دانشگاه علوم پزشکی و خدمات بهداشتی، درمانی ایران

Oncology and Artificial Intelligence

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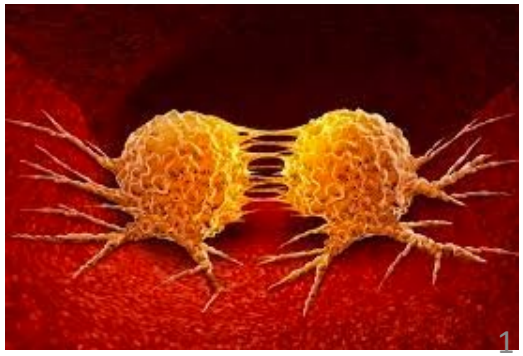
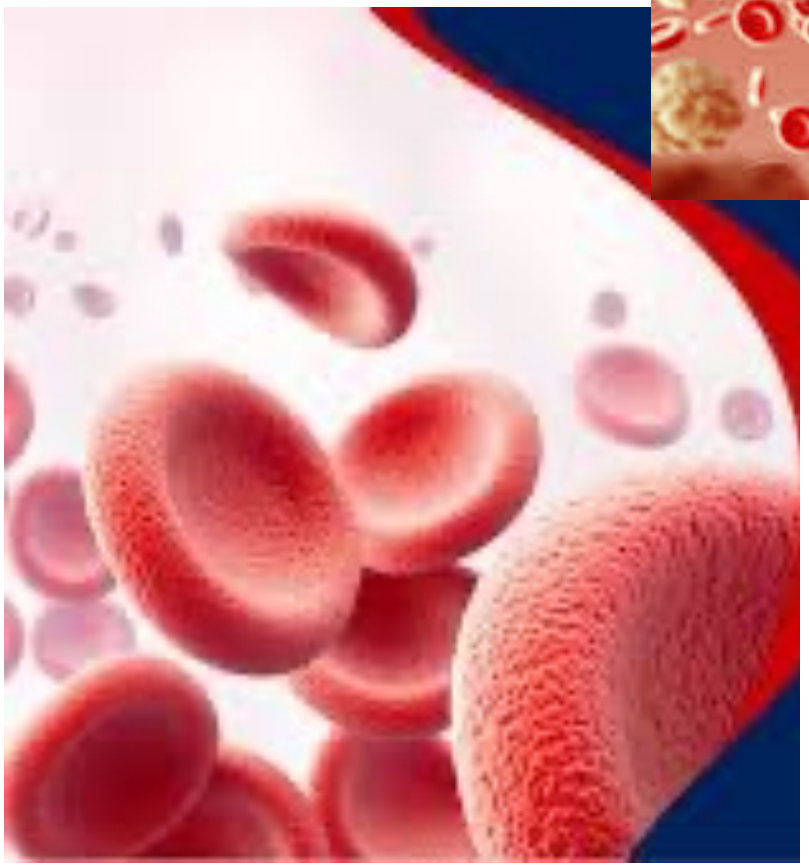
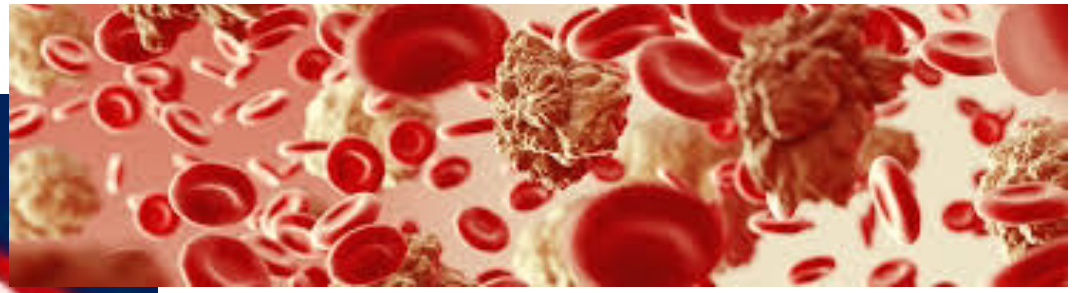
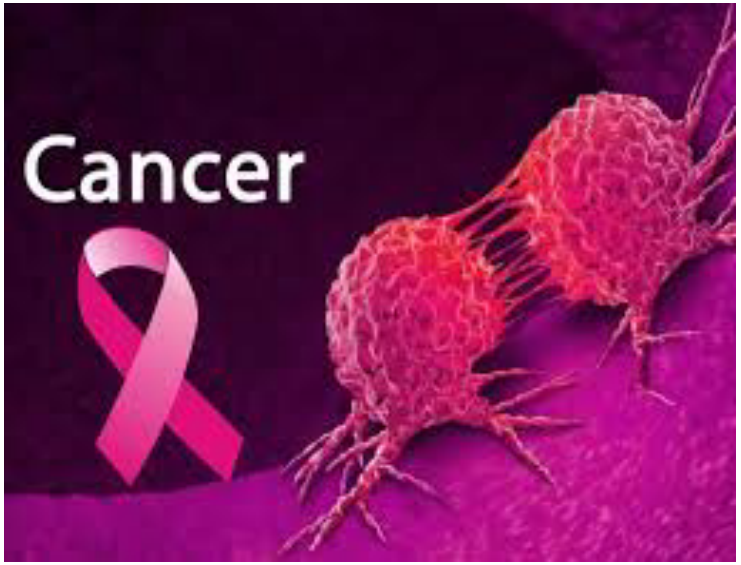


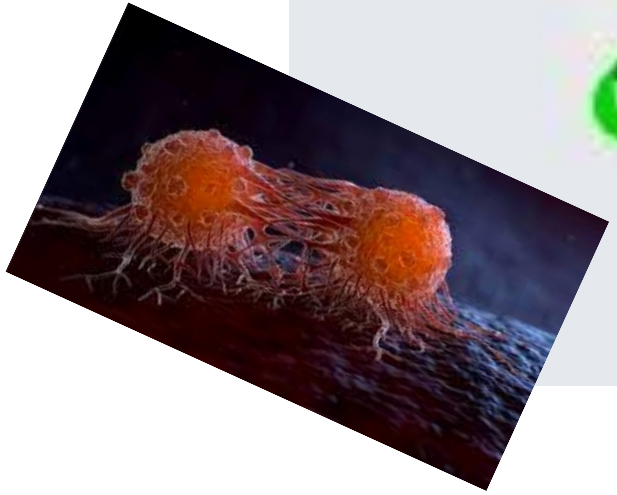
Cancer



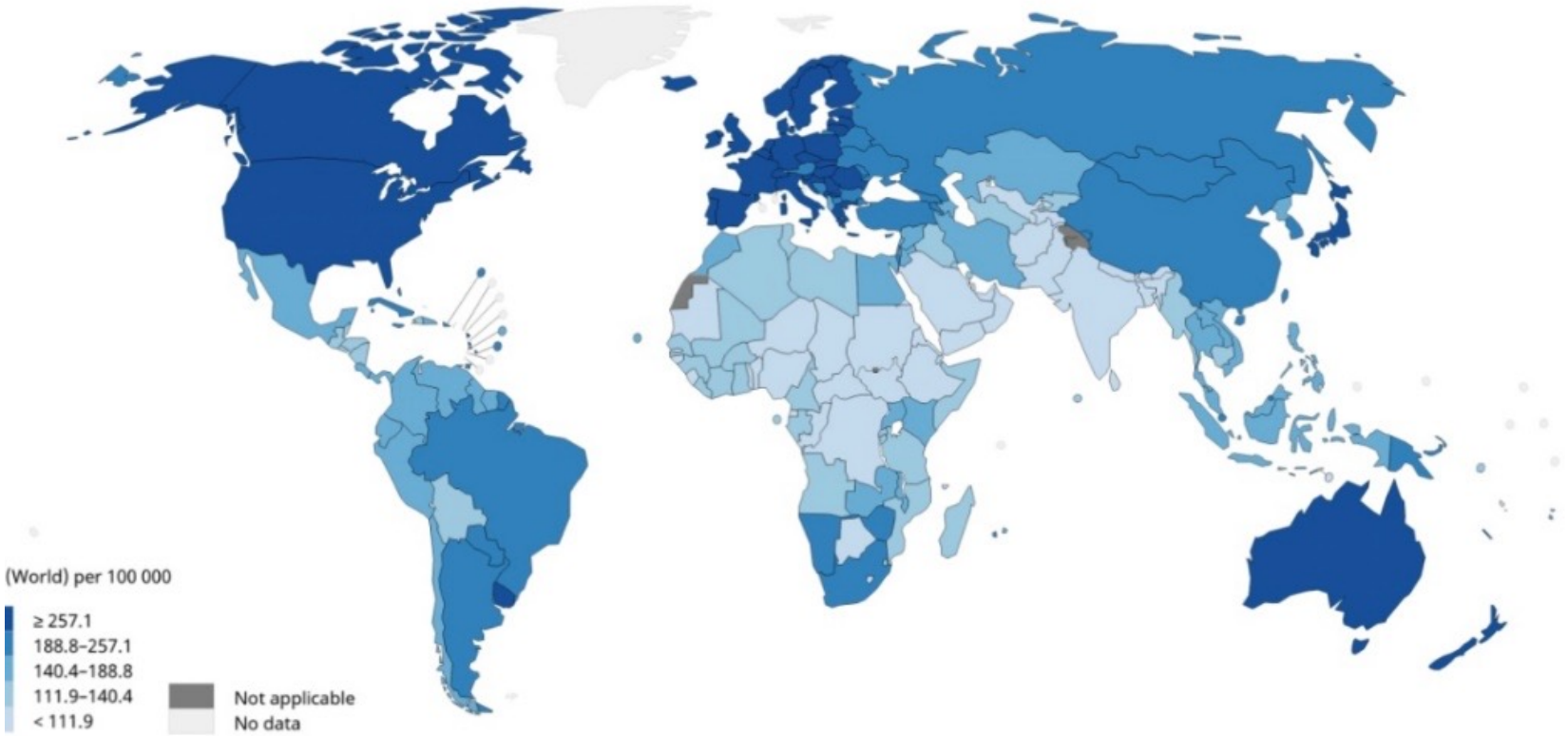




Different types of cancer



Estimated age-standardized incidence rates (World) in 2020, all cancers, both sexes, all ages



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ı part of the World Health Organization / International Agency for Research on Cancer concerning the legal status of any country, territory, city or area
ts authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate borderlines for
there may not yet be full agreement.

Data source: GLOBOCAN 2020
Graph production: IARC
(http://gco.iarc.fr/today)
World Health Organization

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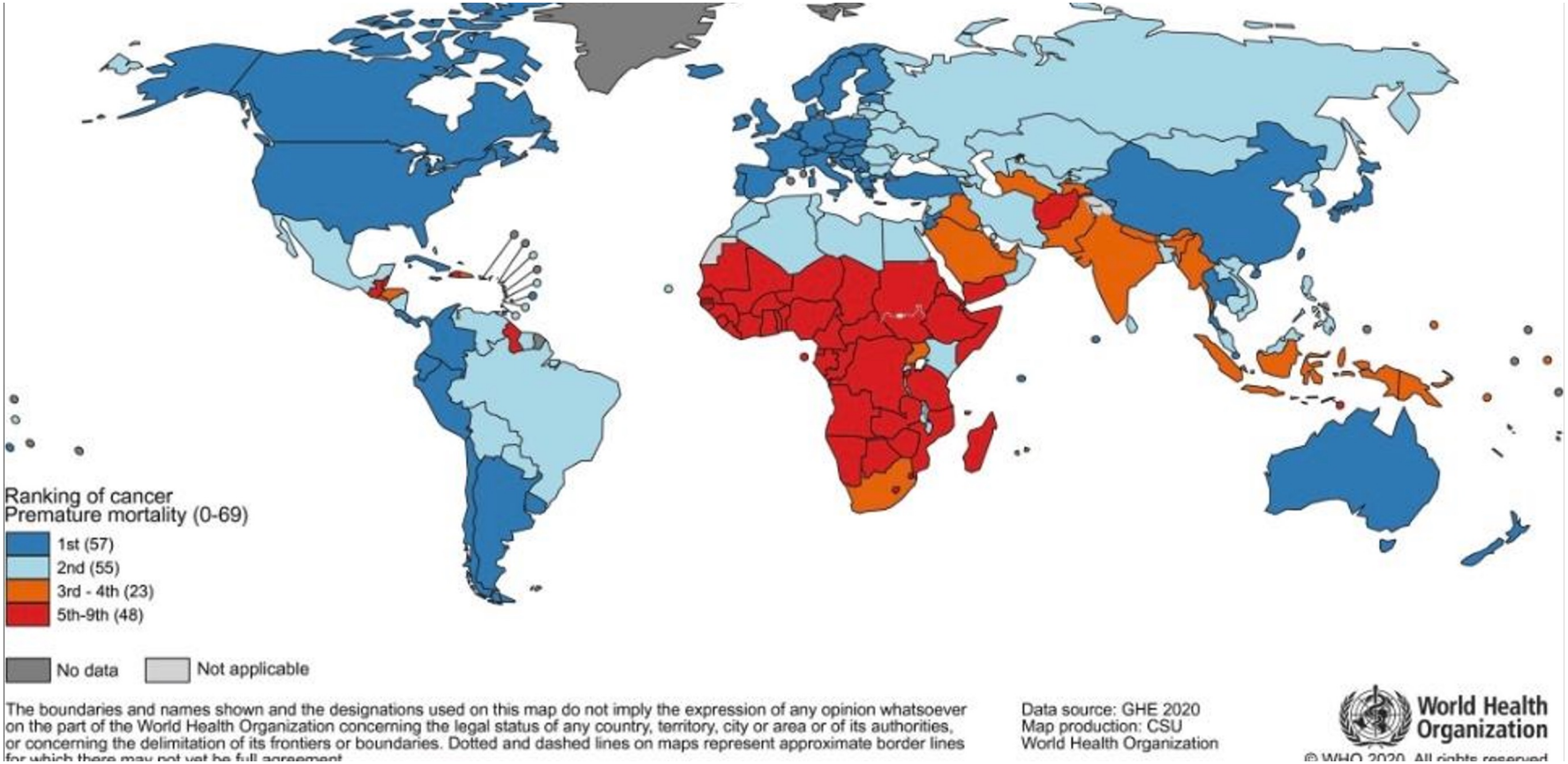
Research on Canc


Ranking of cancer
Premature mortality (0-69)
1st (57)
2nd (55)
3rd - 4th (23)
5th-9th (48)
No data
Not applicable
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.
Data source: GHE 2020
Map production: CSU
World Health Organization
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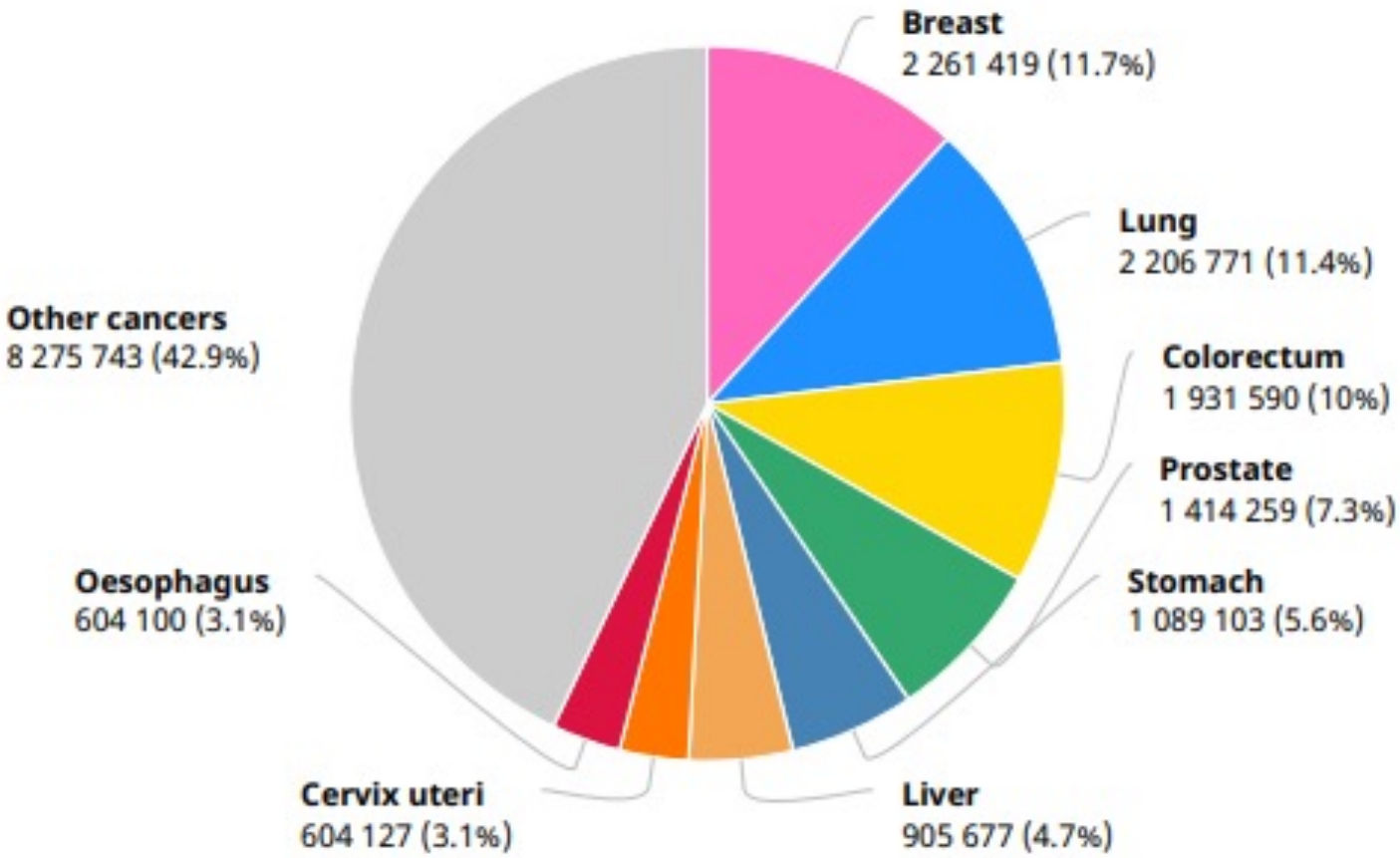
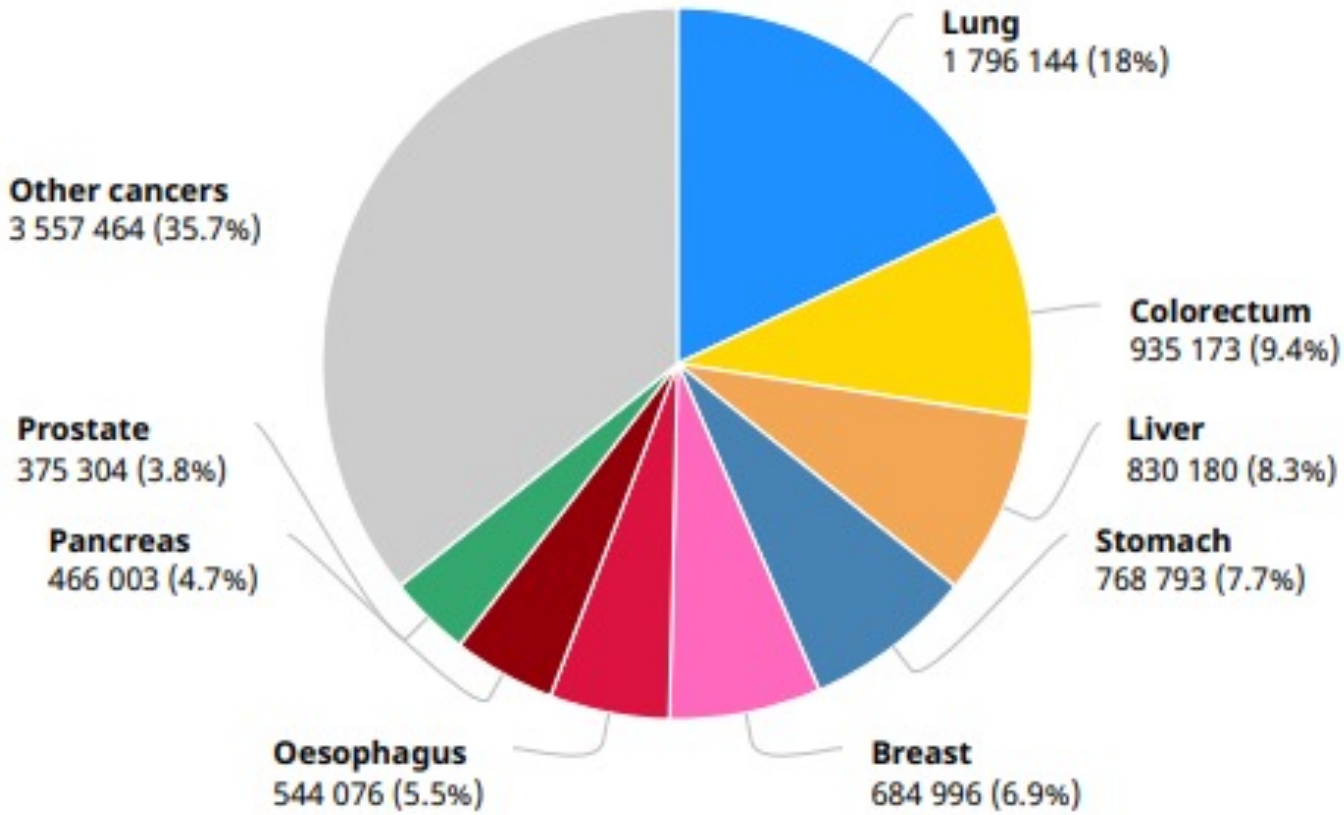
Number of new cases in 2020, both sexes, all ages



Total: 19 292 789 cases

Number of deaths in 2020, both sexes, all ages



Total: 9 958 133 deaths

Numbers at a glance

Total population

83 992 953

Number of new cases

131 191

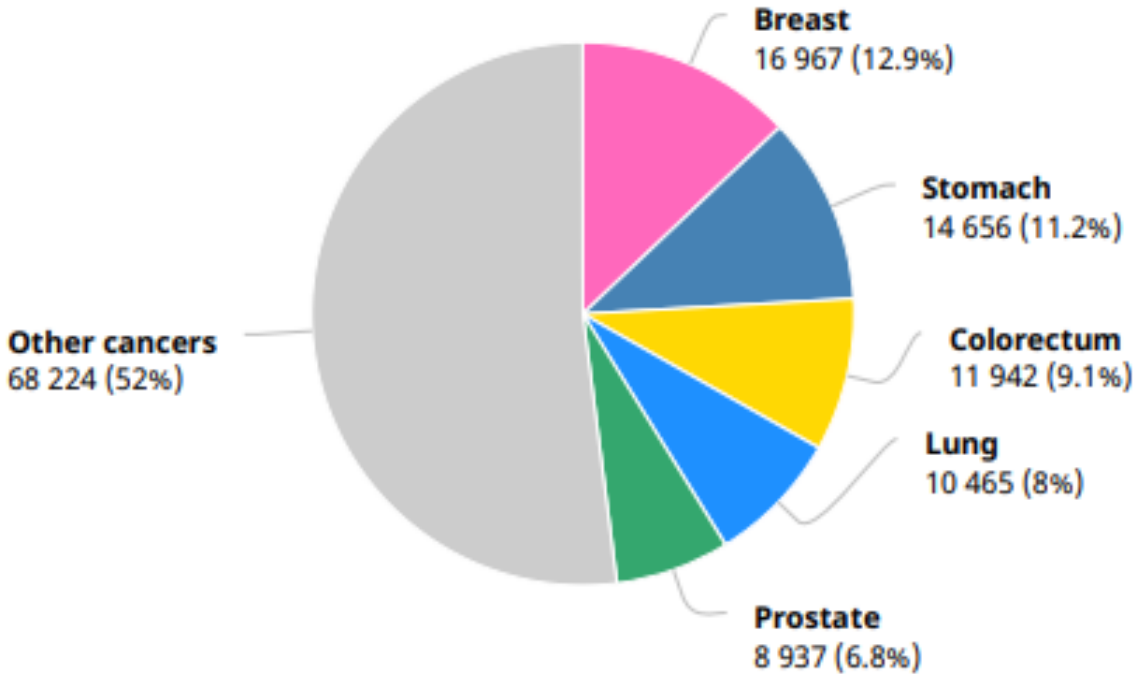
Number of deaths

79 136

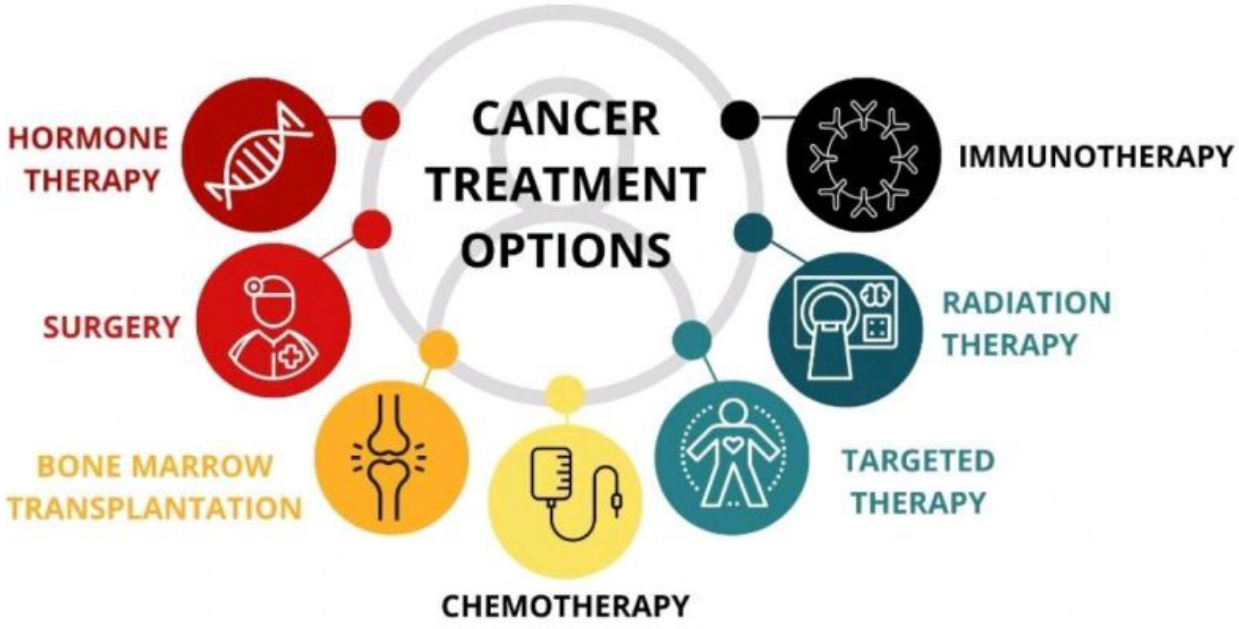
Number of prevalent cases (5-year)

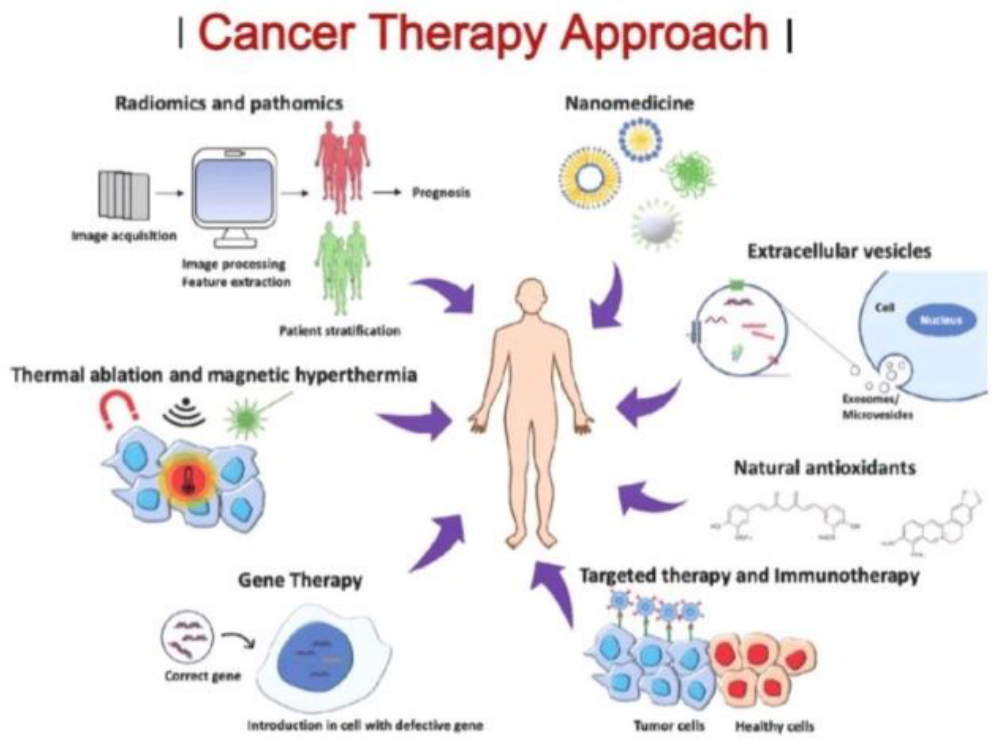
319 740

Number of new cases in 2020, both sexes, all ages

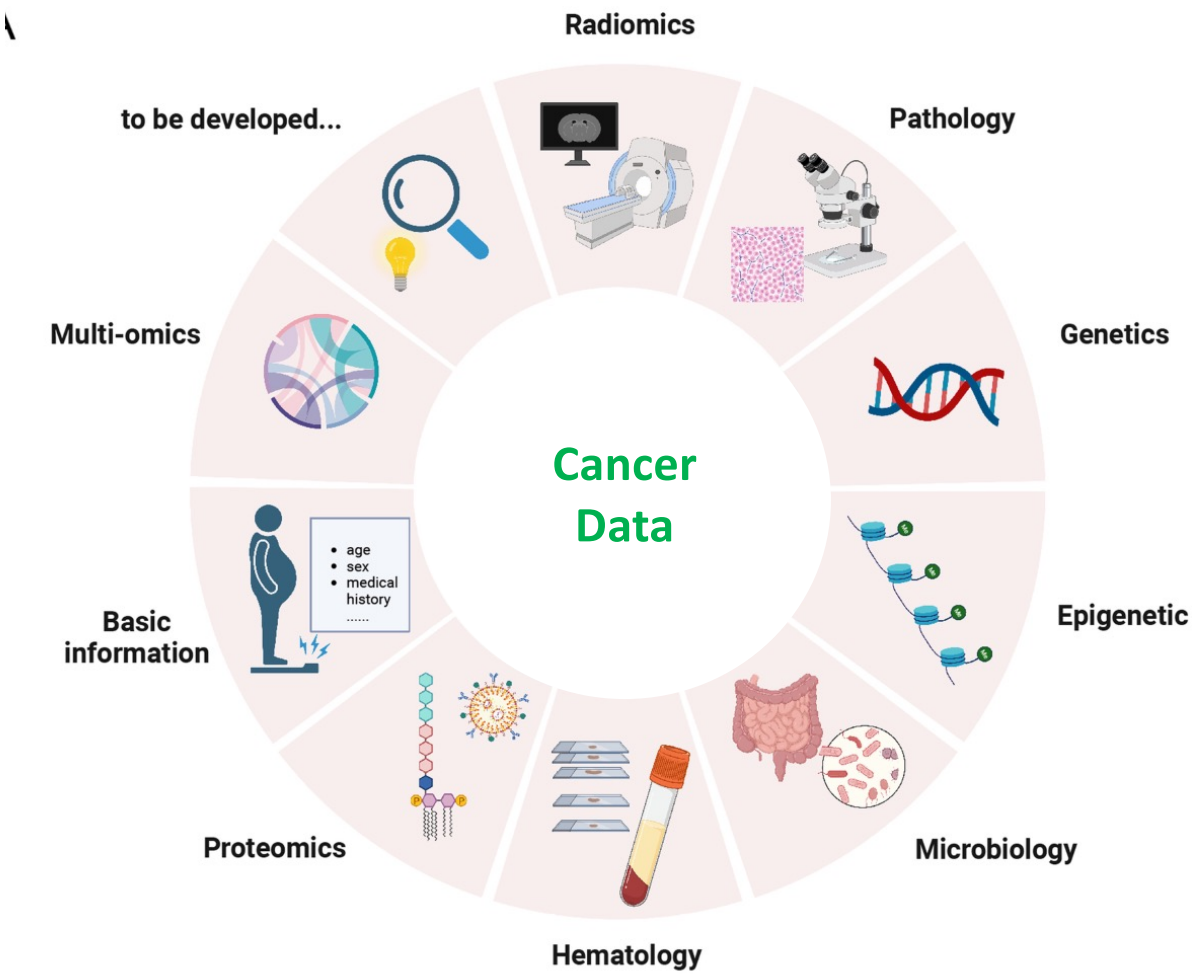


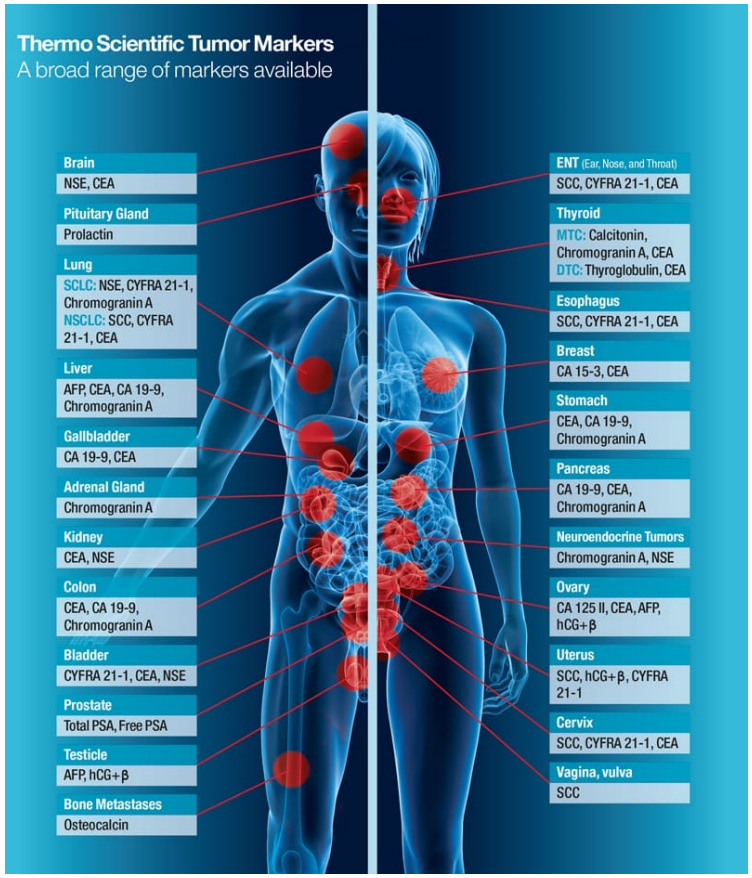
Total: 131 191


CANCER TREATMENT OPTIONS
HORMONE THERAPY
IMMUNOTHERAPY
SURGERY
RADIATION THERAPY
BONE MARROW TRANSPLANTATION
TARGETED THERAPY
CHEMOTHERAPY


| Cancer Therapy Approach |
Radiomics and pathomics
Image acquisition
Image processing
Feature extraction
Prognosis
Patient stratification
Nanomedicine
Extracellular vesicles
Cell
Nucleus
Exosomes/
Microvesicles
Thermal ablation and magnetic hyperthermia
Natural antioxidants
Gene Therapy
Correct gene
Introduction in cell with defective gene
Targeted therapy and Immunotherapy
Tumor cells
Healthy cells

Different Cancers have Different Biomarkers





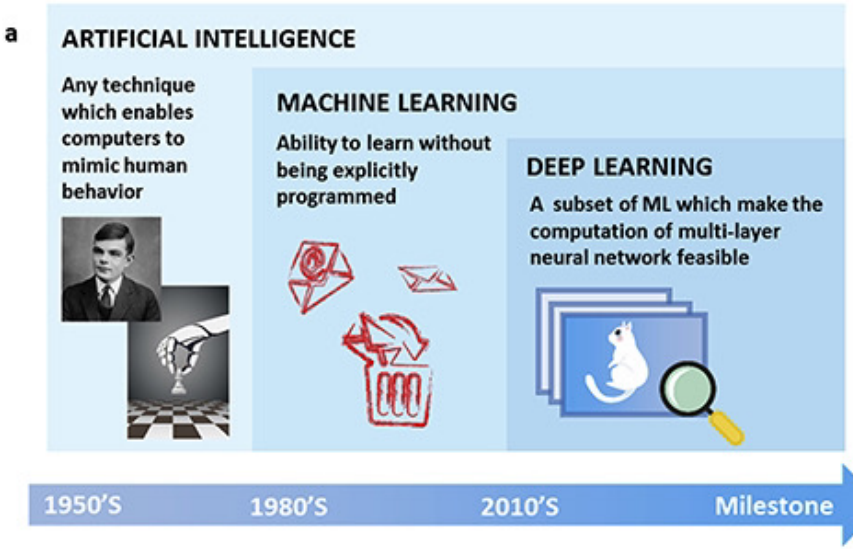
What is Intelligent Oncology?

A branch of science that deals with tumors and cancers.

Intelligent Oncology

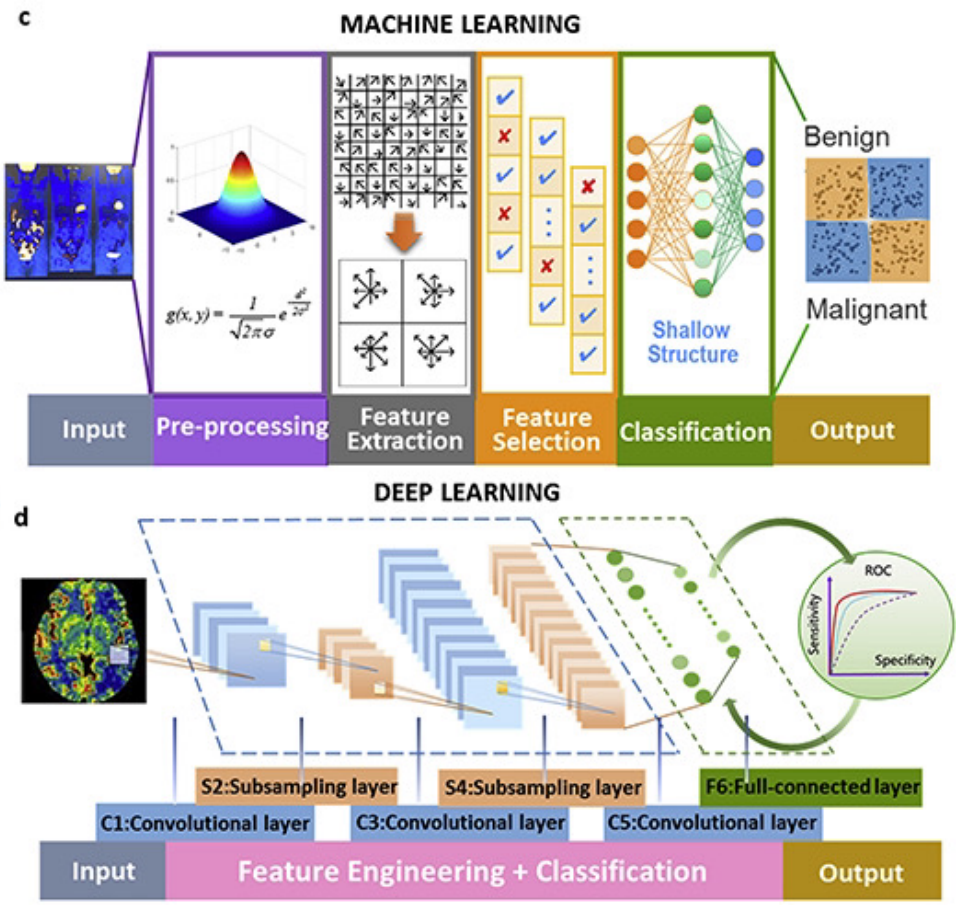
Fusion of Artificial Intelligence (AI) and Oncology in which the power of AI is used for precise diagnosis and treatment.

The concept of the Artificial Intelligence, Machine Learning, and Deep Learning

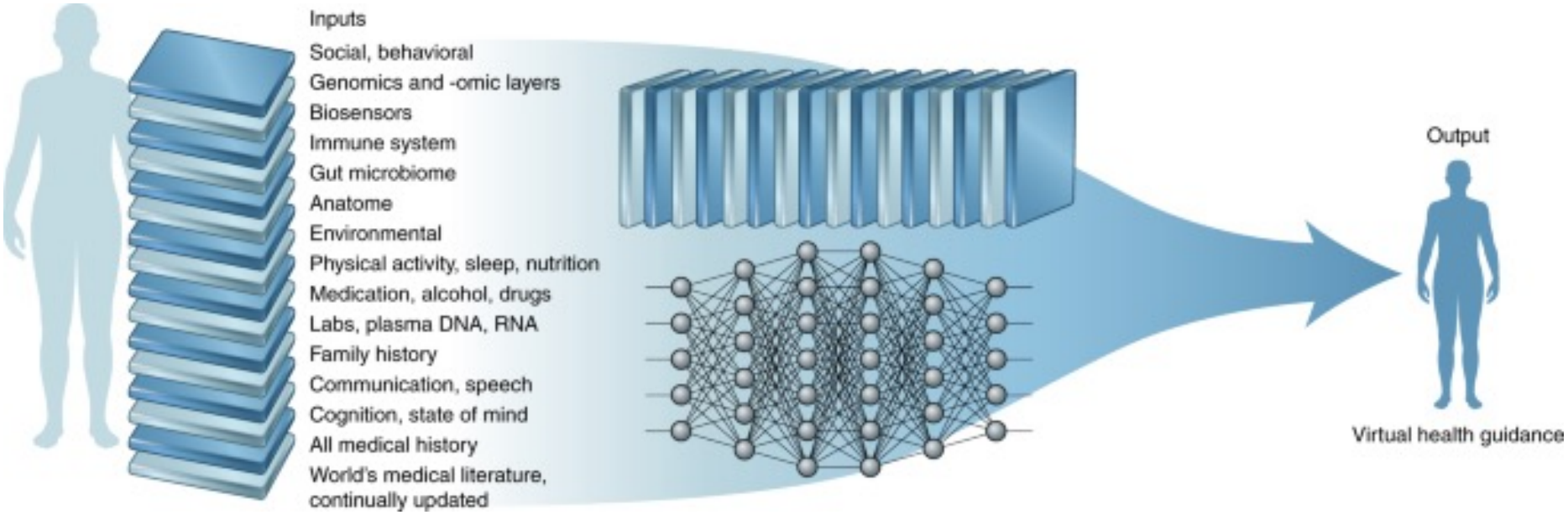


b

DIFFERENCE	MACHINE LEARNING	DEEP LEARNING
Data Dependencies	Excellent performances on a small/medium dataset	Excellent performance on a big dataset
Hardware Dependencies	Work on a low-end machine	Requires powerful machine, preferably with GPU
Feature Engineering	Need to understand the features that represent the data	No need to understand the best feature that represents the data
Execution Time	From few minutes to hours	Up to weeks
Interpretability	Some algorithms are easy to interpret	Difficult to impossible



AI=High-performance medicine



Nature Medicine **volume 25**, pages44–56 (2019)

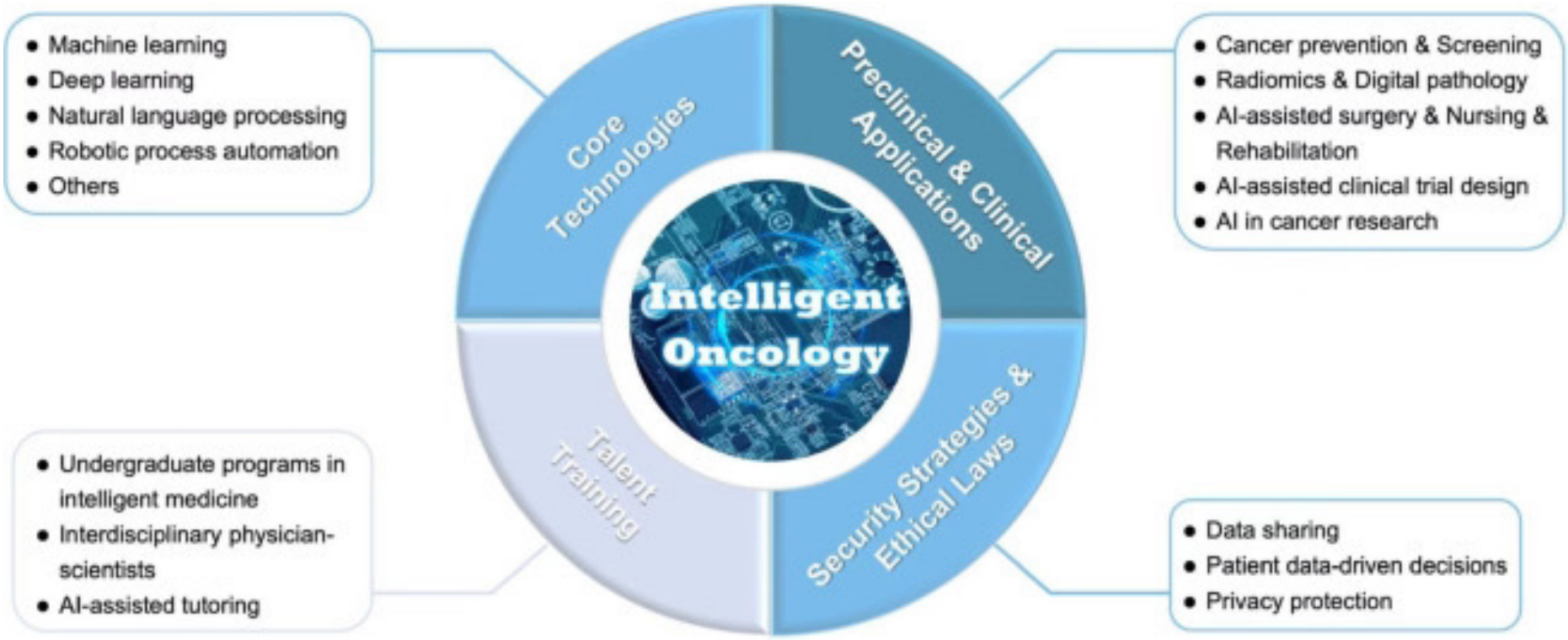
AI: A hope toward …

Early Detection

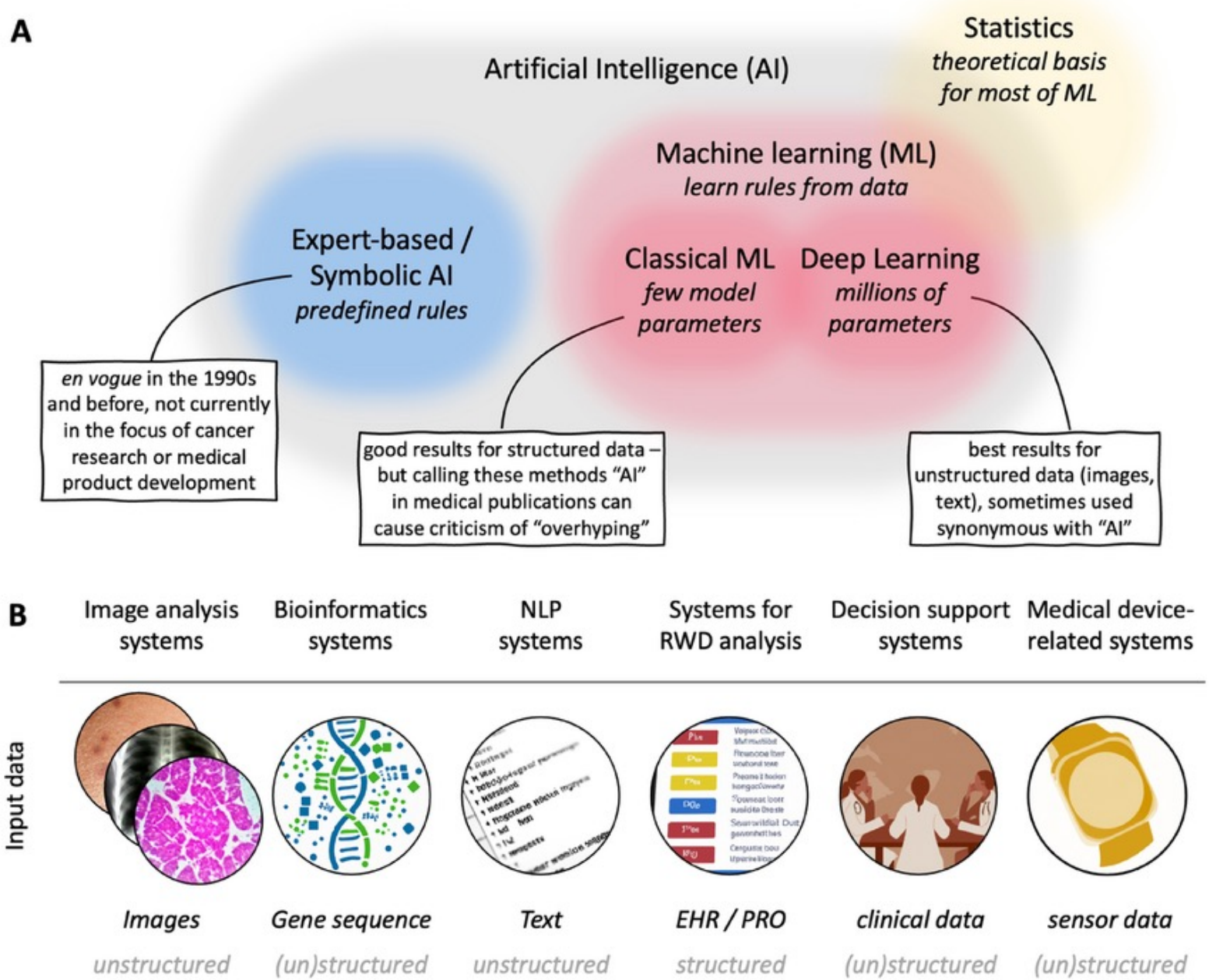
Personalized Treatment

Therapy and after-therapy Monitoring

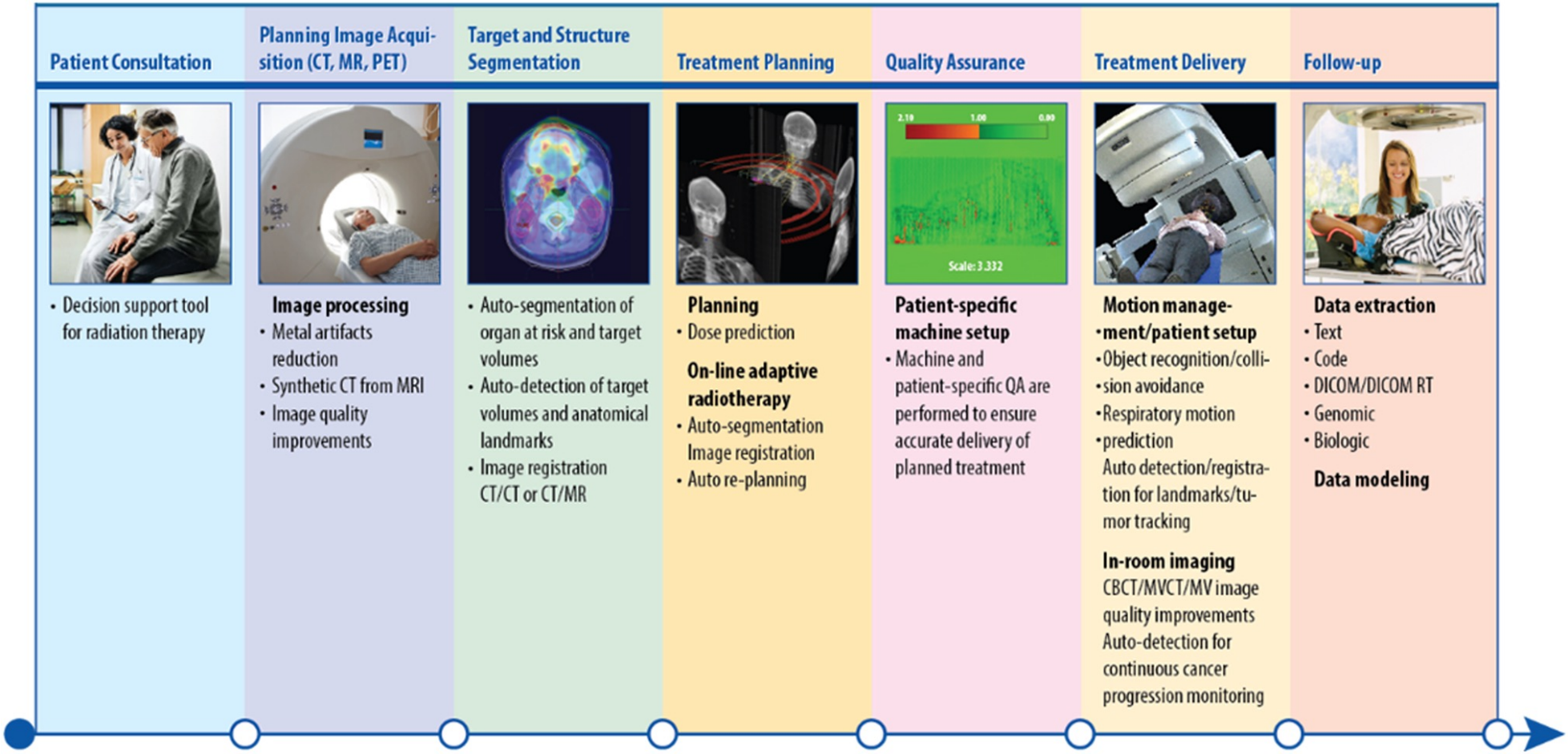
Intelligent Oncology



Journal of the National Cancer Center Volume 3, Issue 1, March 2023, Pages 83-91

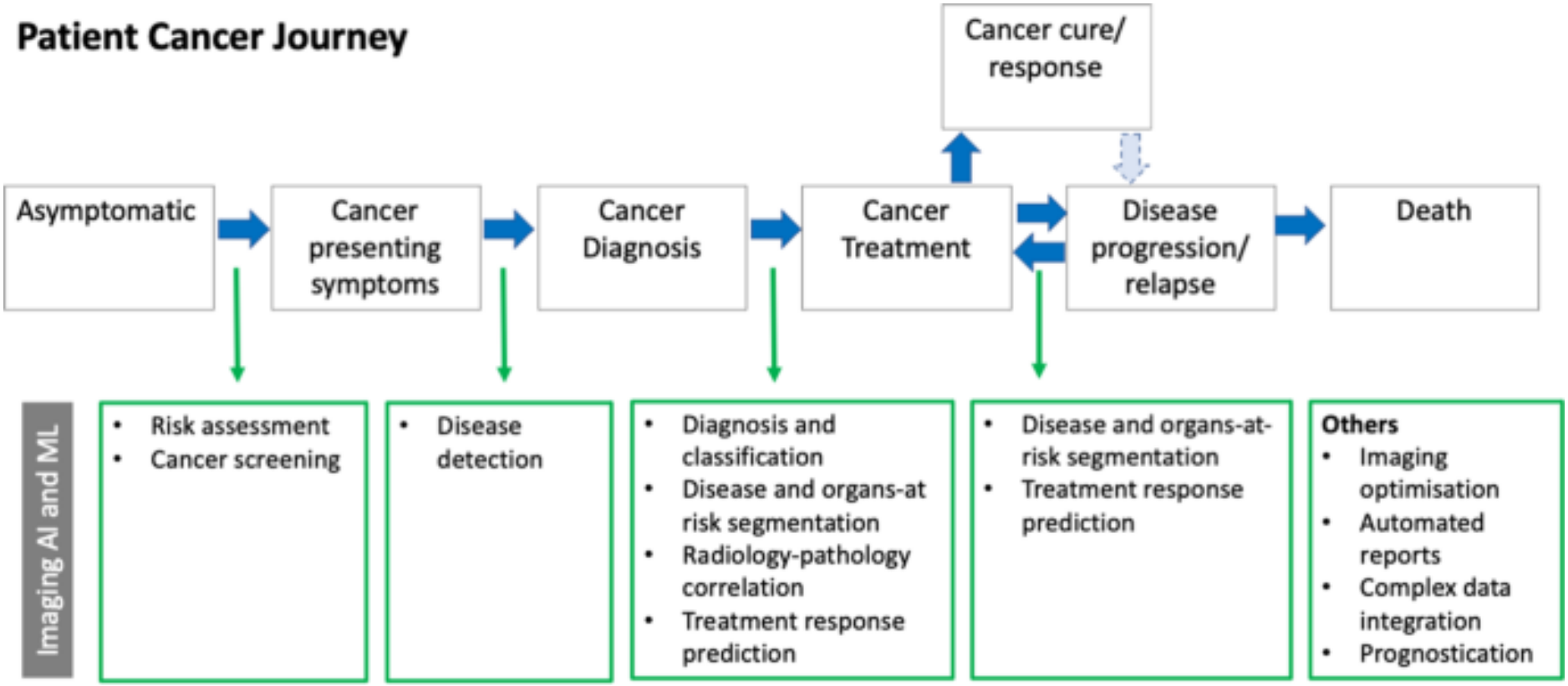

A
Artificial Intelligence (AI)
Statistics
theoretical basis for most of ML
Machine learning (ML)
learn rules from data
Expert-based / Symbolic AI
predefined rules
Classical ML
few model parameters
Deep Learning
millions of parameters
en vogue in the 1990s and before, not currently in the focus of cancer research or medical product development
good results for structured data – but calling these methods "AI" in medical publications can cause criticism of "overhyping"
best results for unstructured data (images, text), sometimes used synonymous with "AI"
B
Image analysis systems
Bioinformatics systems
NLP systems
Systems for RWD analysis
Decision support systems
Medical device-related systems
Input data
Images
unstructured
Gene sequence
(un)structured
Text
unstructured
EHR / PRO
structured
clinical data
(un)structured
sensor data
(un)structured

AI in Oncology



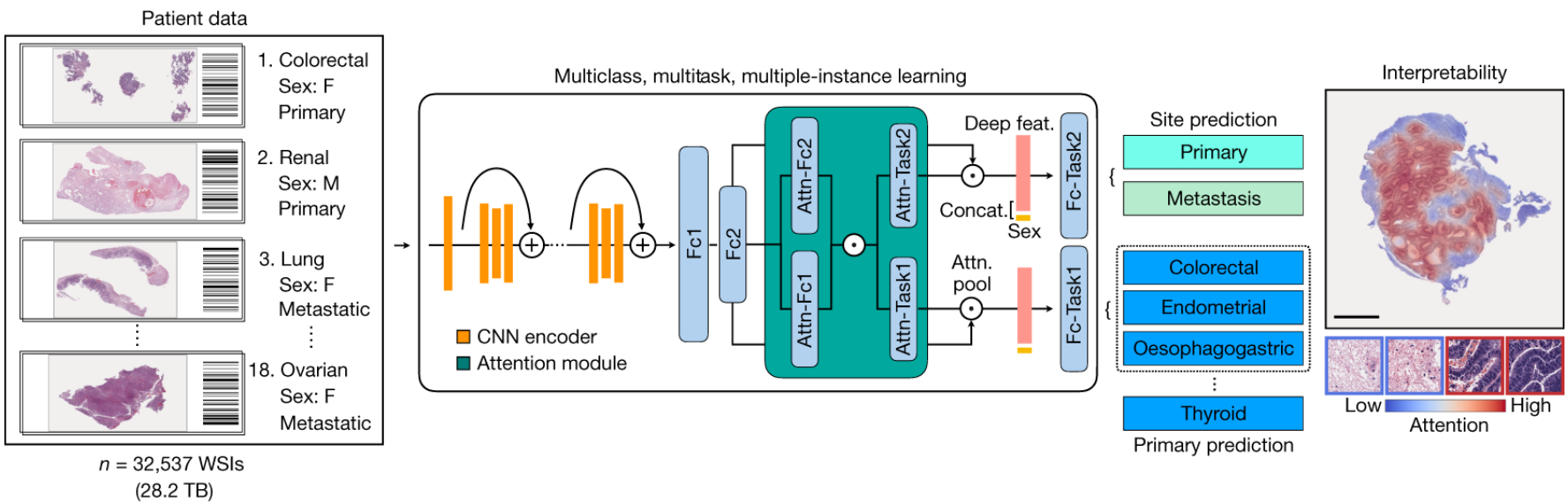
Oncogene **volume 42**, pages3089–3097 (2023)

AI in Oncology

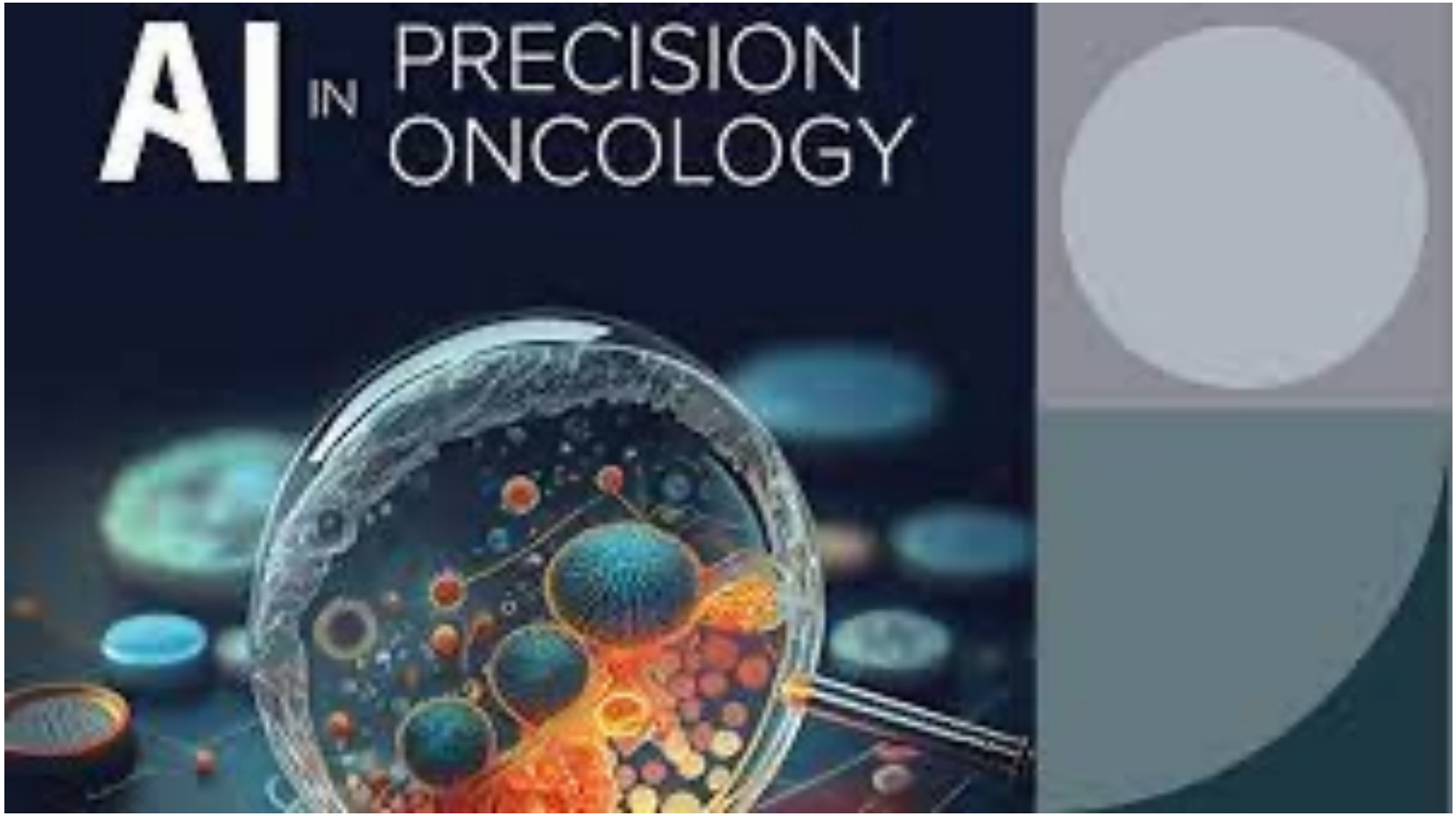


AI and Cancer Prevention

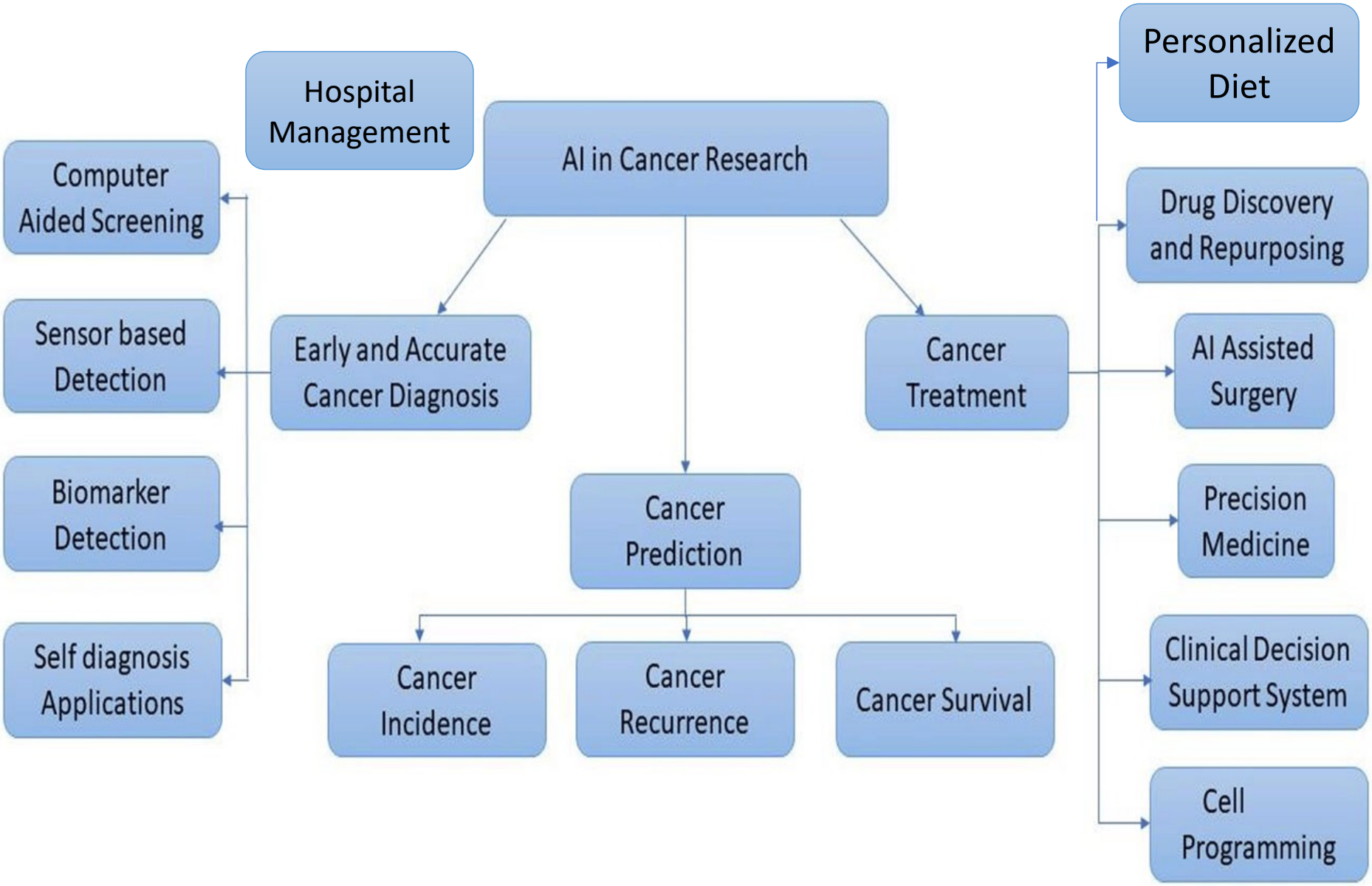
AI for detection origin of cancer

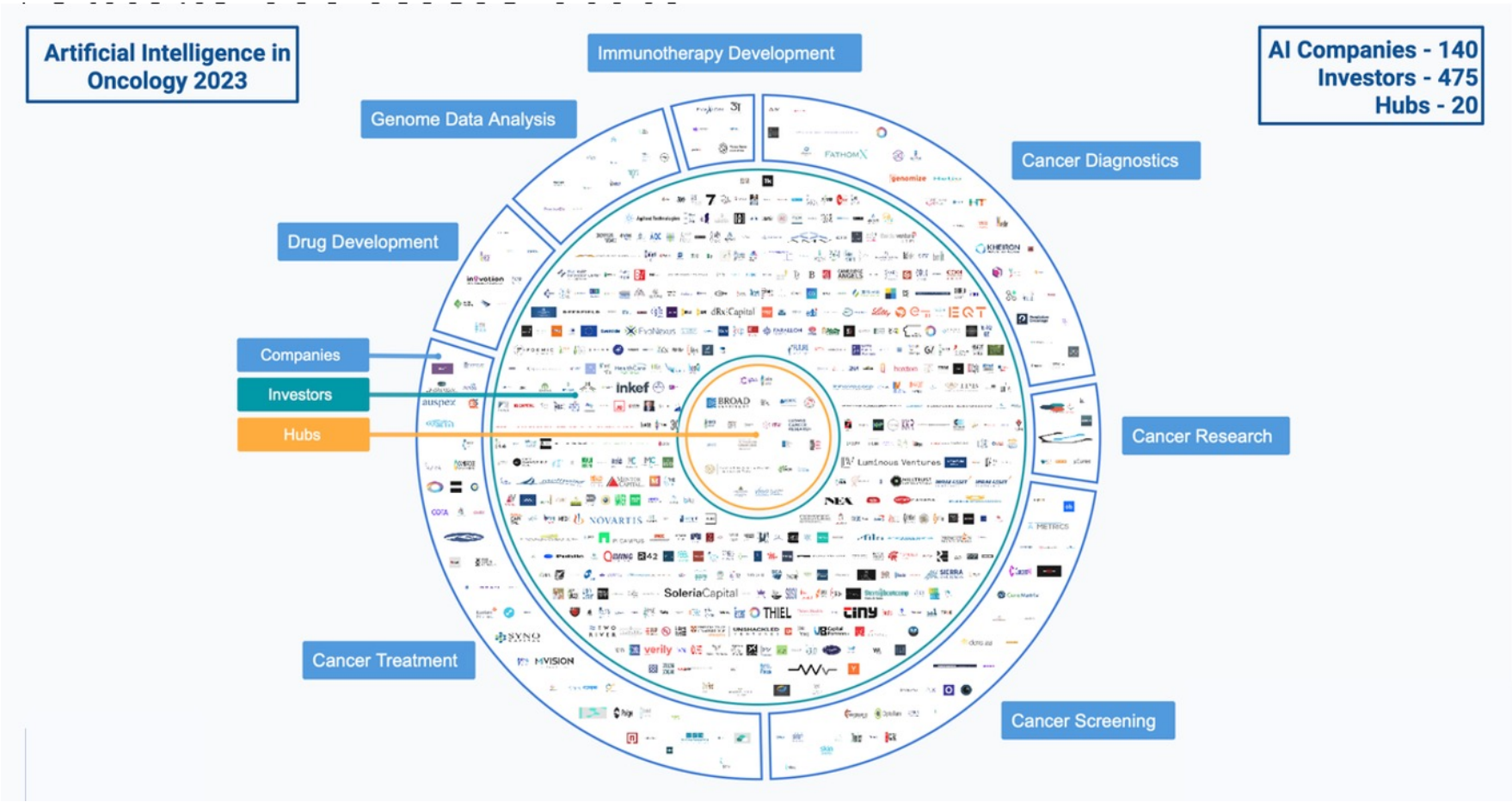


Nature **volume 594**, pages106–110 (2021)


AI IN PRECISION ONCOLOGY

Other AI Application in Cancer




Artificial Intelligence in Oncology 2023
AI Companies - 140
Investors - 475
Hubs - 20
Immunotherapy Development
Genome Data Analysis
Cancer Diagnostics
Drug Development
Companies
Investors
Hubs
Cancer Research
Cancer Treatment
Cancer Screening

THANK YOU FOR YOUR ATTENTION