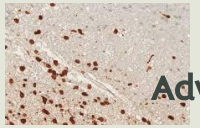
Genome Sequencing

Standard & Advanced Lab

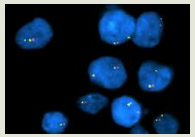
Treatment selection

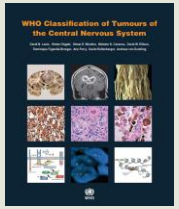
Clinical Cohorts/Clinical Trials

Collaboration

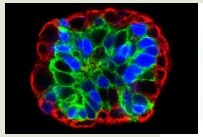


Advanced Pathology





Cancer cell lines



Spheroid Organoid

Orthotopic xenograft

Zebrafish Model

Drug testing/Tailored regimen

Genome Institute of Singapore
A*STAR

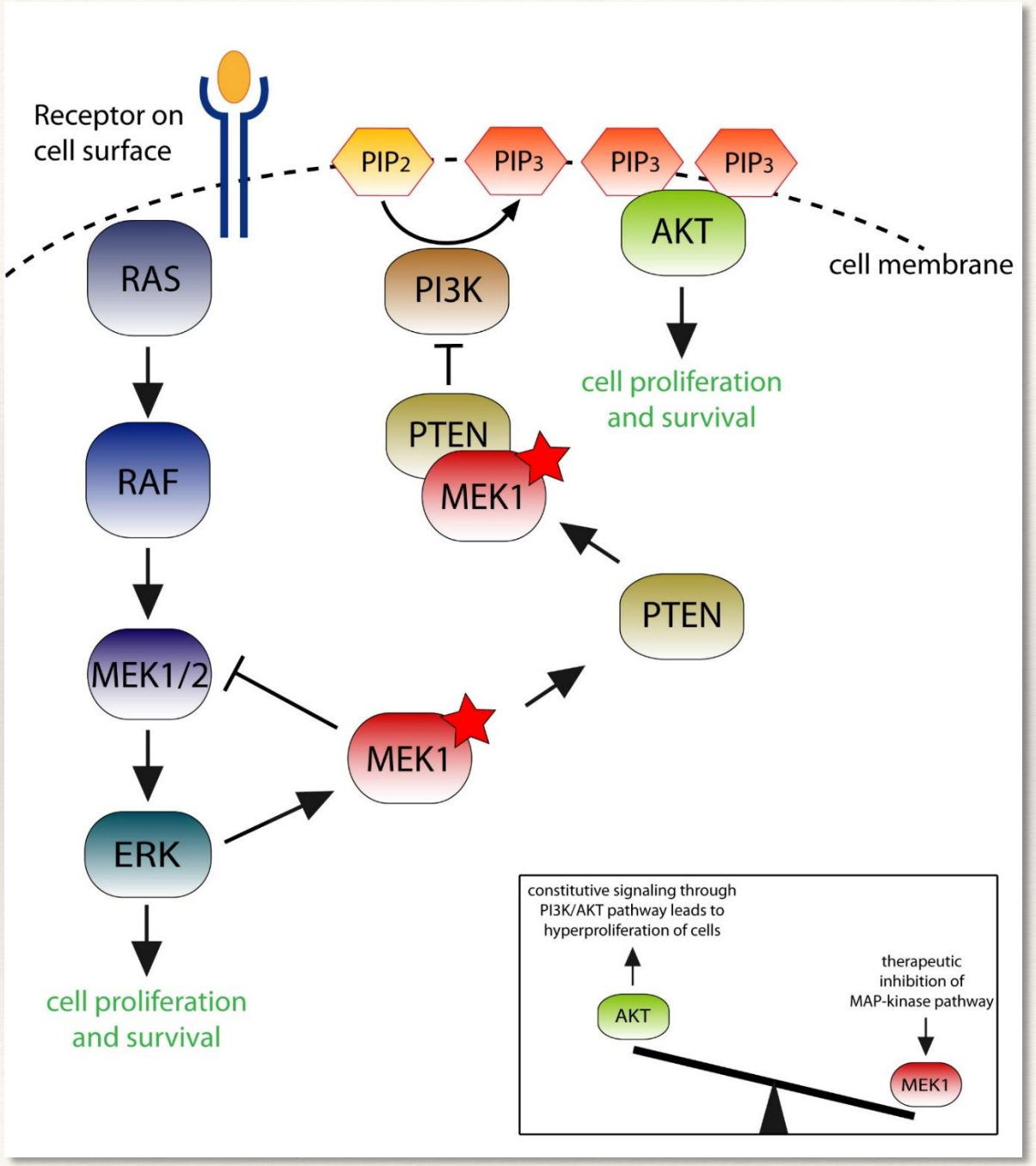
National Neuroscience Institute
SingHealth

DANA-FARBER CANCER INSTITUTE

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center

RESEARCH UNIVERSITY NETWORK THAILAND

CANCER PRECISION MEDICINE



Gene alterations

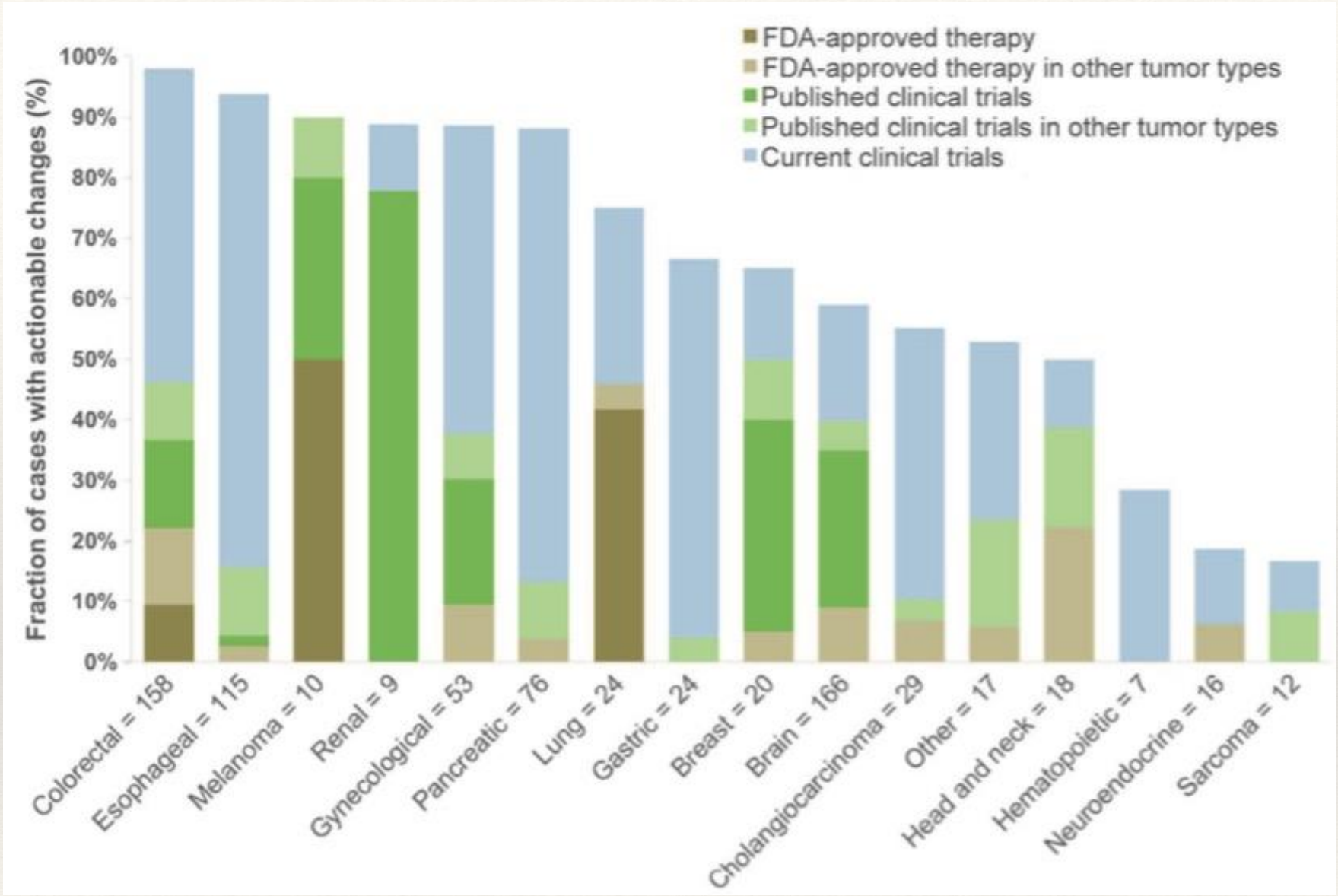
Mutant proteins

Drugs

Abnormal functions

GENOMICS THAILAND

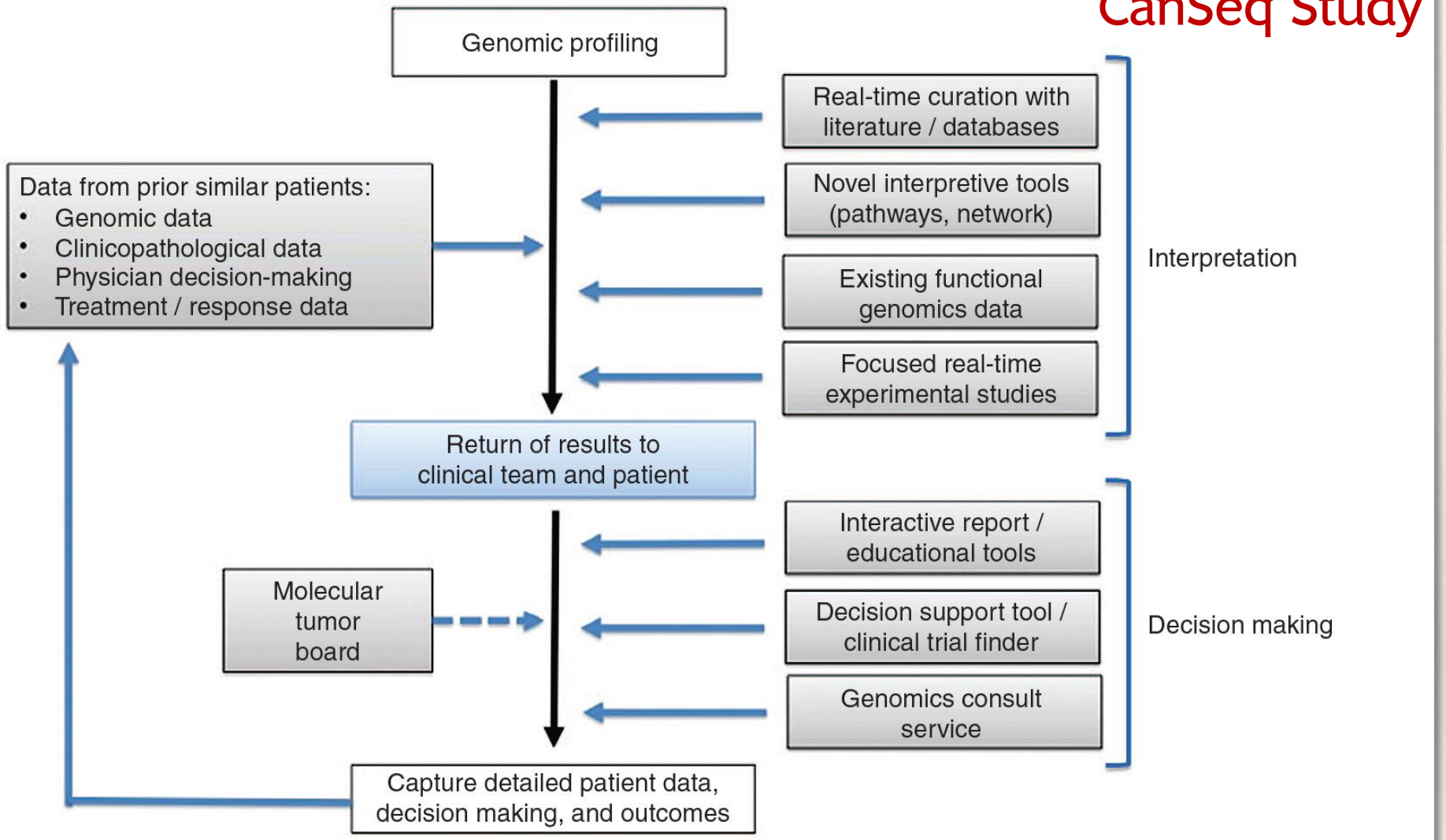
CANCER PRECISION MEDICINE



GENOMICS THAILAND

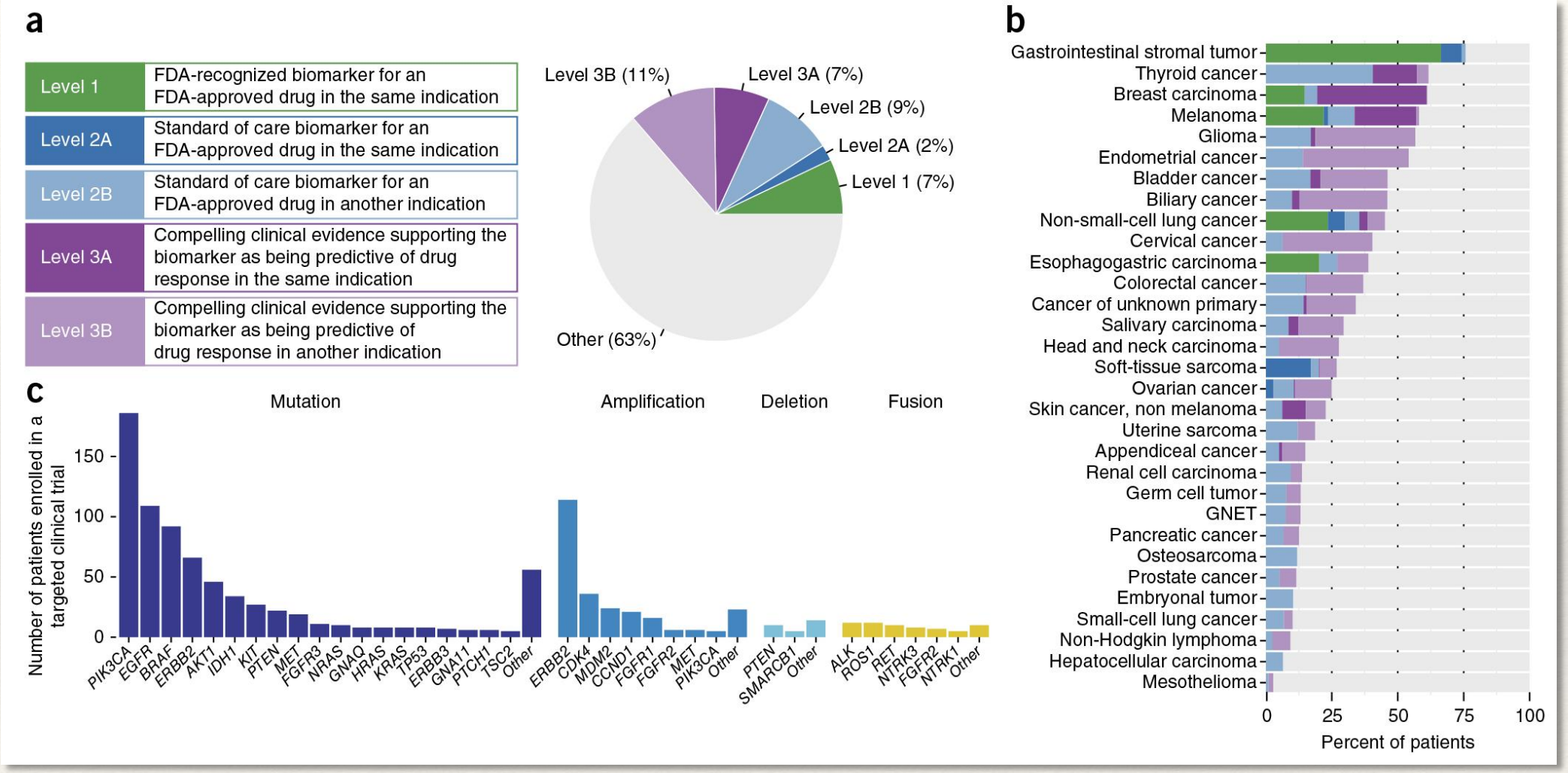
CANCER PRECISION MEDICINE

CanSeq Study

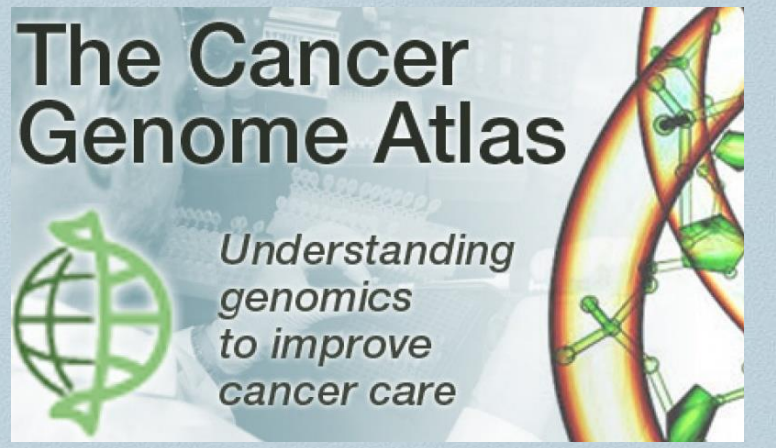


Ghazani AA, et al. Genet Med (2017) January 26, 2017

MSK-IMPACT



Zehir A, et al. Nat Med (2017) published online May 8, 2017



International Cancer Genome Consortium

unicancer

TRACERx

CANCER RESEARCH UK

NCRI National Cancer Research Institute

NCI Designated Comprehensive Cancer Center

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center

Memorial Sloan-Kettering Cancer Center
The Best Cancer Care. Anywhere.

DANA-FARBER CANCER INSTITUTE

FRED HUTCH CURES START HERE

MAYO CLINIC

JOHNS HOPKINS MEDICINE


THE UNIVERSITY OF TEXAS
MD Anderson
Cancer Center


NCI
Designated
Comprehensive
Cancer Center


MEMORIAL SLOAN-KETTERING CANCER CENTER
ESTABLISHED 1884
Memorial Sloan-Kettering
Cancer Center
The Best Cancer Care. Anywhere.


MAYO
CLINIC


JOHNS HOPKINS
MEDICINE


DANA-FARBER
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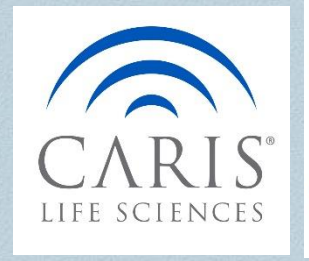
FRED HUTCH
CURES START HERE


NHS
England


FOUNDATION
MEDICINE®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LIFE SCIENCES


myriad®
WHEN DECISIONS MATTER


prosigna®
Breast cancer
prognostic gene signature assay


Ambry Genetics®


oncotype DX®


TEMPUS

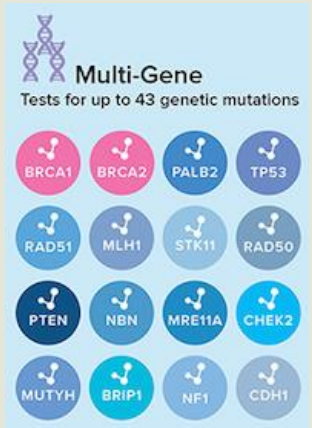
Current Work and Resources

Clinical data and biospecimens

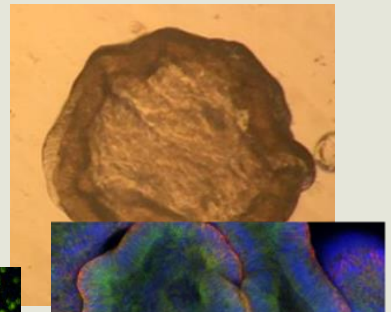
>3,000 cases

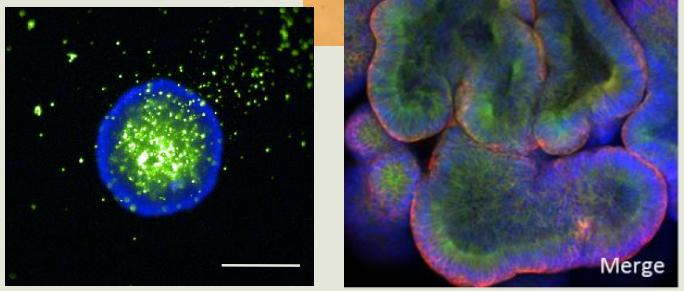
>400 germline and tumor genome data

Cell lines and drug testing platform

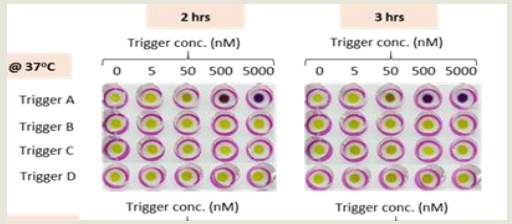


Multigene panel test



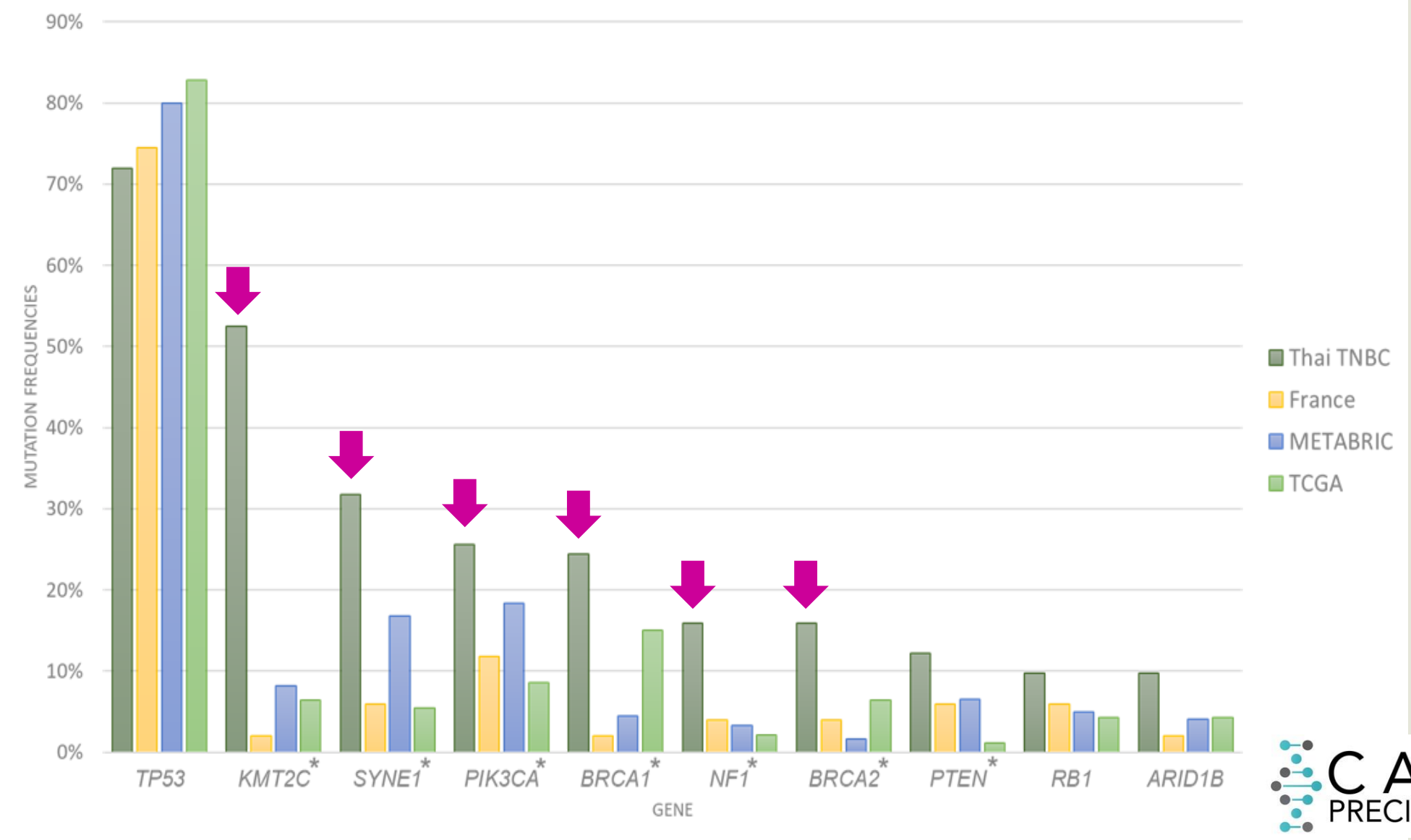


> 200 cancer cell lines and avatars

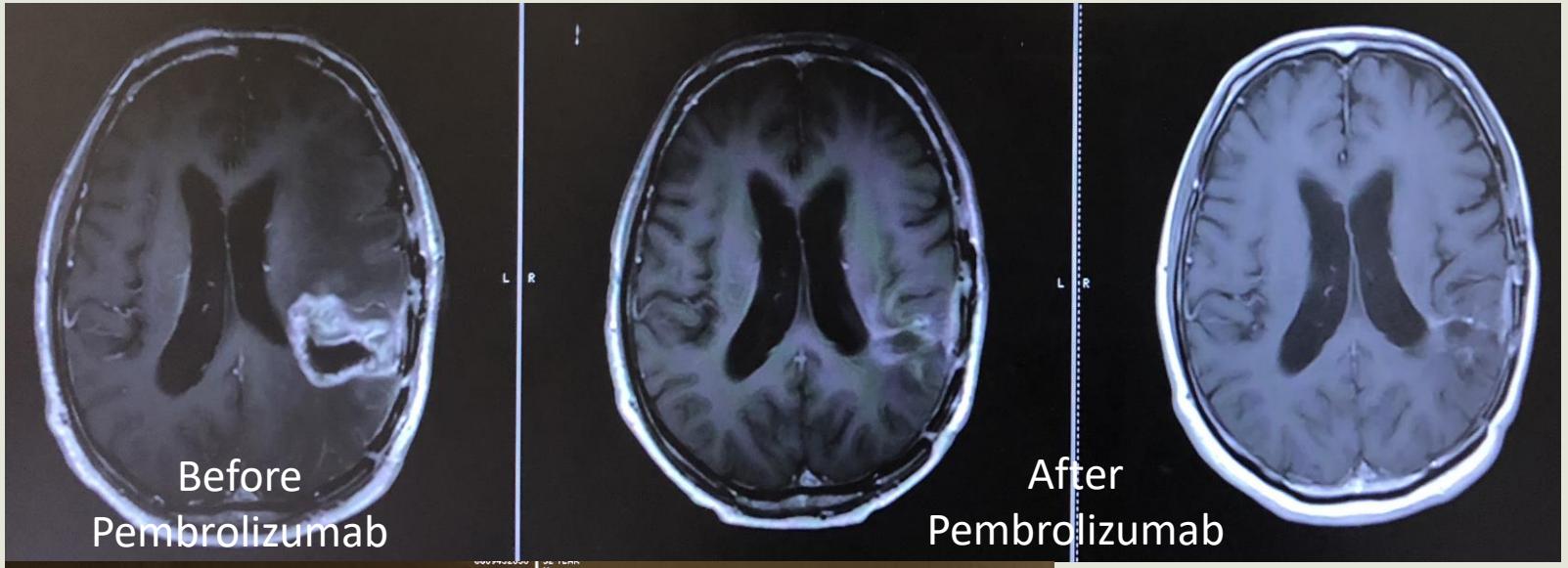


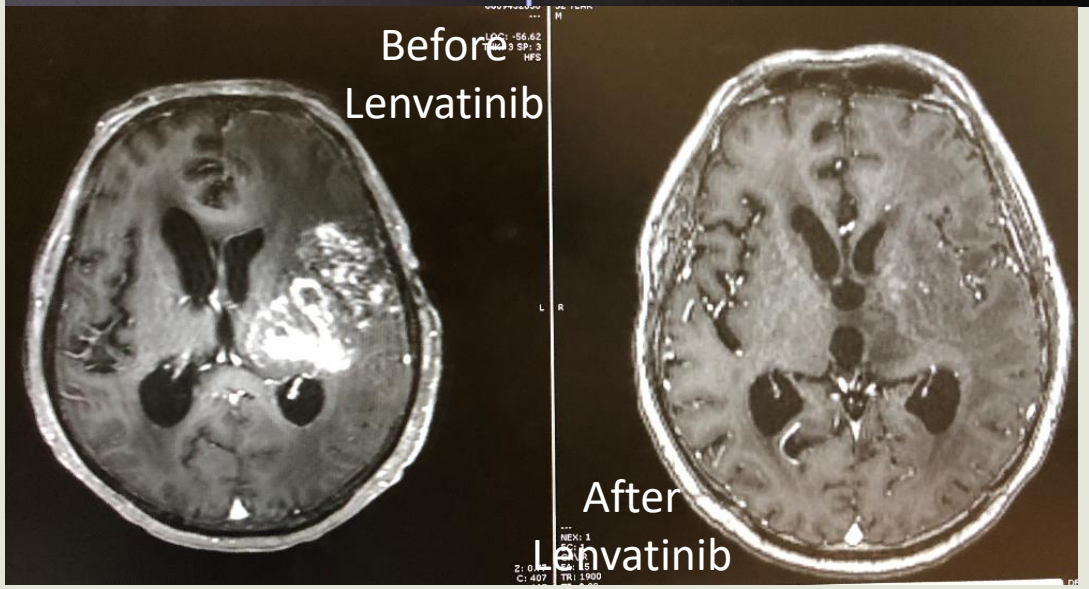
POCT (rapid Dx)

Mutated genes in Triple negative breast cancer

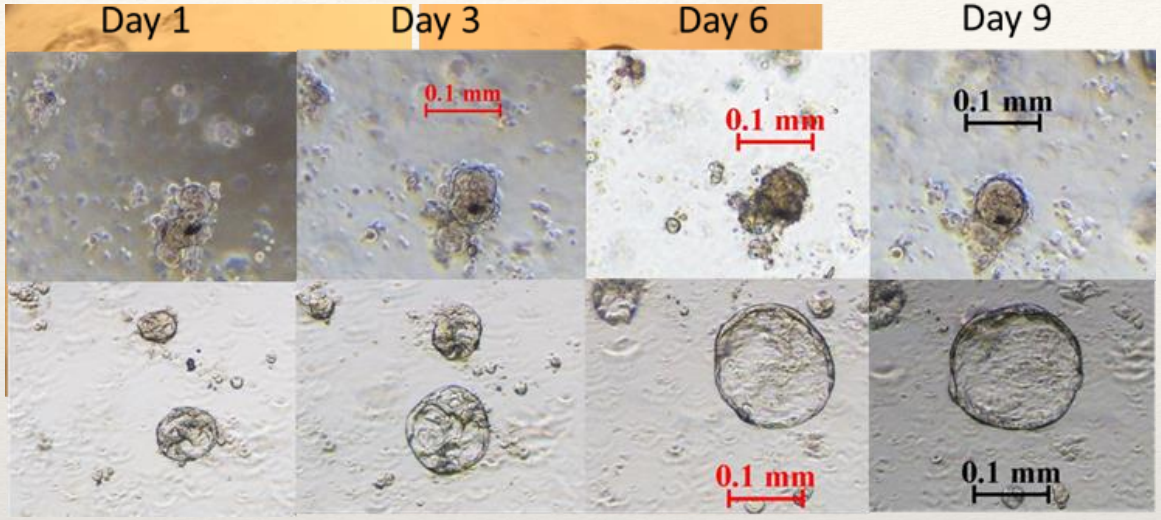


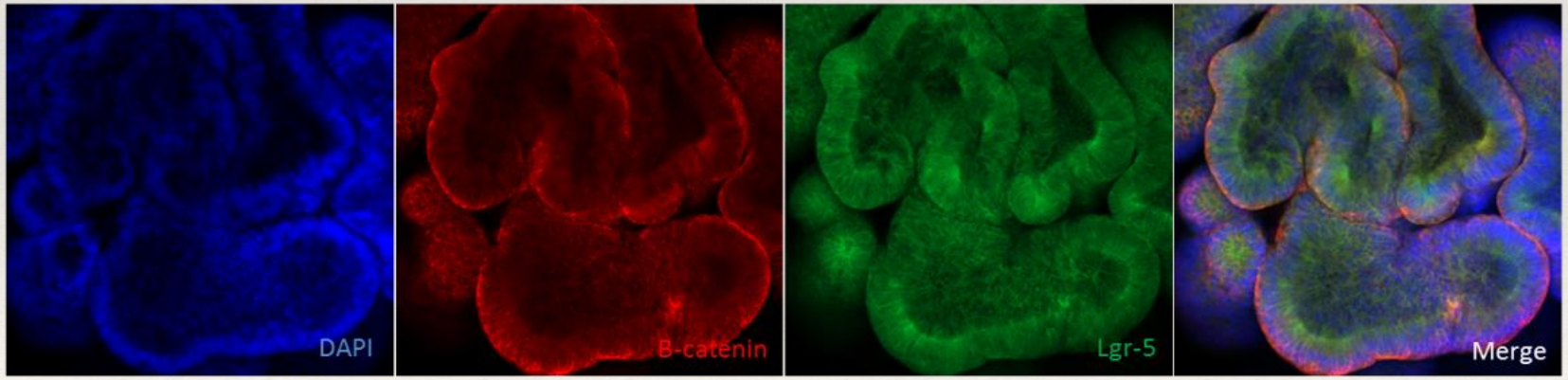
Tumor sequencing can guide treatment in selected cases





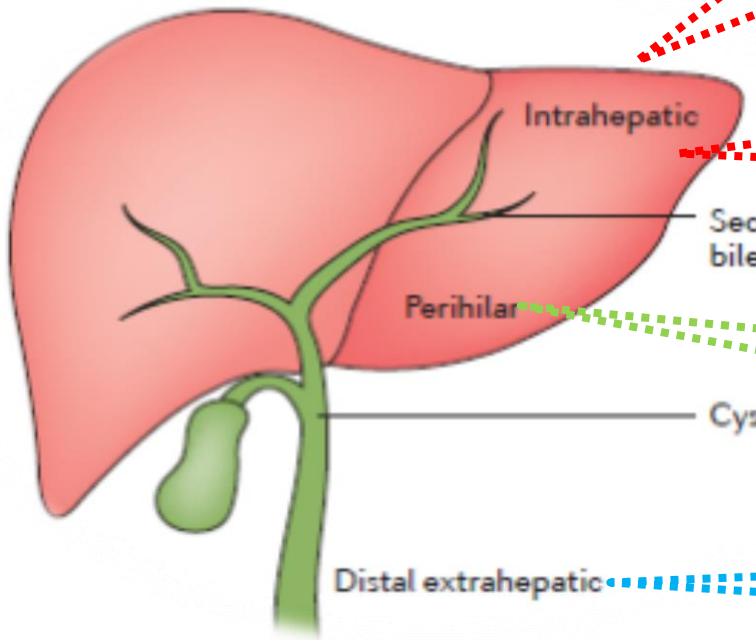
Living cancer cells in the tube





Colon & breast cancer organoid

SYSTEMS-BASED CLASSIFICATIONS OF CHOLANGIOCARCINOMA USING PAN-OMICS



HuCCA-1, KKU-M055, KKU-M156, KKU-M213, KKU-M214, KKU-D068, KKU-D131, KKU-D138

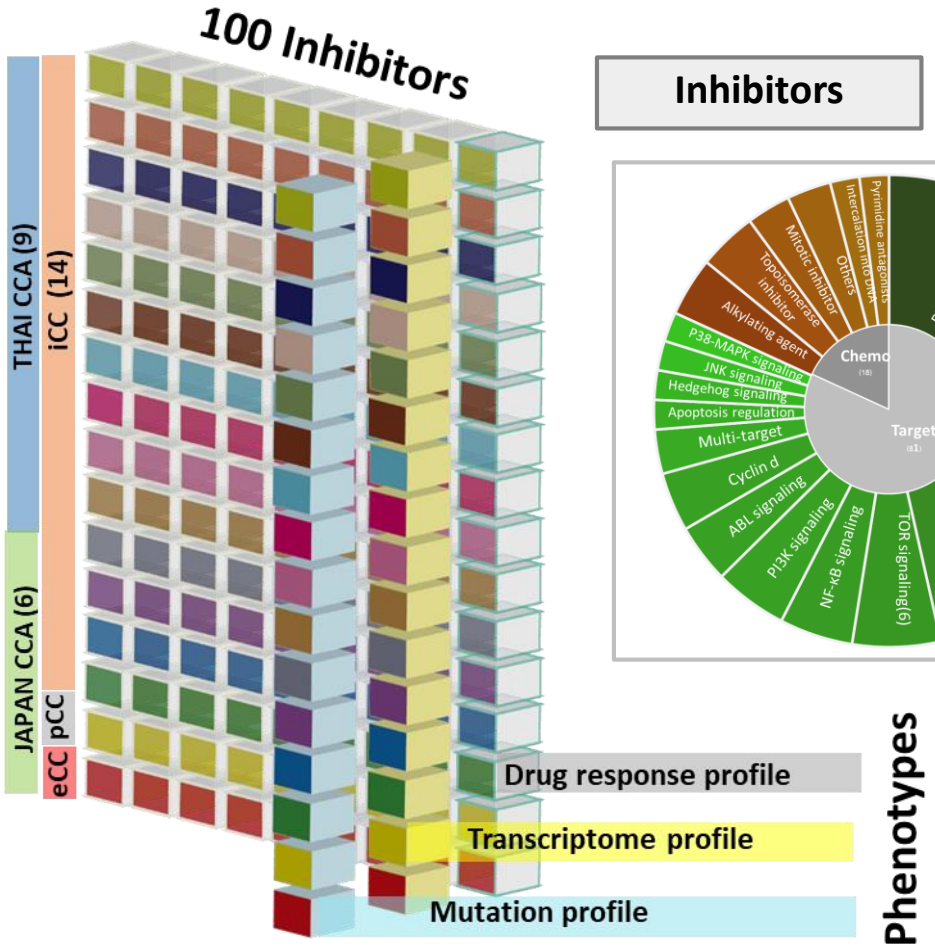
HuCCT-1, HuH-28, RBE, SSP-25, TKKK, YSCCC

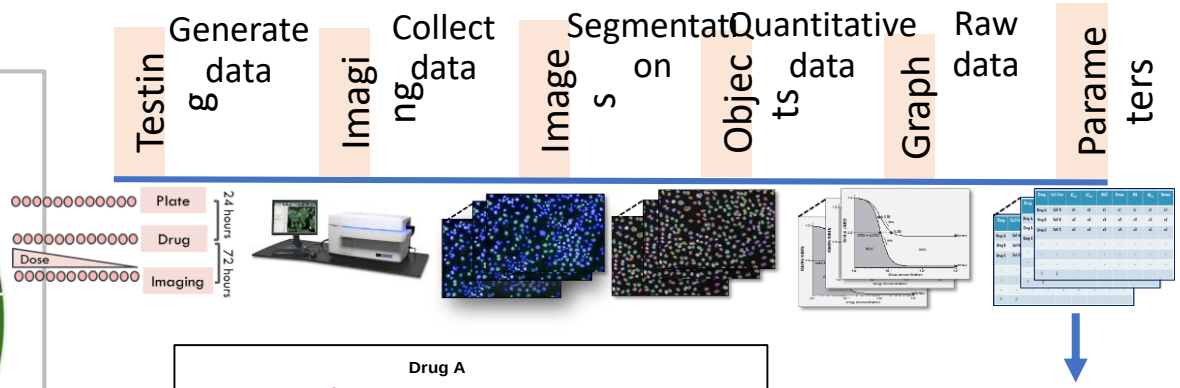
KKU-M100

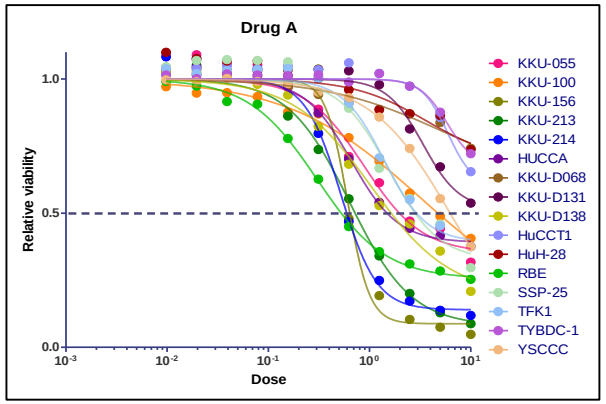
TFK-1

Manuscript In preparation

Integrated network-based cellular signatures and drug response in cholangiocarcinoma





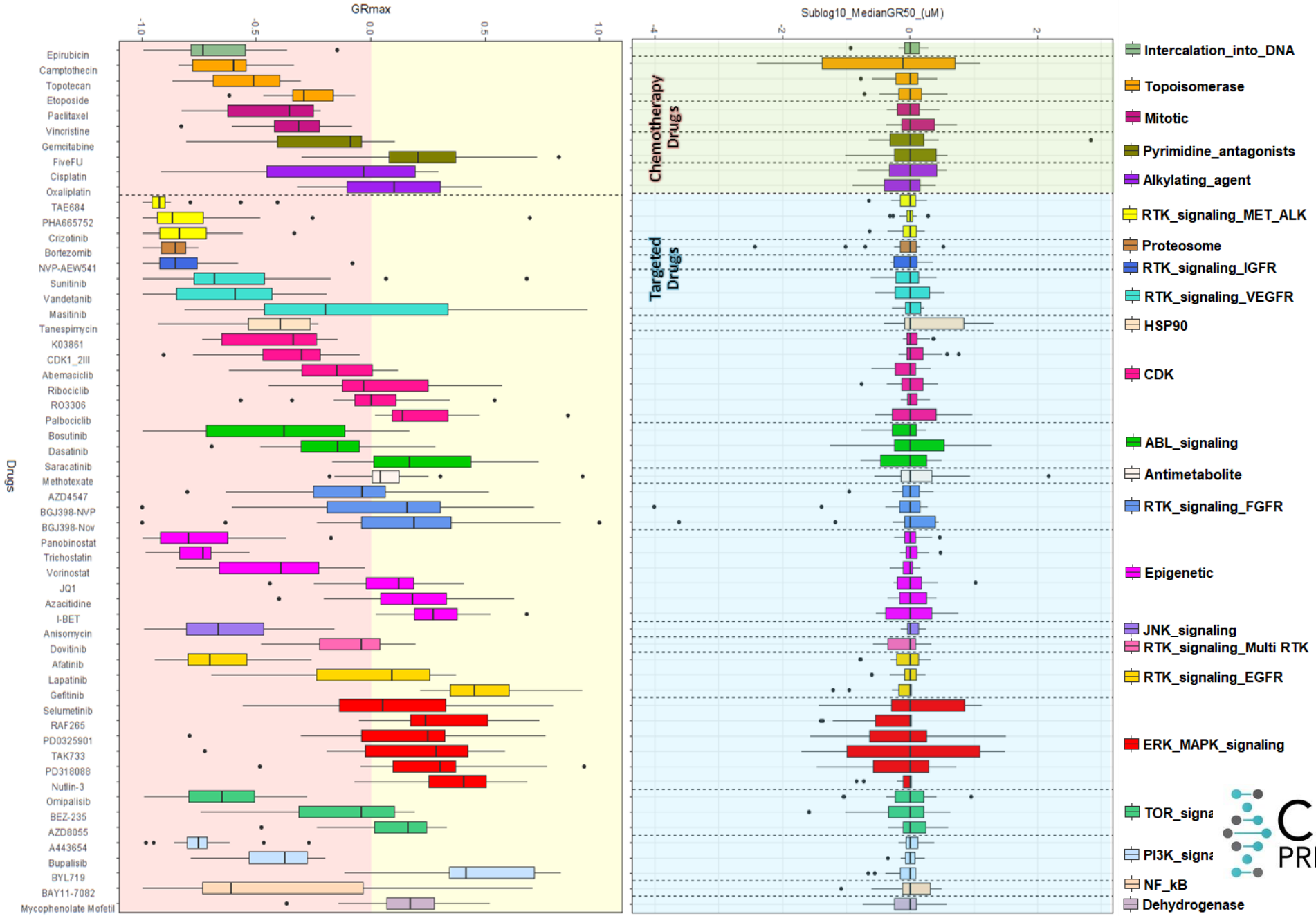


16 cell lines
x 100 inhibitors
X11 doses x 2 repeat
= 35200 data points

CANCER PRECISION MEDICINE

Manuscript In preparation

CCA Cell lines show broad ranges of drug response to different drug groups



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CANCER PRECISION MEDICINE

Drug testing parallel to treatment

GENOMICS THAILAND

CRC case 7: Male, 67 years old
Primary Diagnosis: CA splenic flexure colon
Morphology: Moderately-differentiated adenocarcinoma
Tumor Stage: pT4aN2bMx

Timeline

- ✓ Surgery
- ✓ organoid

Aug, 2016

Oct, 2016-Mar,2017

Treatment:
- ✓ Capecitabine
- ✓ Eloxatin or Oxaliplatin
- ✓ 3-0-3

Sep, 2017

Recurrent

Recurrent: plan FOLFIRI+Avastin

Dec, 2017

FOLFIRI+Avastin Regimen
- ➢ Fluorouracil
- ➢ Leucovorin
- ➢ Irinotecan
- ➢ Bevacizumab

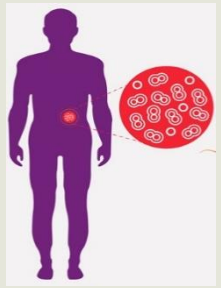
PDX#F1 Nov2017

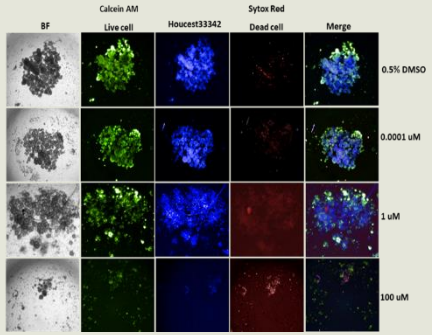
PDX#F2 Jan2018

PDX#F3, Apr2018
Irinotecan 23Apr18-18May18

Stable disease

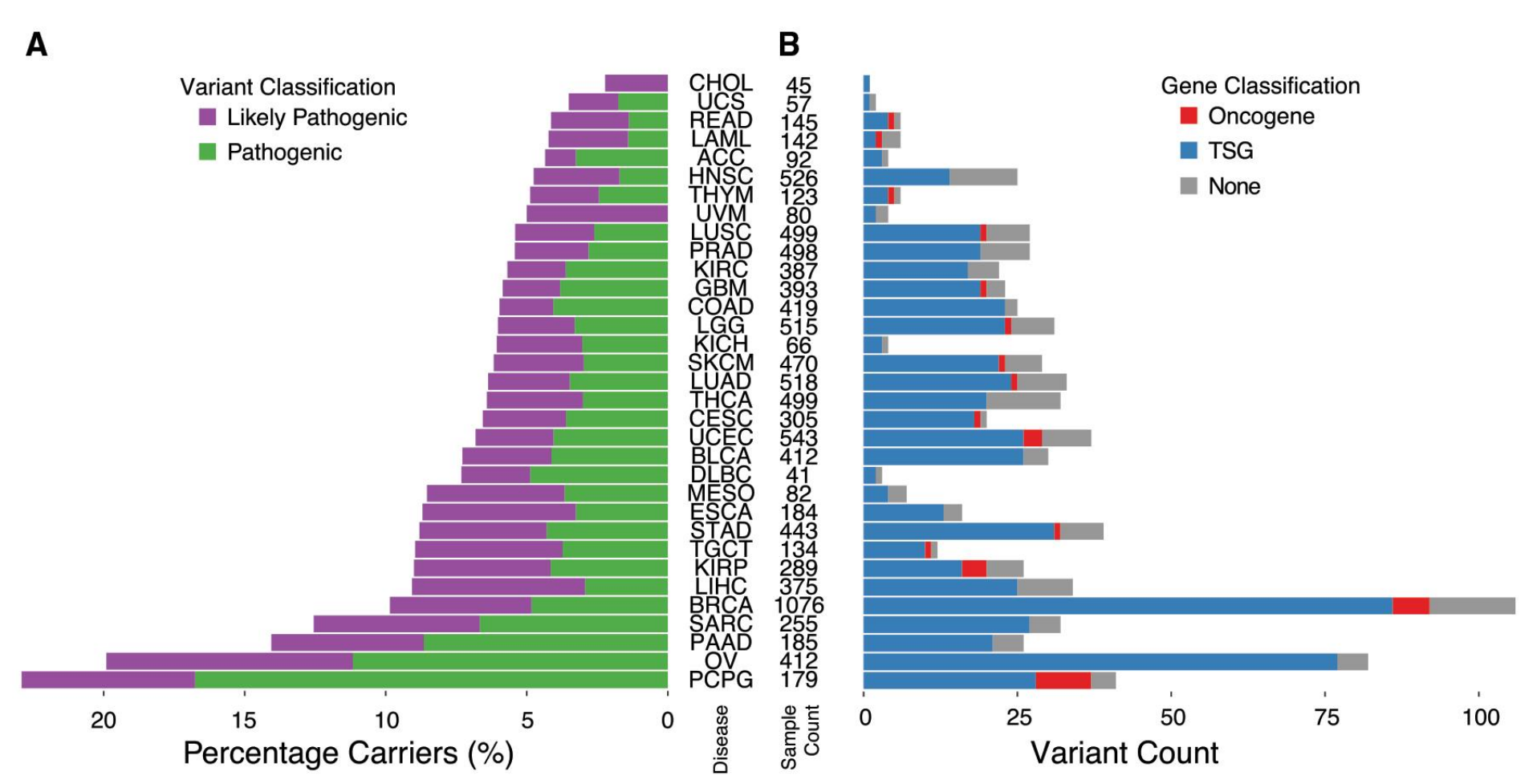
May, 2018



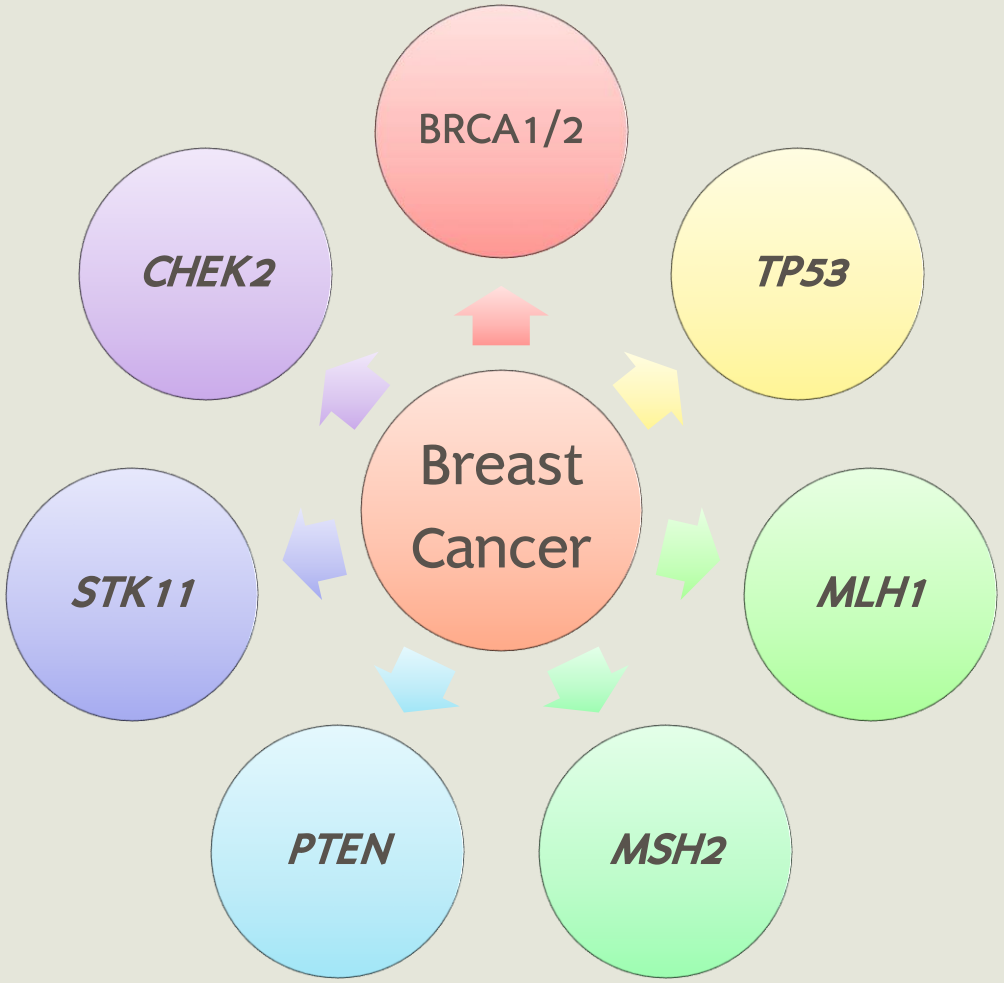


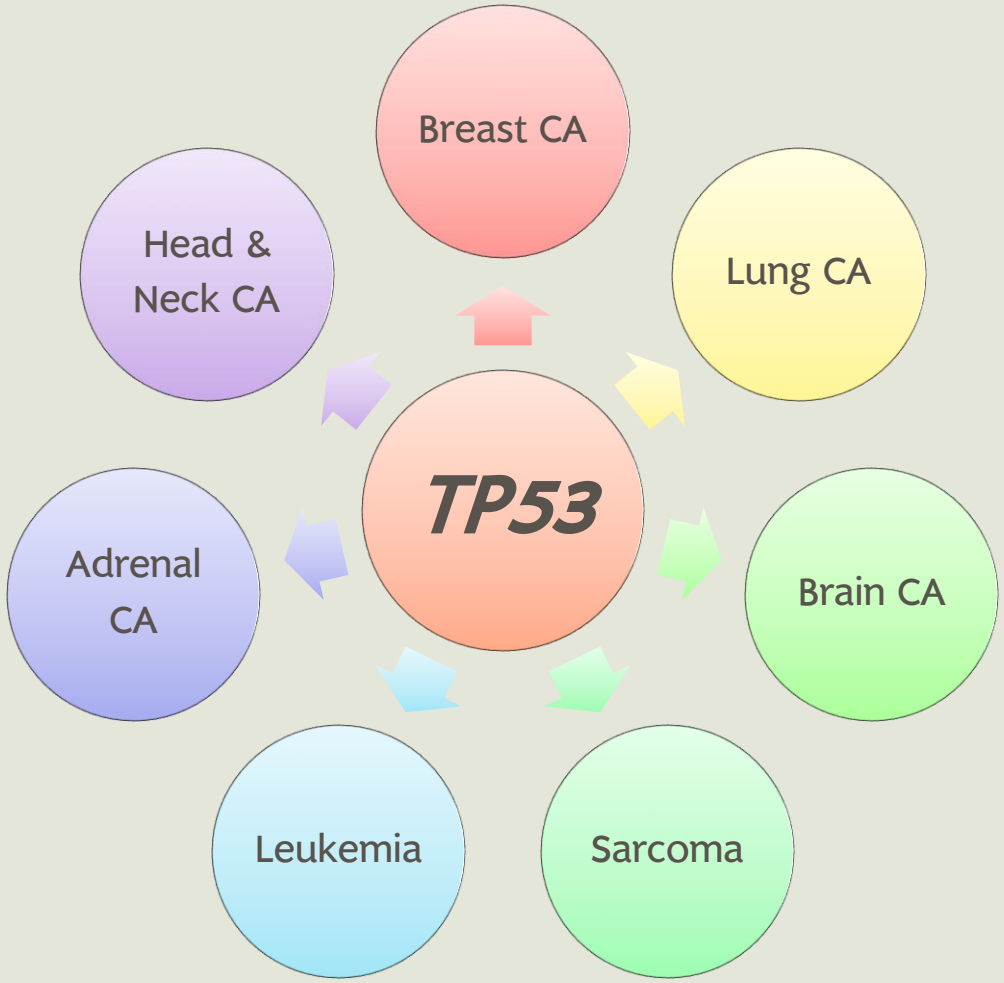
CANCER PRECISION MEDICINE

Germline Variants in TCGA

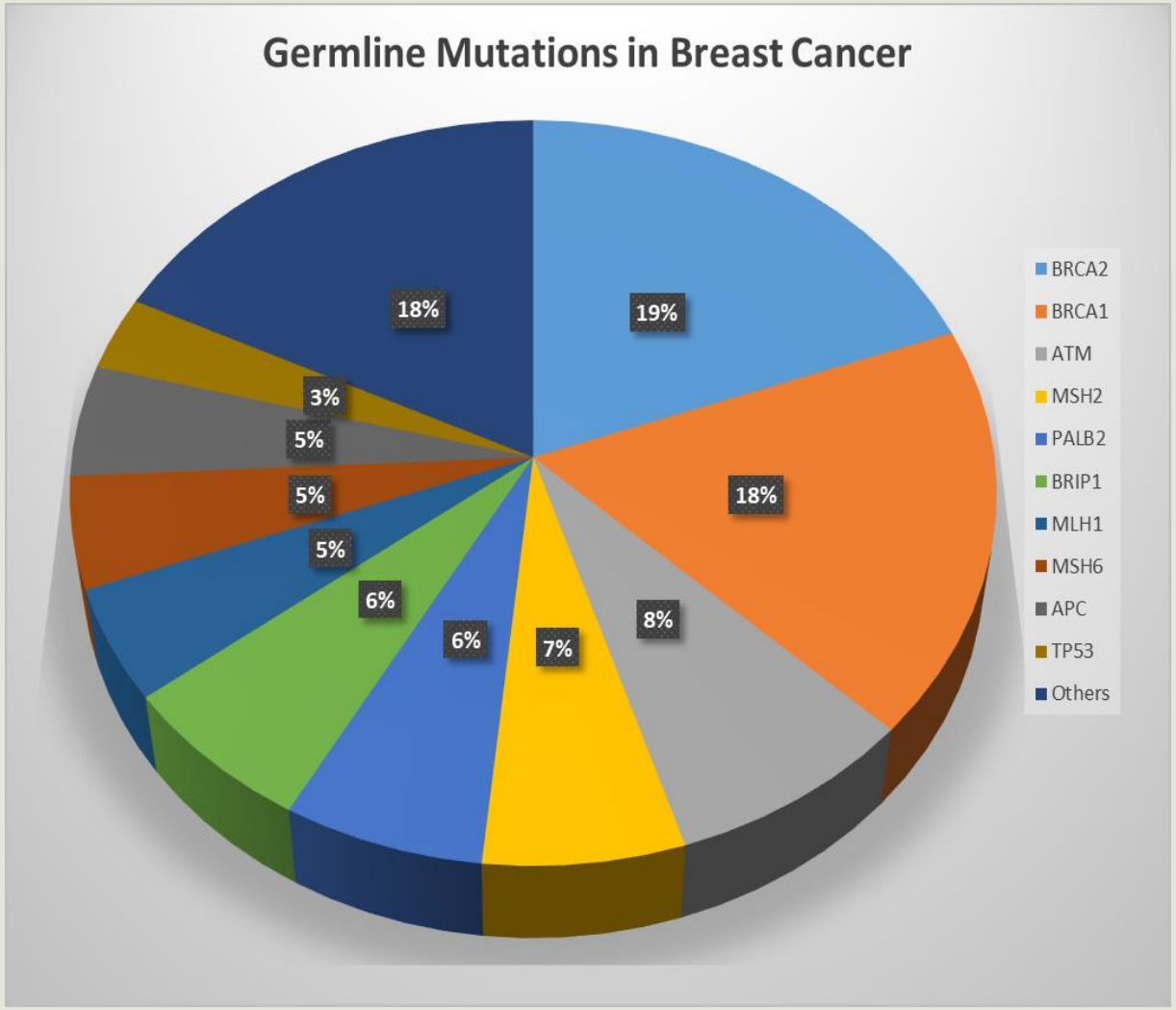


Huang KL, et al. Cell (2018) 173, 355–370


BRCA1/2
CHEK2
TP53
Breast Cancer
STK11
MLH1
PTEN
MSH2


Breast CA
Head & Neck CA
Lung CA
TP53
Adrenal CA
Brain CA
Leukemia
Sarcoma

Germline Variants in Thai Breast Cancer



APC, ATM, AXIN2, BARD1, BMPR1A, BRCA1, BRCA2, BRIP1, CDH1, CDK4, CDKN2A, CHEK2, EPCAM, FANCC, MLH1, MSH2, MSH6, MUTYH, NBN, NTHL1, PALB2, PMS2, POLD1, POLE, PTEN, RAD51C, RAD51D, SMAD4, STK11, TP53, VHL, XRCC2

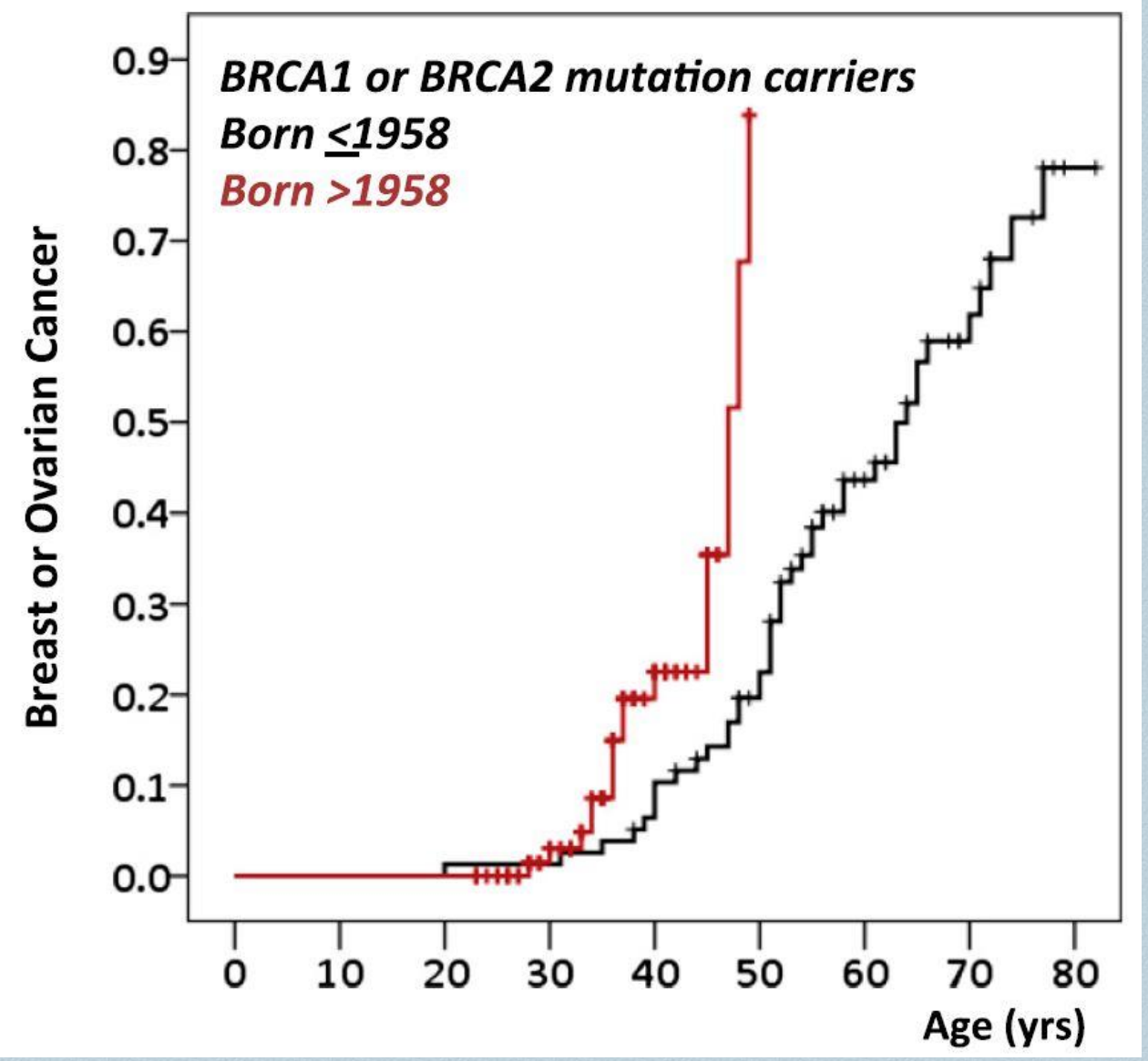
Probands with clinical suspicion of hereditary breast cancer (NCCN guideline 2018)

31.2% identified pathogenic/likely pathogenic variants (PVS, PS)

Nation-wide expansion could prevent/early detect breast cancer up to 5,000 cases/yr and save 220M/yr

(Unpublished data)

Hereditary Breast Ovarian Cancer



The New York Times

The Opinion Pages

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY

OP-ED CONTRIBUTOR

My Medical Choice

By ANGELINA JOLIE

Published: May 14, 2013 | 1712 Comments

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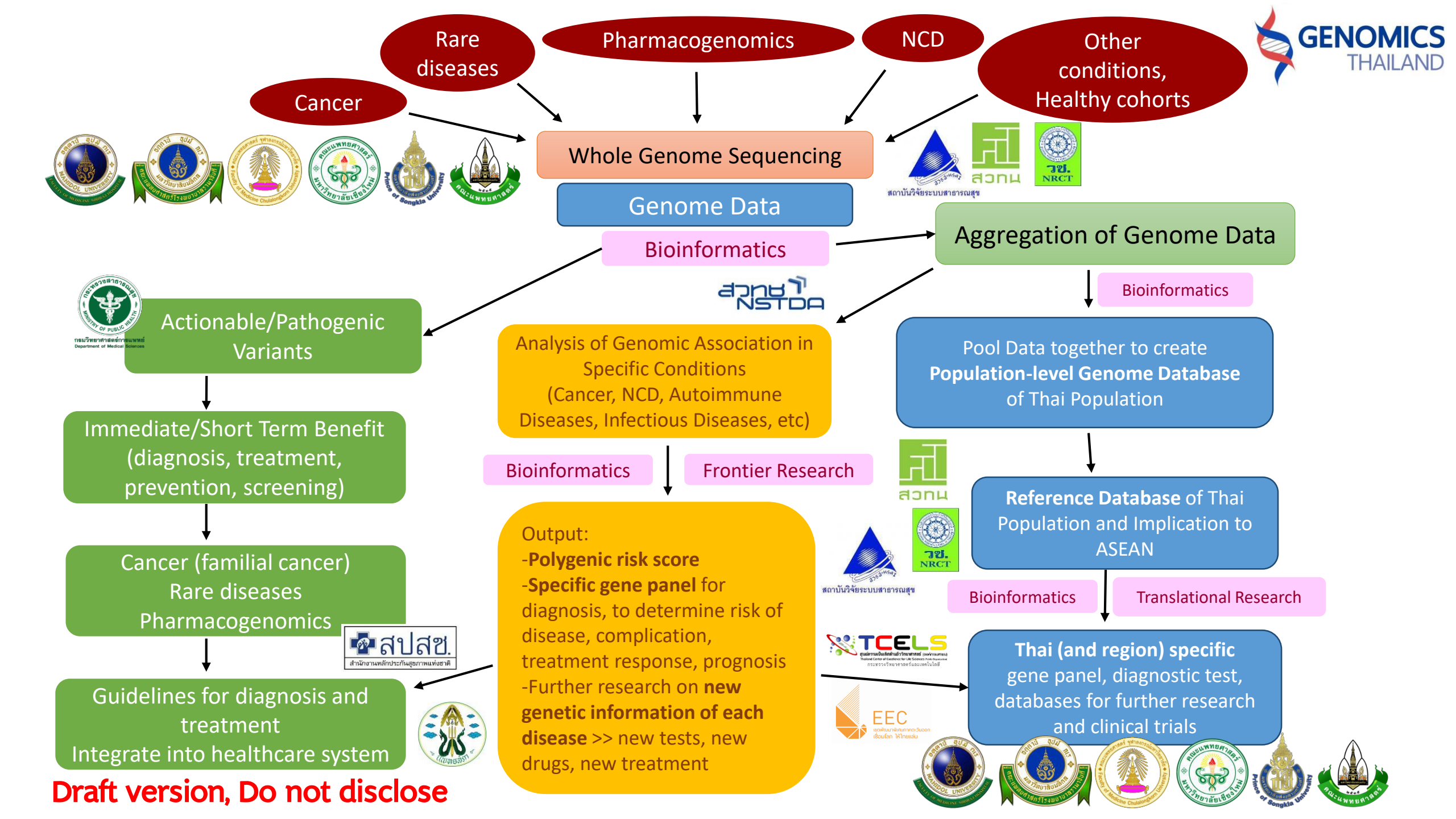
Rare diseases
Pharmacogenomics
NCD
Other conditions, Healthy cohorts
Cancer
GENOMICS THAILAND
Whole Genome Sequencing
Genome Data
Bioinformatics
Aggregation of Genome Data
Bioinformatics
Actionable/Pathogenic Variants
Immediate/Short Term Benefit (diagnosis, treatment, prevention, screening)
Cancer (familial cancer)
Rare diseases
Pharmacogenomics
Guidelines for diagnosis and treatment
Integrate into healthcare system
Analysis of Genomic Association in Specific Conditions (Cancer, NCD, Autoimmune Diseases, Infectious Diseases, etc)
Bioinformatics
Frontier Research
Output:
-Polygenic risk score
-Specific gene panel for diagnosis, to determine risk of disease, complication, treatment response, prognosis
-Further research on new genetic information of each disease >> new tests, new drugs, new treatment
Pool Data together to create Population-level Genome Database of Thai Population
Reference Database of Thai Population and Implication to ASEAN
Bioinformatics
Translational Research
Thai (and region) specific gene panel, diagnostic test, databases for further research and clinical trials
Draft version, Do not disclose

RESEARCH UNIVERSITY NETWORK THAILAND

Health Cluster

CANCER PRECISION MEDICINE

SiSP
Siriraj Initiative in Systems Pharmacology

CU SB

CANCER PRECISION MEDICINE

@CAPrecisionMed

ZeBR


GENOMICS
THAILAND


กระทรวงวิทยาศาสตร์และเทคโนโลยี
MINISTRY OF SCIENCE AND TECHNOLOGY


กระทรวงสาธารณสุข
MINISTRY OF PUBLIC HEALTH


กระทรวงศึกษาธิการ
Ministry of Education