THE FUTURE OF CANCER DATA: UNLOCKING INSIGHTS WITH PATHOLOGY REPORTING

Cancer Collaborators: Partnering to Improve Care Utilizing Pathology Data and Cancer Reporting

Peter Paul Yu, MD, FACP, FASCO

OCTOBER 6 | 12:45–1:15 PM CT

COLLEGE of AMERICAN PATHOLOGISTS
Laboratory Quality Solutions

CAP23 | CHICAGO

#PATHDATA

Pathology & Medical Oncology

Convergence of biology, technology and clinical care

Peter Paul Yu MD FACP FASCO
Hartford HealthCare Cancer Institute

College of American Pathologists Cancer Data Summit
October 6, 2023

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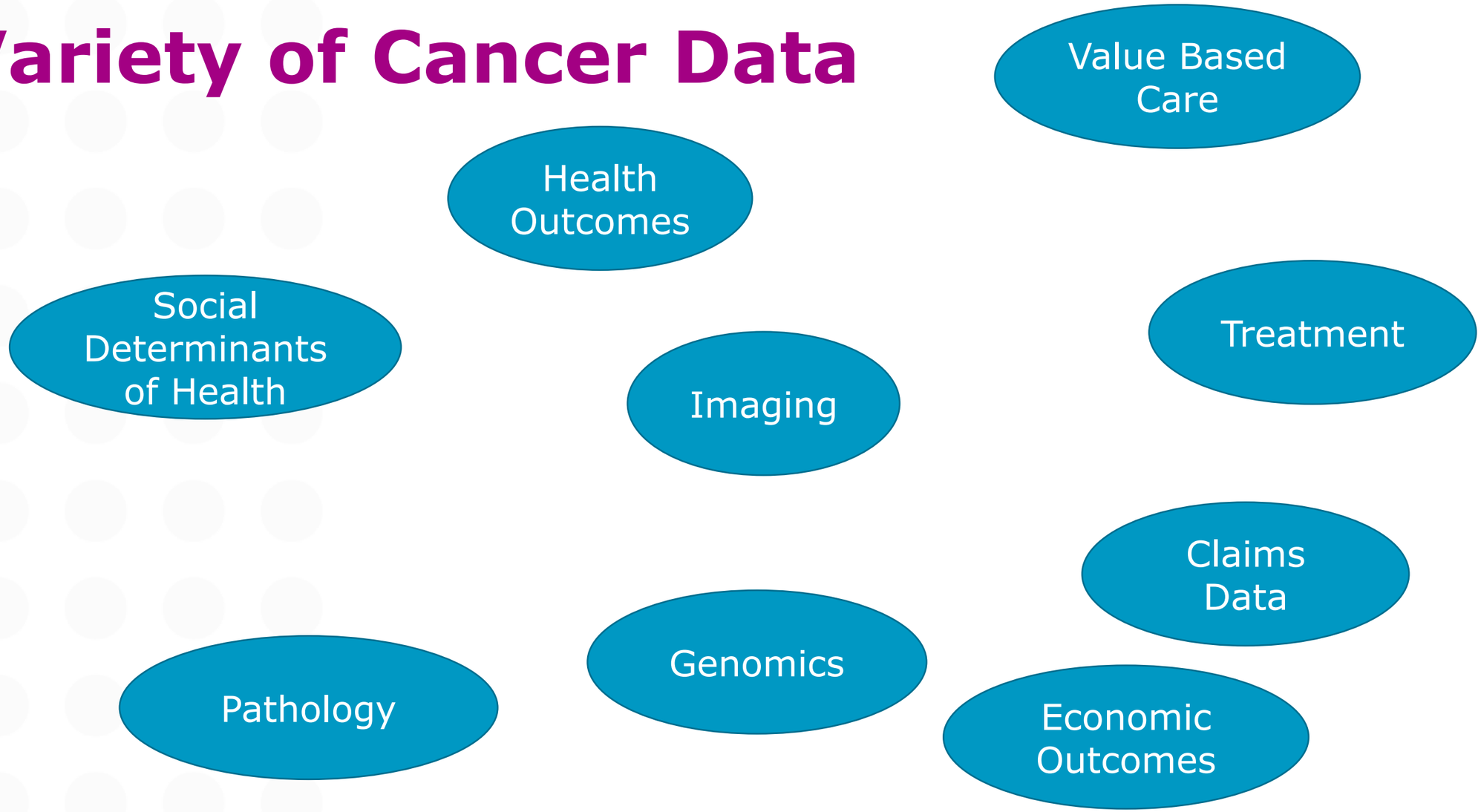
Disclosures

- No disclosures

Today's topics

- Data Ecosystem & Data Models
- Cancer Biology & Staging
- Clinical decision-making

Variety of Cancer Data



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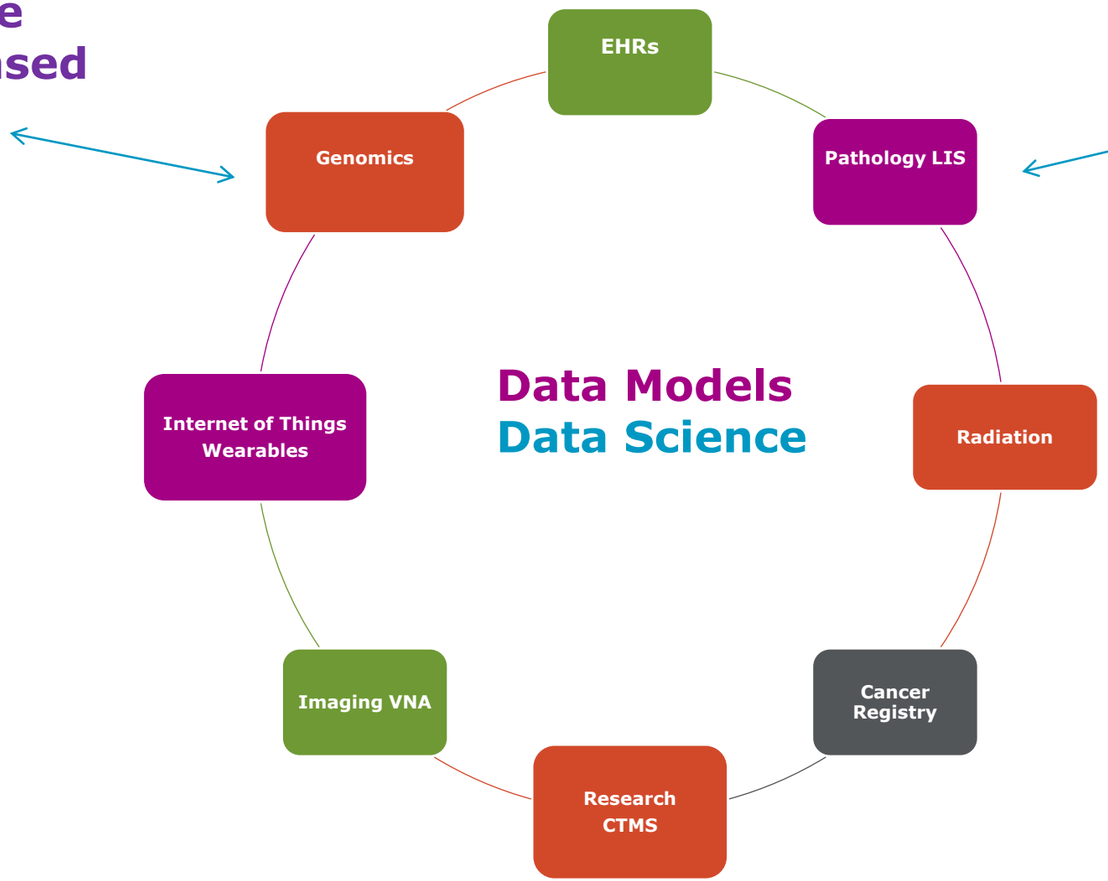
Data Architecture

Real World Evidence
Outcomes & Value-Based
Payers
Life Sciences
Pharma
FDA
PCORI



Cancer Registries
State DPH-CDC
NCI SEER
ACS NCDB
ASCO QOPI

Strategic Partners
Common Data Model

Absent data standards we are blind

By romana klee from usa - sammati tarka prakarana, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=59461928

With a data model the whole is the sum of the parts

Mammal

Elephant

Legs: 4
Tail: Yes
Size: Large
Arms: Trunk
Diet: Vegetarian
Geography: India

Data Models underlie data architecture

- Cancer Diagnosis
  - SNOMED CT "Standard"
  - ICD-0-3
  - NAACCR
  - CAP eCP
  - AJCC V8

- Concepts
  - Histology
  - Anatomic Site
  - Grade
  - Stage

Oncology Data Models

- **Chemotherapy Treatment**
  - **HemeOnc.org "Standard"**
  - **Anatomical Therapeutics Chemical Drug Classification**
  - **RxNorm**

- **Concepts**
  - **Drug combination**
  - **Dosing**
  - **Schedule**
  - **Cycles**

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mCODE™ Minimal Common Oncology Data Elements

A FHIR-based core set of common data elements for cancer that is standardized, computable and clinically applicable in every electronic patient record with a cancer diagnosis

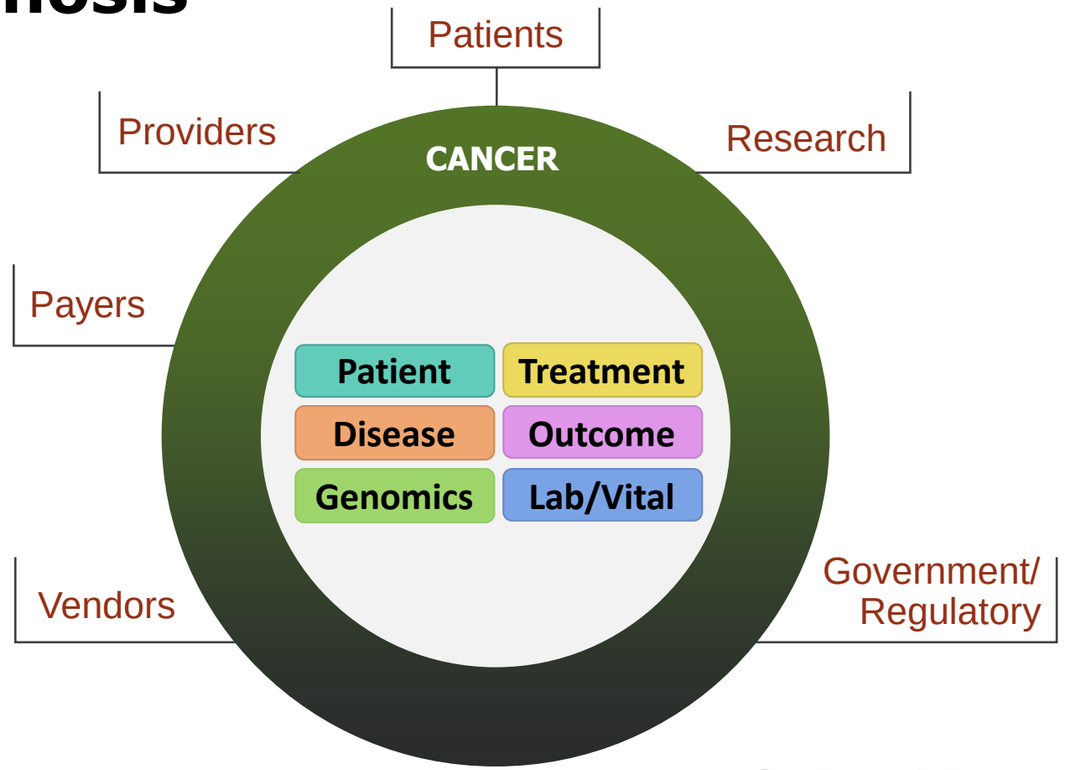
A **standard health record** for oncology

The **minimal set of data elements** applicable to all cancers, and collected for:

Standardized information exchange

Use-case driven and targeted use

Oncology data element domains:
patient, disease, treatment, outcomes, genomics, lab/vital



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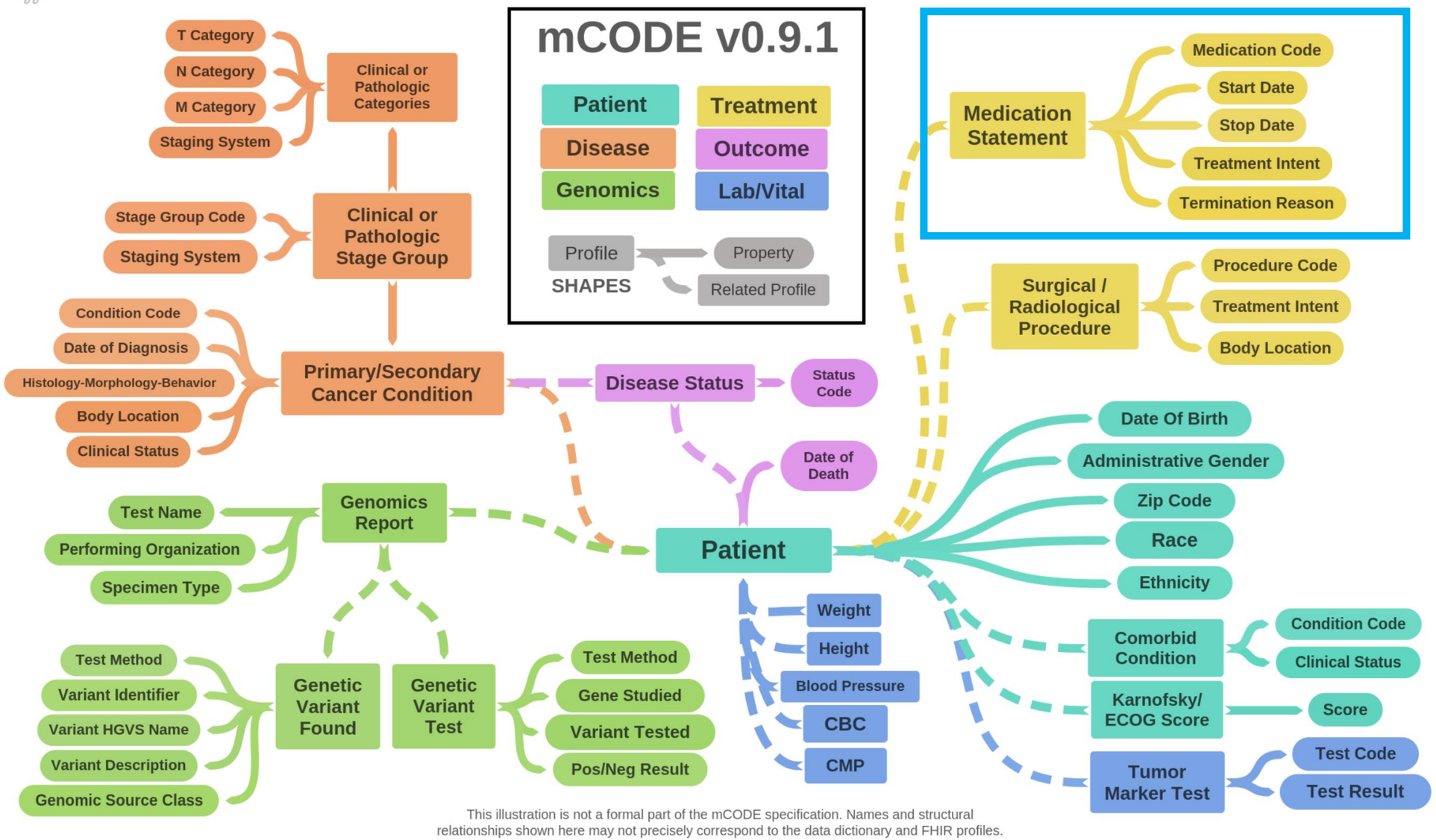
mCODE™ Conceptual Model

Source: http://build.fhir.org/ig/HL7/fhir-mCODE-ig/branches/master/index.html#Modeling



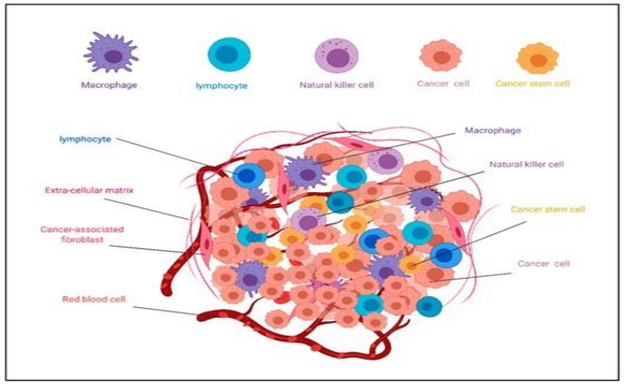
The Future of Cancer Staging

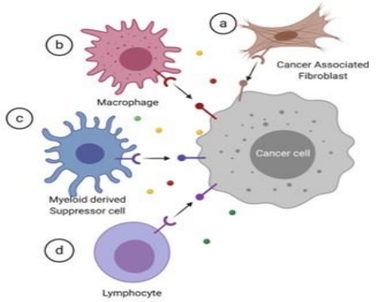
ASCO®
AMERICAN SOCIETY OF CLINICAL ONCOLOGY
MAKING A WORLD OF DIFFERENCE IN CANCER CARE

Re-thinking T stage

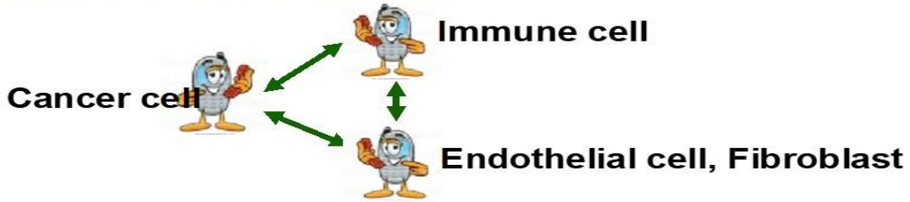
Tumors: an ecosystem of interacting and inter-dependent cellular communities

(not enough to study tumor cells in isolation)





How does crosstalk between tumor cells and their neighbors influence their survival, growth and therapy/immune response?

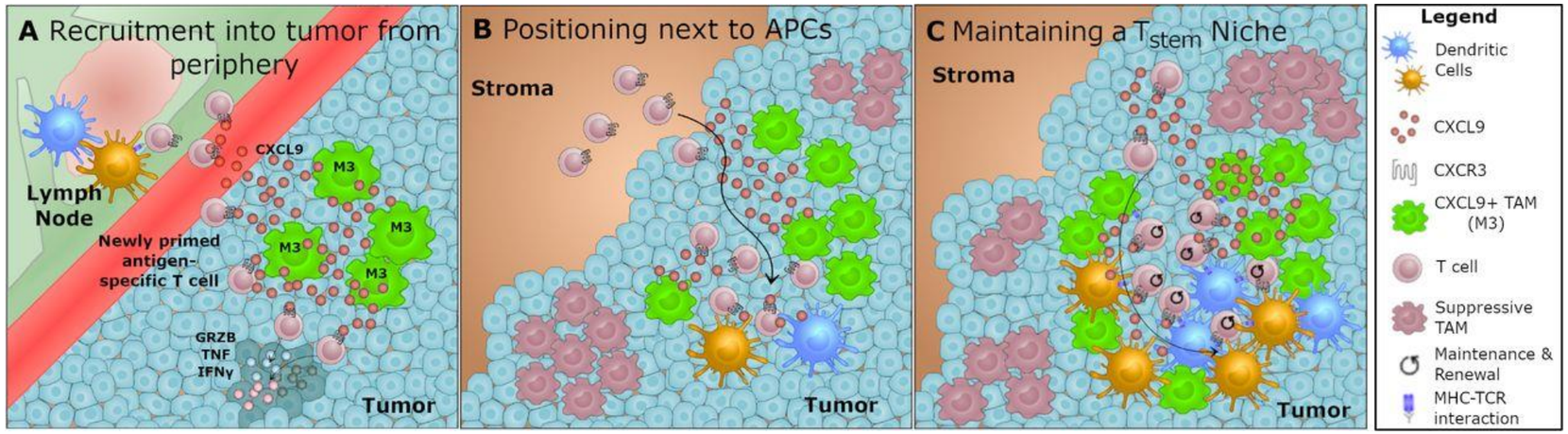


ASCO Breakthrough #ASCOBT23

PRESENTED BY: Dr. Ramanuj DasGupta

ASCO AMERICAN SOCIETY OF CLINICAL ONCOLOGY
KNOWLEDGE CONQUERS CANCER

Re-thinking T stage

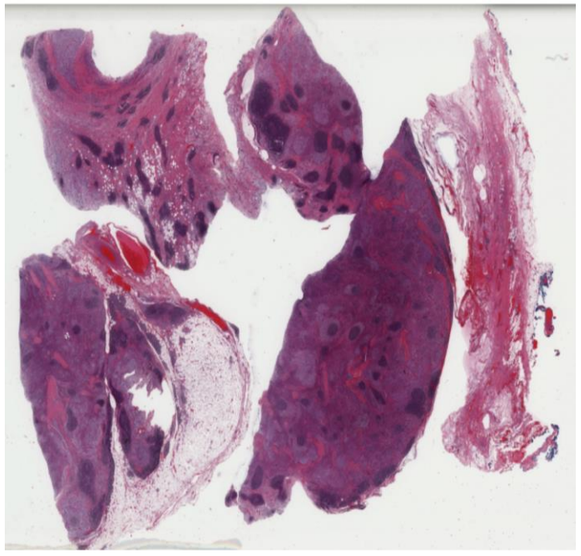


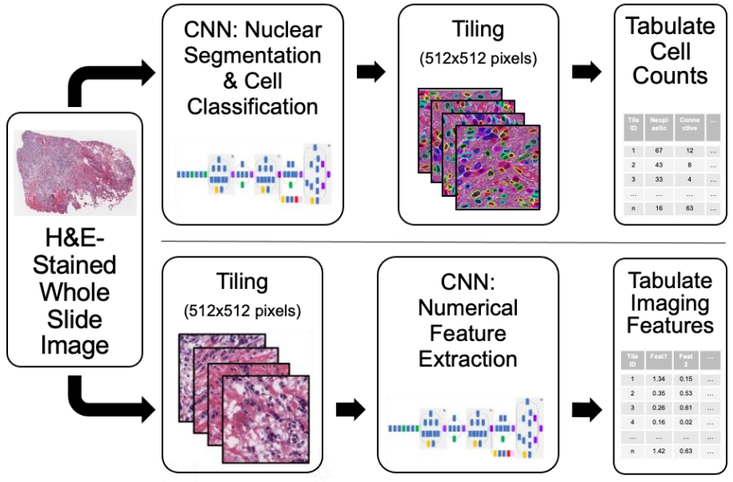
Paola Marie Marcovecchio et al. J Immunother Cancer 2021;9:e002045

Journal for ImmunoTherapy of Cancer

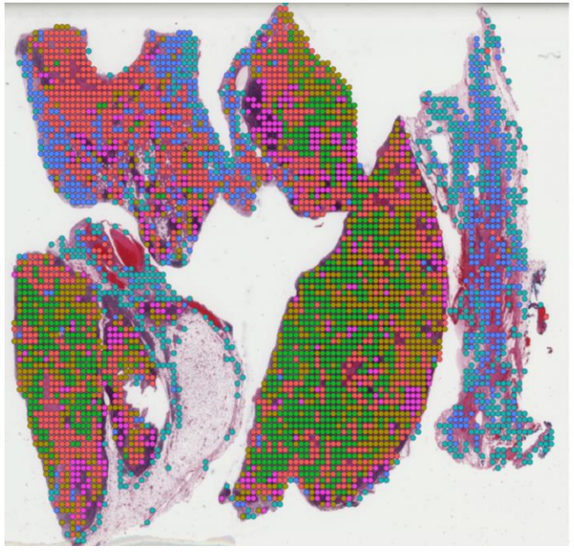
Tumor Regions Cluster by Imaging Features

TCGA: Sarcoma

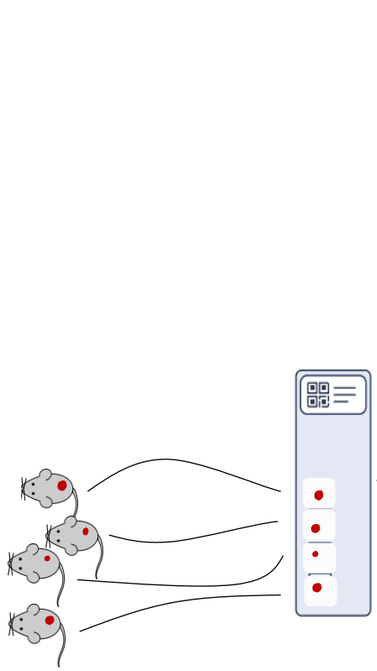




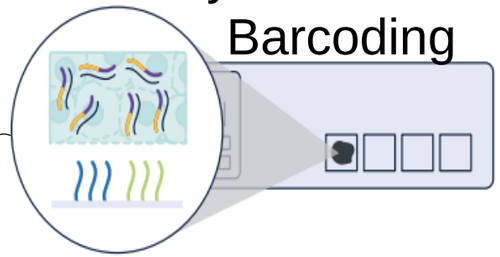
Cluster Tiles Based on Imaging Features

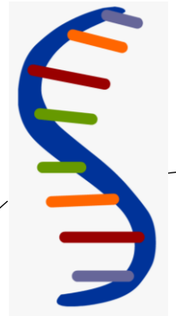


Aligning Transcriptomic and Spatial Data



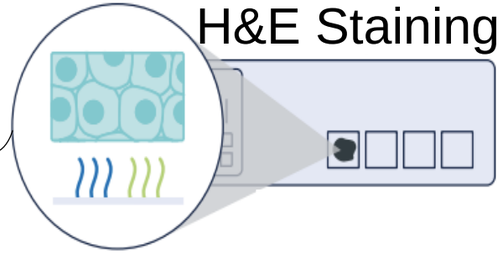
Hybridization & Barcoding

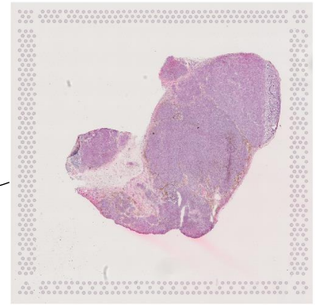




RNA Transcripts

H&E Staining





Digitized Images

Match Spatial Coordinates to Align Datasets

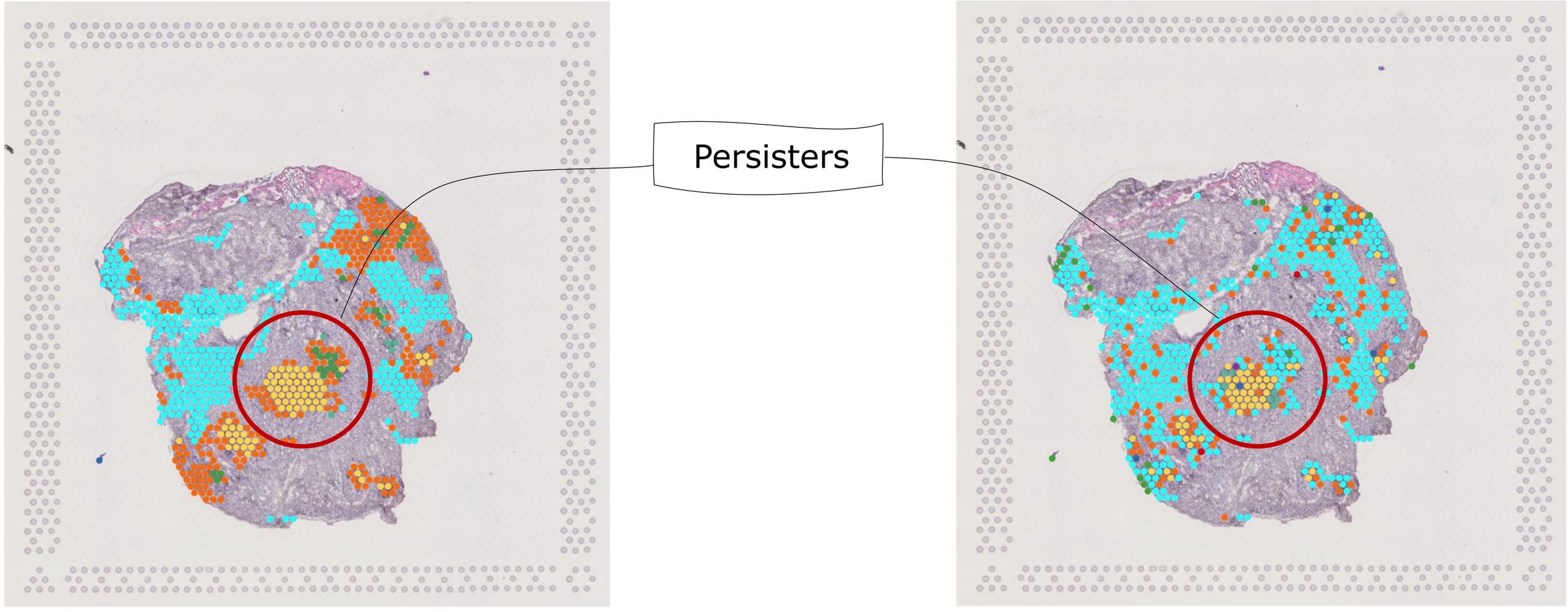
Spot-Level Data Types:
(spot diameter = 50 µm)

Gene Expression Levels
Inferred Copy Number Variants
Cell Fate Trajectories
Imaging Feature Arrays

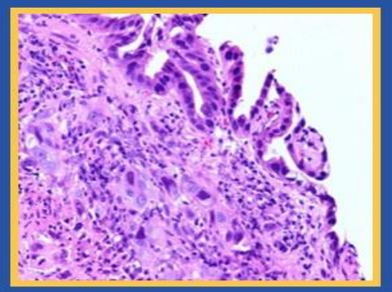
Imaging Features Correlate with Gene Expression Signatures

Gene expression-defined clones

Imaging-defined clones

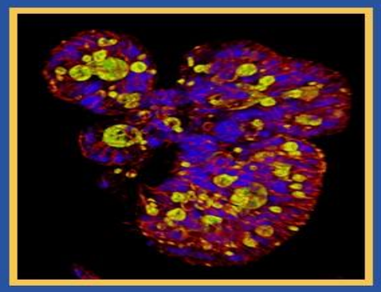


The evolving landscape of biopsies

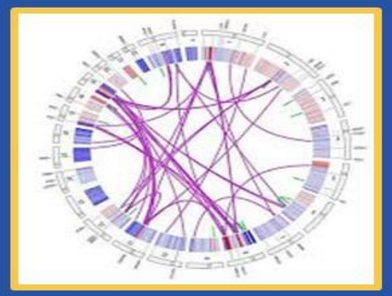


Tissue Biopsy

Liquid Biopsy



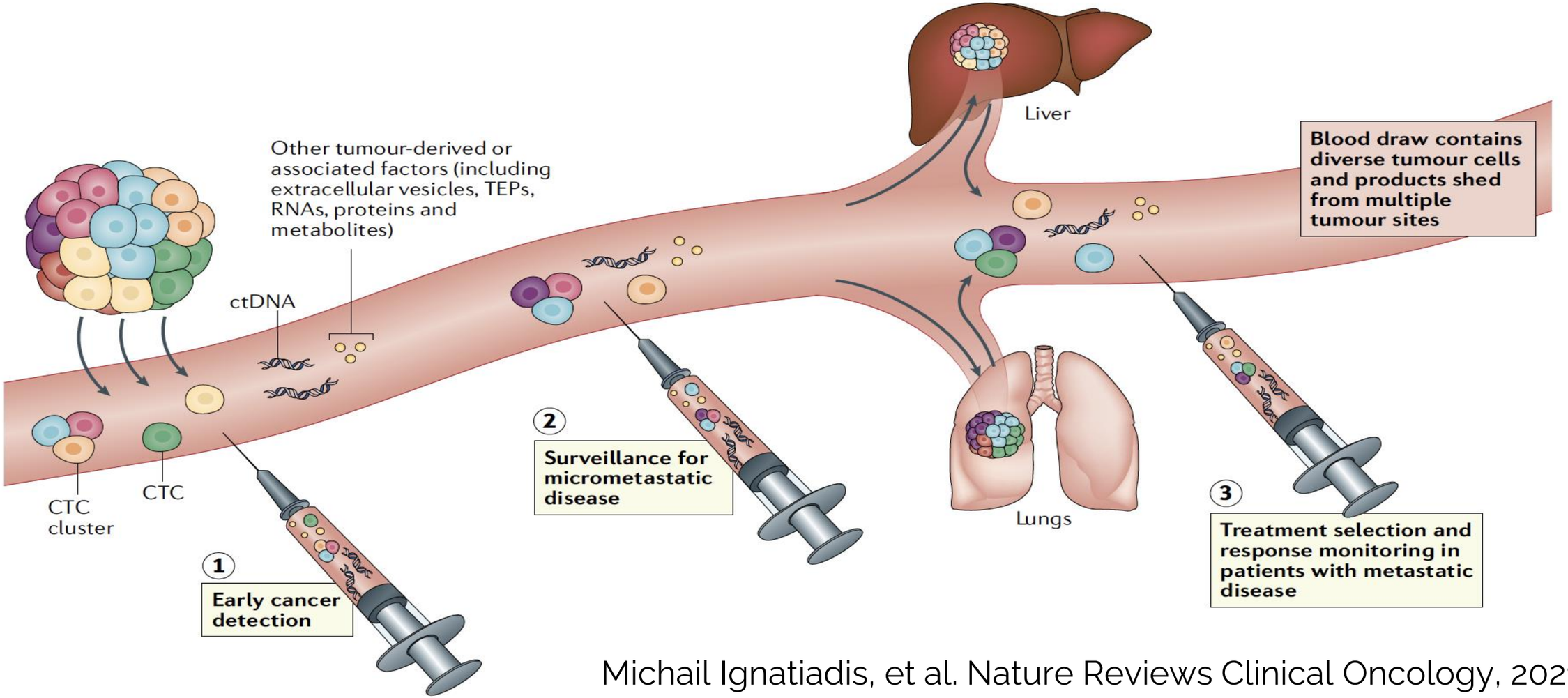
Functional Biopsy



PRESENTED AT: Breakthrough A Global Summit for Oncology Innovators #ASCOBT19 PRESENTED BY: Nicola Valeri

Presented By Nicola Valeri at 2019 ASCO Breakthrough: A Global Summit for Oncology Innovators

Liquid Biopsy: Re-thinking N



Michail Ignatiadis, et al. Nature Reviews Clinical Oncology, 2021

Hartford HealthCare Cancer Institute

2023 ASCO® ANNUAL MEETING

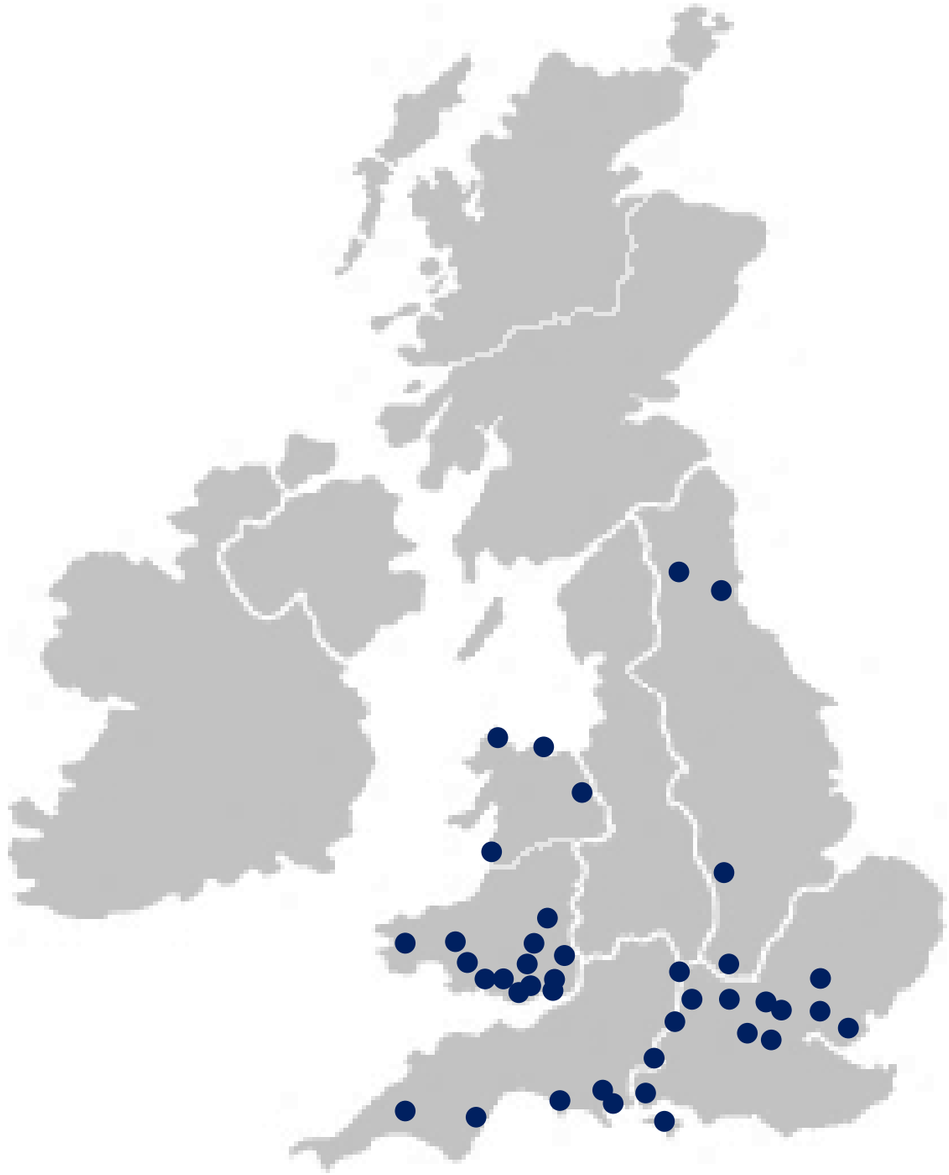
Large-scale observational prospective cohort study of a multi-cancer early detection (MCED) test in symptomatic patients referred for cancer investigation.

SYMPLIFY

Dr Brian D Nicholson, Associate Professor
Nuffield Department of Primary Care Health Sciences, University of Oxford, UK.

SYMPLIFY Study Design

- **Prospective observational cohort study**
- **44 hospital centres in England and Wales**
- **6,240 patients in 5 months**
- **Symptomatic patients referred to one of five Cancer Pathways by their Family Doctor**
- **Each participant consented to:**
  - **An additional blood draw**
  - **Follow-up in NHS records and registries**



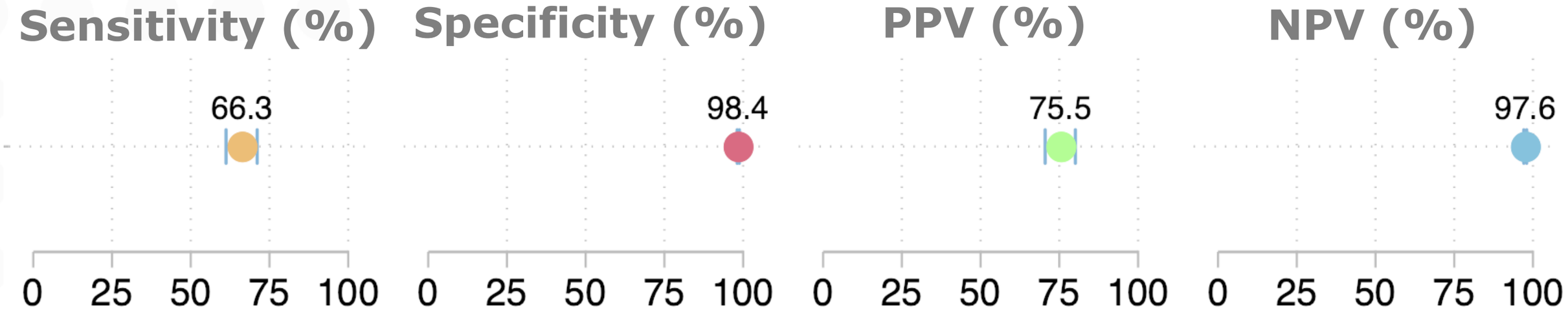
NHS, National Health Service.

Dr Brian D Nicholson MRCGP DPhil

Primary Objective: To evaluate the performance of a MCED test for the detection of invasive cancer.

323
Cases for which MCED test detected a cancer signal

244
In whom cancer was diagnosed



MCED, multi-cancer early detection test; NPV, negative predictive value; PPV, positive predictive value.

Dr Brian D Nicholson MRCGP DPhil

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Re-thinking N staging

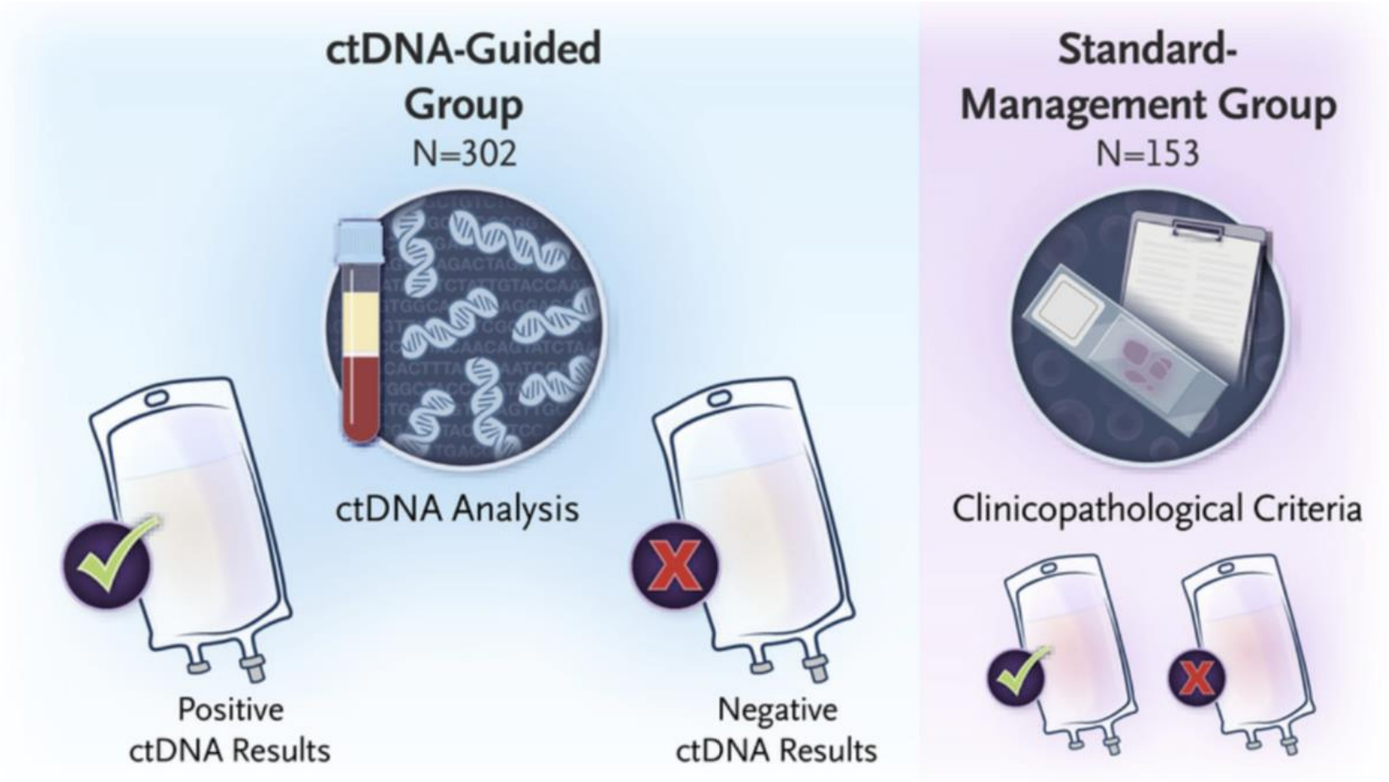
The NEW ENGLAND JOURNAL of MEDICINE

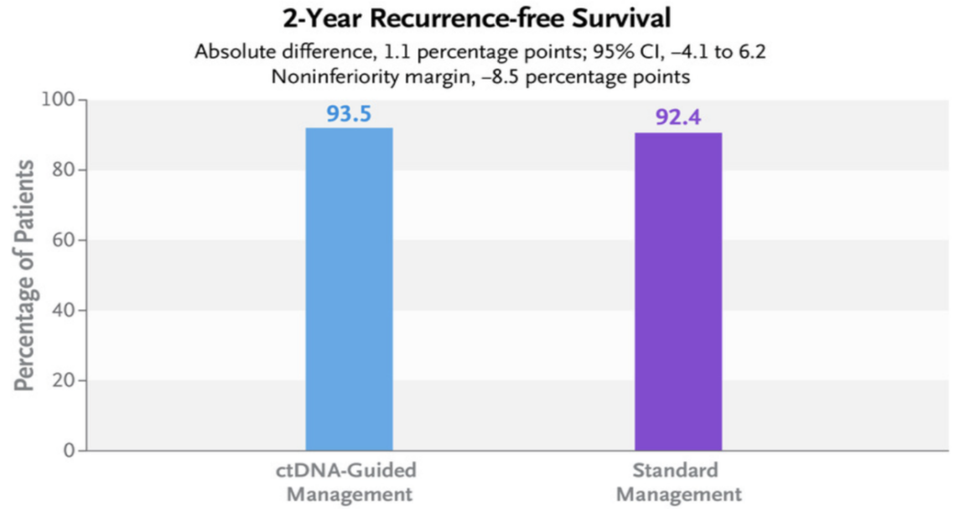
ESTABLISHED IN 1812 JUNE 16, 2022 VOL. 386 NO. 24

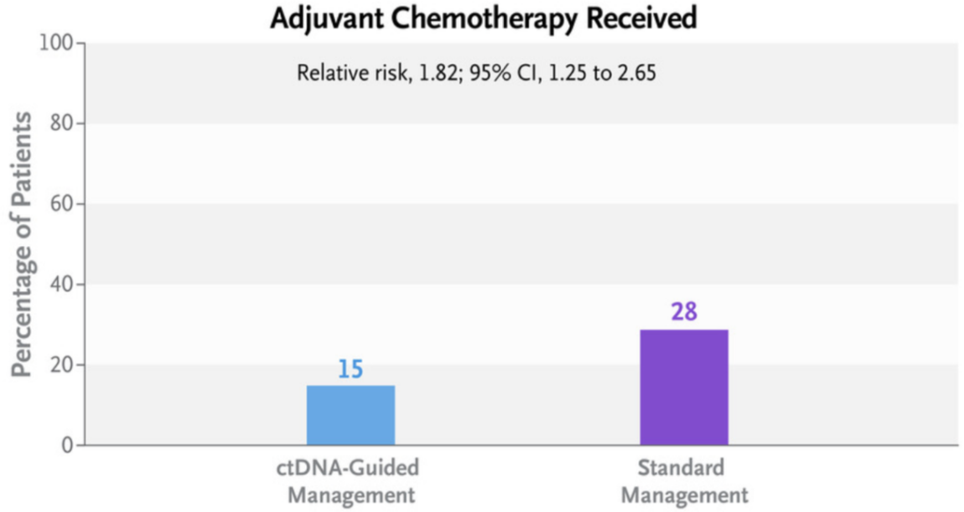
Circulating Tumor DNA Analysis Guiding Adjuvant Therapy in Stage II Colon Cancer

Jeanne Tie, M.D., Joshua D. Cohen, M.Phil., Kamel Lahouel, Ph.D., Serigne N. Lo, Ph.D., Yuxuan Wang, M.D., Ph.D., Suzanne Kosmider, M.B., B.S., Rachel Wong, M.B., B.S., Jeremy Shapiro, M.B., B.S., Margaret Lee, M.B., B.S., Sam Harris, M.B., B.S., Adnan Khattak, M.B., B.S., Matthew Burge, M.B., B.S., Marion Harris, M.B., B.S., James Lynam, M.B., B.S., Louise Nott, M.B., B.S., Fiona Day, Ph.D., Theresa Hayes, M.B., B.S., Sue-Anne McLachlan, M.B., B.S., Belinda Lee, M.B., B.S., Janine Ptak, M.S., Natalie Silliman, B.S., Lisa Dobbyn, B.A., Maria Popoli, M.S., Ralph Hruban, M.D., Anne Marie Lennon, M.D., Ph.D., Nicholas Papadopoulos, Ph.D., Kenneth W. Kinzler, Ph.D., Bert Vogelstein, M.D., Cristian Tomasetti, Ph.D., and Peter Gibbs, M.D., for the DYNAMIC Investigators*

ctDNA guides treatment in colorectal cancer







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ASCO Breakthrough

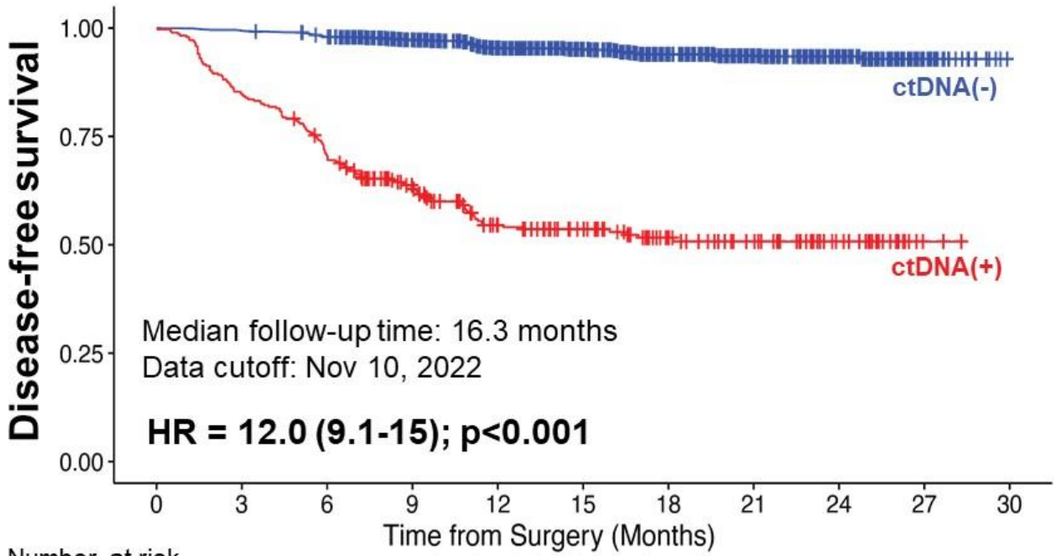
Postoperative circulating tumor DNA-based molecular residual disease in patients with *BRAF* ^{V600E} and MSI-H colorectal cancer: Updated results from GALAXY study in the CIRCULATE-Japan

Jun Watanabe[1], Eiji Oki[2], Daisuke Kotani[3], Yoshiaki Nakamura[3], Saori Mishima[3], Hideaki Bando[4], Hiroki Yukami[5], Koji Ando[6], Masaaki Miyo[7], Keiji Hirata[8], Naoya Akazawa[9], Kun-Huei Yeh[10], George Laliotis[11], Adham Jurdi[11], Minetta Liu[11], Hiroya Taniguchi[12], Ichiro Takemasa[7], Takeshi Kato[13], Masaki Mori[14], and Takayuki Yoshino[3]

[1]Gastroenterological Center, Yokohama City University Medical Center, Yokohama, Japan; [2]Department of Surgery And Science, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan; [3]Department of Gastroenterology and Gastrointestinal Oncology, National Cancer Center Hospital East, Kashiwa, Japan; [4]Translational Research Support Section, National Cancer Center Hospital East, Kashiwa, Japan; [5]Cancer Chemotherapy Center, Osaka Medical and Pharmaceutical University, Osaka, Japan; [6]Department of Colorectal Surgery, National Cancer Center Hospital East, Kashiwa, Japan, [7]Department of Surgery, Surgical Oncology and Science, Sapporo Medical University, Sapporo, Japan; [8]Department of Surgery, University of Occupational And Environmental Health, Japan; [9]Department of Gastroenterological Surgery, Sendai Open Hospital, Japan; [10]National Taiwan University Hospital, Taipei, Taiwan; [11]Natera, Inc., Austin, Texas, USA; [12]Department of Clinical Oncology, Aichi Cancer Center Hospital, Japan; [13]Department of Colorectal Surgery, National Hospital Organization Osaka National Hospital,Japan; [14]Tokai University Hospital, Tokai University School of Medicine, Japan

DFS by post-op-4w ctDNA status and ctDNA dynamics from post-op-4w to 12w in overall population (pStage II-IV)

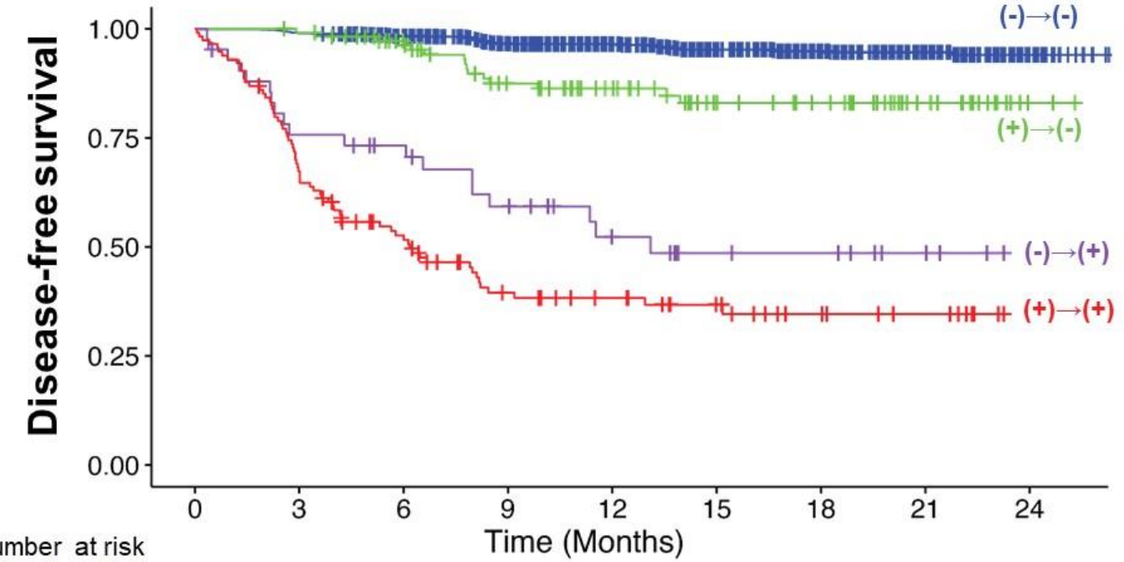
ctDNA status at 4-weeks MRD time point



Number at risk											
ctDNA (-)	1797	1786	1756	1568	1323	1054	731	502	231	37	0
ctDNA (+)	286	242	200	158	113	93	62	49	27	2	0

Dynamics	ctDNA Negative	ctDNA Positive
Events (n)	96/1797 (5.3%)	130/286 (45.5%)
18M-DFS	93.9 (92.5-95)	51.6 (45.2-57.6)
HR	**Reference**	**12.0**
95% CI	Not applicable	9.1 - 15
P	Not applicable	<0.001

ctDNA Dynamics from 4 weeks to 12 weeks



Number at risk									
Persistently Negative	1529	1524	1508	1391	1176	938	648	439	204
Converted Negative	112	111	109	95	74	60	42	36	19
Converted Positive	43	42	31	27	21	14	9	8	4
Persistently Positive	124	114	76	52	33	27	18	11	7

Dynamics	Persistently Negative	Converted Negative	Converted Positive	Persistently Positive
Events (n)	69/1529 (4.5%)	16/112 (14.3%)	20/43 (46.5%)	78/124 (62.9%)
18M-DFS	94.9 (93.5-96)	82.2 (72.3-88.9)	47.4 (30.4-62.7)	33.8 (25-42.8)
HR	**Reference**	**3.5**	**14.5**	**25.4**
95% CI	Not applicable	1.9 - 5.8	8.8 - 23.8	18.3 - 35.3
P	Not applicable	<0.001	<0.001	<0.001

Galaxy

- ***VEGA***
  - High risk Stage 2 & Low risk Stage 3 colon cancer patients
  - ctDNA negative post-op week 4
  - Randomize to adjuvant chemotherapy vs observation
- ***ALTAIR***
  - No clinical signs of cancer post-op
  - ctDNA detected any time after surgery
  - Randomize to chemotherapy (trifluridine/tipiracil) versus observation

Synoptic Report

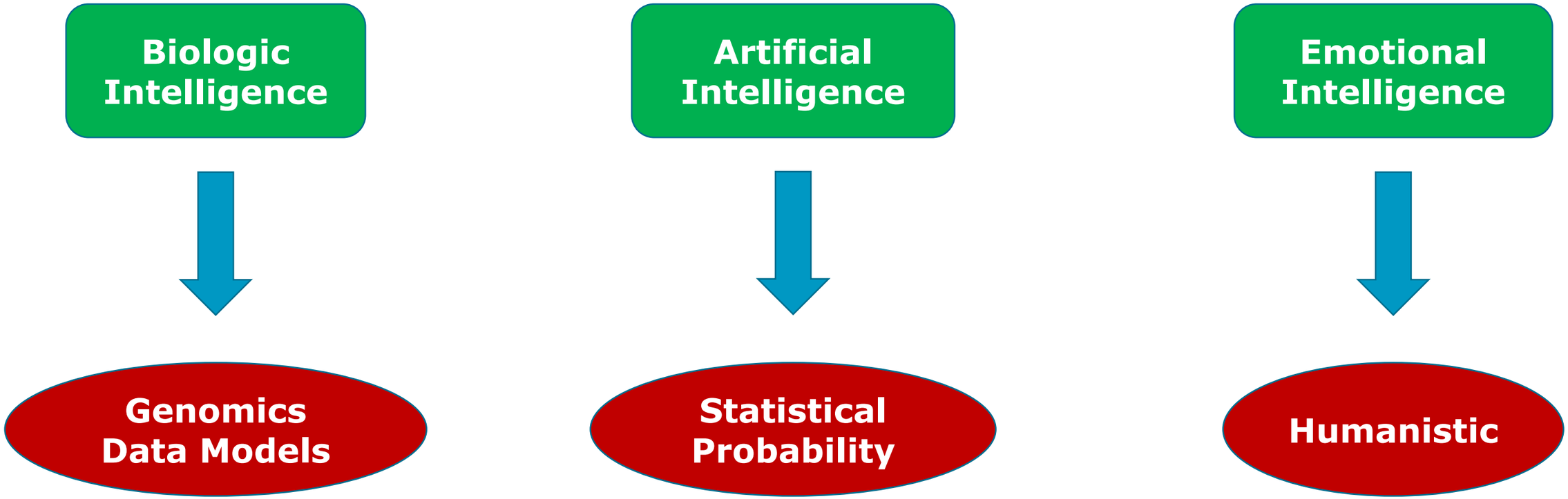
Synoptic Report:
Specimen
    Specimen: Terminal ileum and Right colon
Procedure: Extended right colectomy
Tumor
    Tumor Site: Transverse colon - Per op note
Histologic Type: Mucinous adenocarcinoma
Histologic Grade: G2, moderately differentiated
Tumor Size: 3.8 Centimeters (cm)
Tumor Extent: Invades through muscularis propria into the pericolonic or perirectal tissue
Macroscopic Tumor Perforation: Not identified
Lymphovascular Invasion: Not identified
Perineural Invasion: Not identified
Number of Tumor Buds: 1 per 'hotspot' field
Tumor Bud Score: Low (0-4)
Treatment Effect: No known presurgical therapy
Margins
    Margin Status for Invasive Carcinoma: All margins negative for invasive carcinoma
Margin Status for Non-Invasive Tumor: All margins negative for high-grade dysplasia / intramucosal carcinoma and low-grade dysplasia
Regional Lymph Nodes
    Regional Lymph Node Status: Tumor present in regional lymph node(s)
    Number of Lymph Nodes with Tumor: 4
    Number of Lymph Nodes Examined: 47
Tumor Deposits: Not identified
Pathologic Stage Classification (pTNM, AJCC 8th Edition)
    pT Category: pT3
pN Category: pN2a
AJCC Prognostic Stage: IIIB

CAP eCC 2022 Q2 Release

ChatGPT 4 200 words at 8th grade level

- This report is about a specimen from a surgery to remove part of the large intestine. The tumor found was a type of cancer called mucinous adenocarcinoma. It was moderately differentiated, which means it wasn't too advanced. The tumor was about 3.8 centimeters big and had spread into nearby tissue. *There were no signs of the tumor breaking through the outer layer of the intestine* or spreading through blood or nerves.
- The surgical margins around the tumor were clear of cancer cells, both for invasive cancer and non-invasive changes. However, cancer was found in some of the nearby lymph nodes. Among the 47 lymph nodes examined, 4 had cancer. The cancer hadn't spread to distant areas.
- The cancer's stage was determined based on its size, spread to lymph nodes, and other factors. *It was classified as stage IIIB*, which indicates it had advanced a bit but hadn't spread to distant parts of the body. This information helps doctors understand the cancer's severity and plan further treatment if needed. The report is from a specific medical release, the CAP eCC 2022 Q2 Release.

Clinical Intelligence



The Future of Cancer Data:
Unlocking Insights With Pathology Reporting Summit

October 6, 2023