# Intelligent oncology: Early detection, Targeted Therapy, Continuous Monitoring


**دکتر نسیبه رادی راز**

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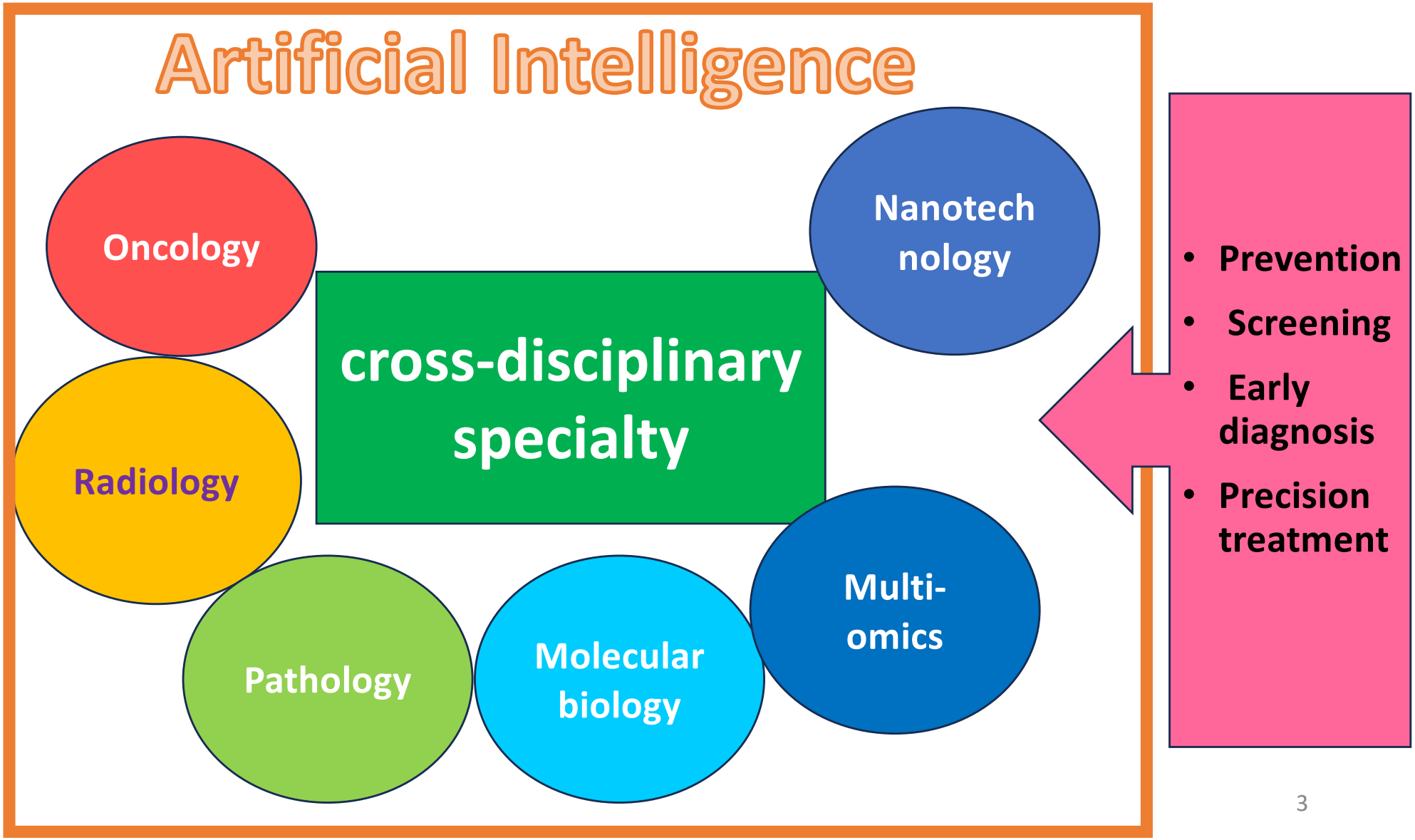
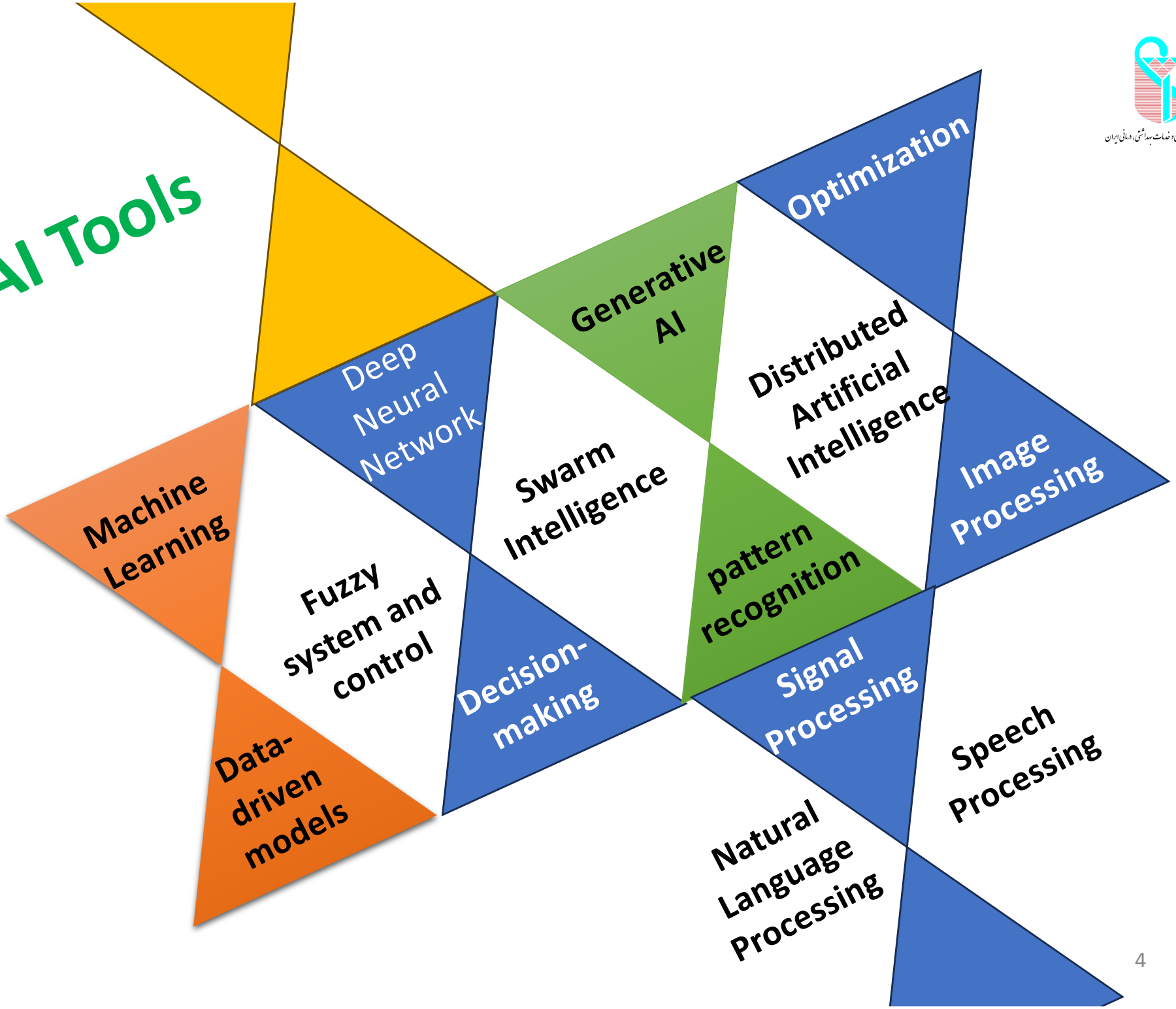
دانشگاه علوم پزشکی و خدمات بهداشتی، درمانی ایران

بسم الله الرحمن الرحیم

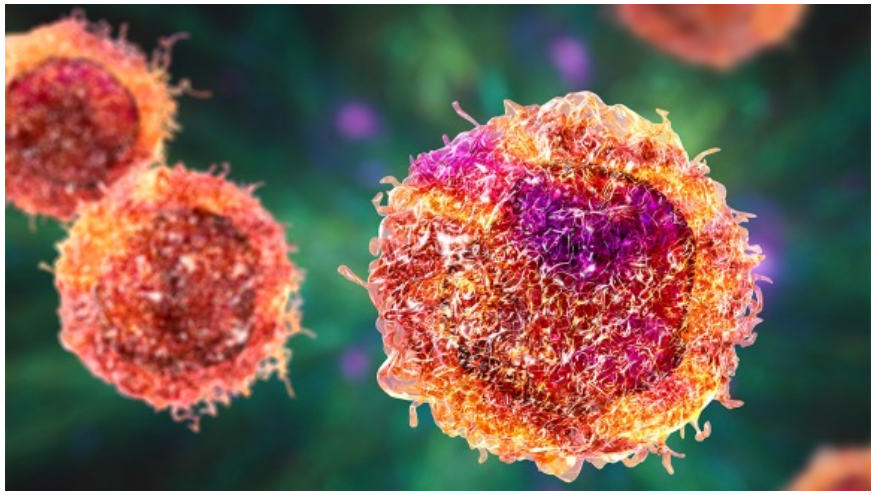
# Intelligent Oncology

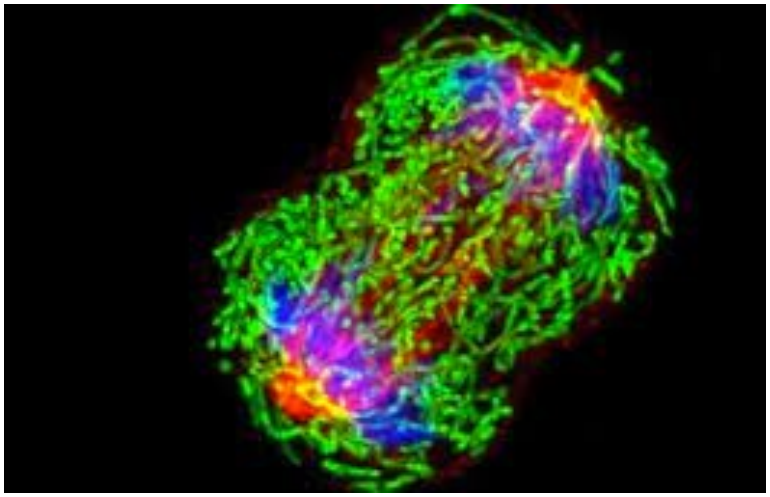


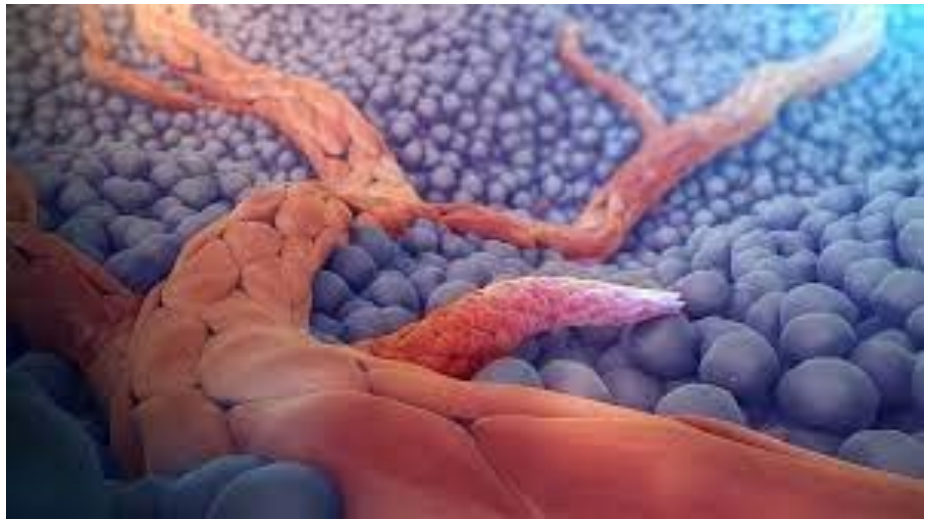
# AI Tools

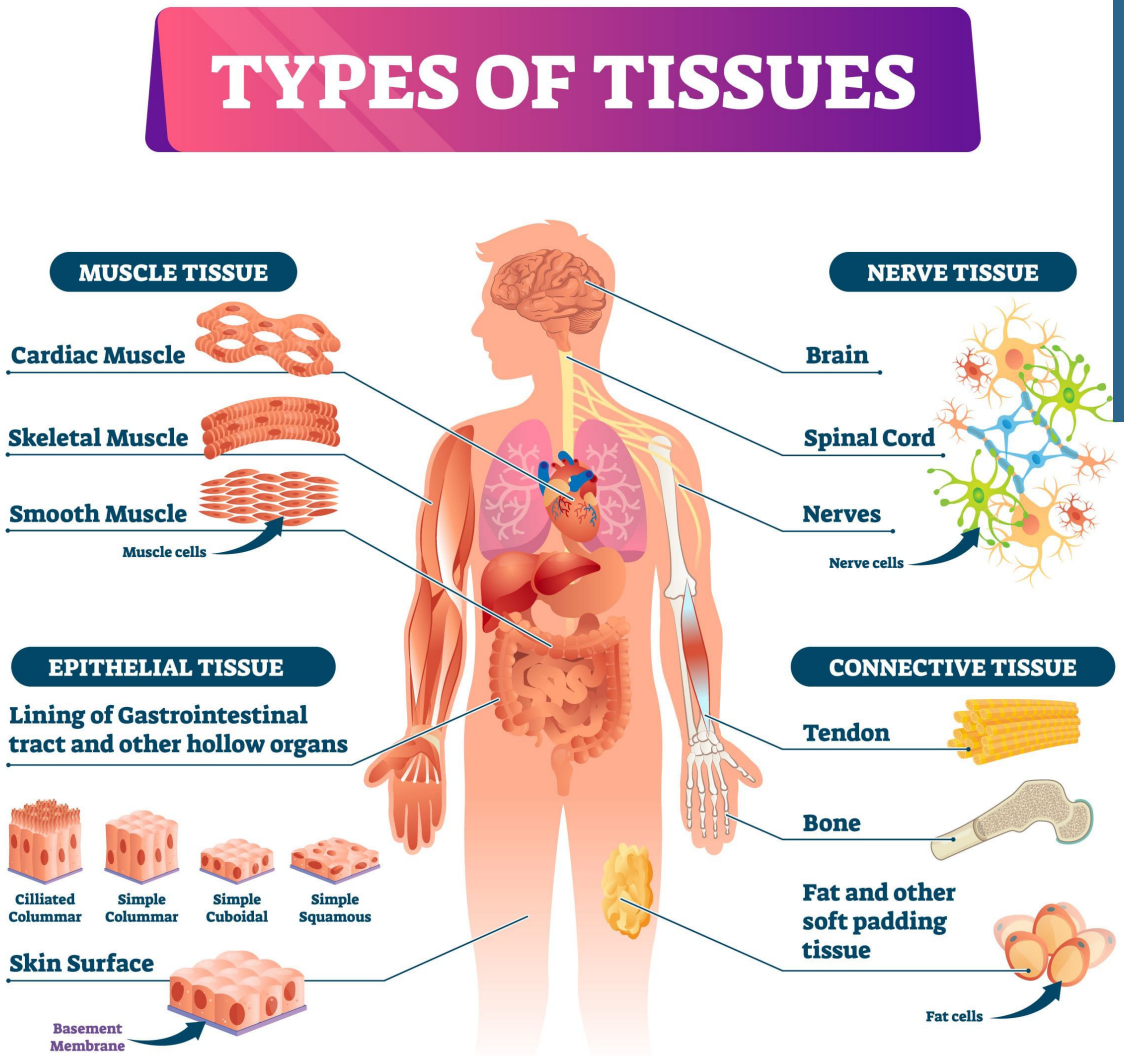

Machine Learning
Deep Neural Network
Generative AI
Optimization
Fuzzy system and control
Swarm Intelligence
Distributed Artificial Intelligence
Image Processing
Data-driven models
Decision-making
pattern recognition
Signal Processing
Speech Processing
Natural Language Processing

# Cancer



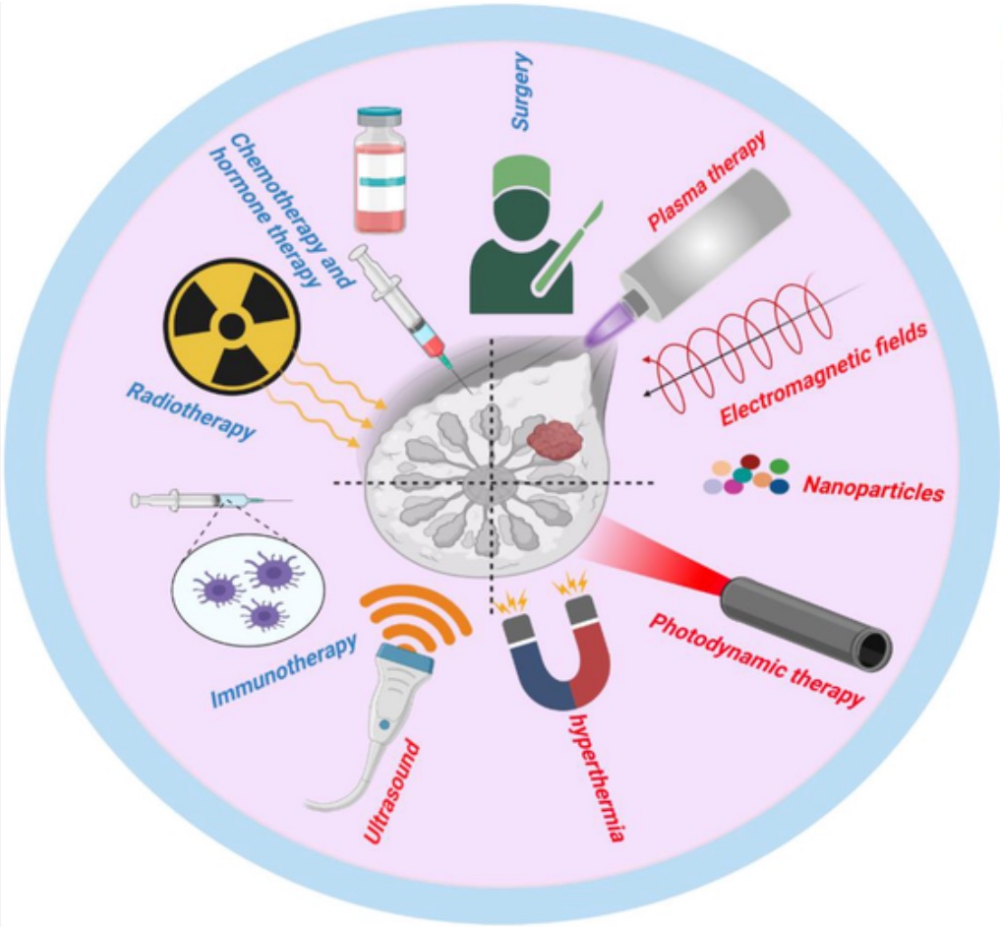


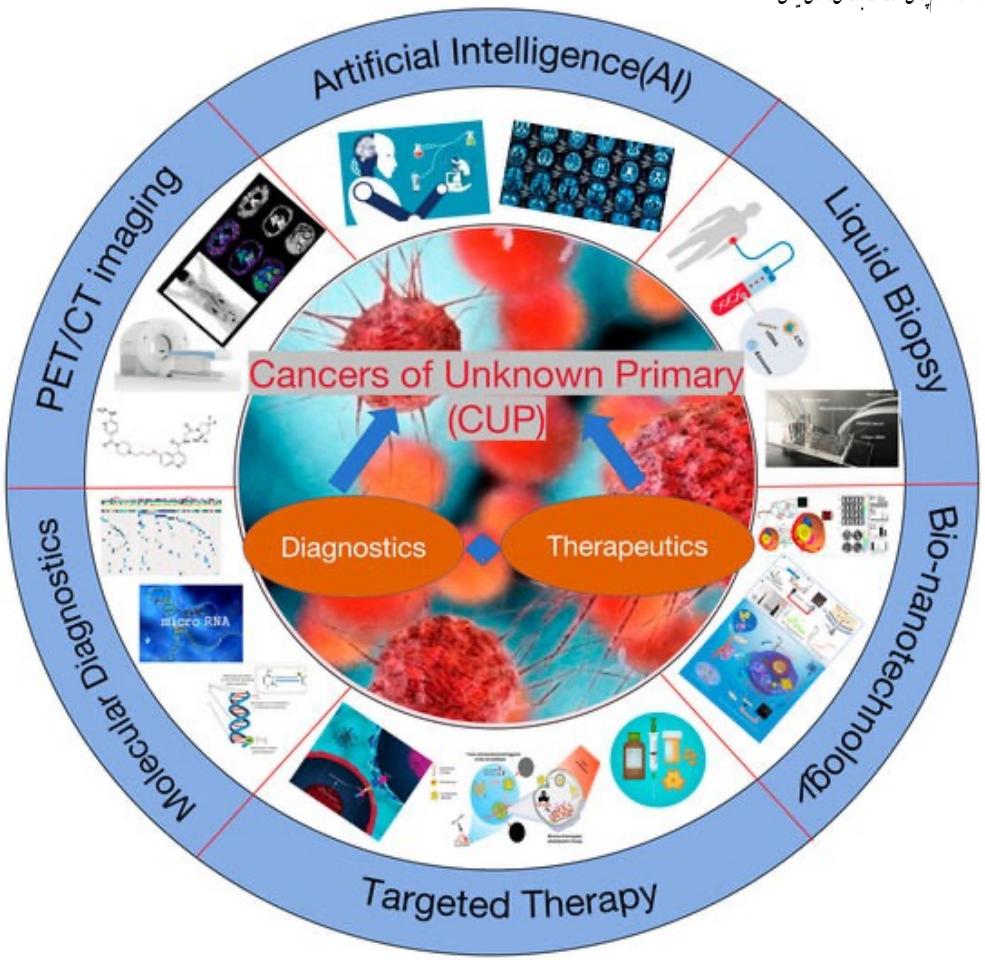



TYPES OF TISSUES
MUSCLE TISSUE
Cardiac Muscle
Skeletal Muscle
Smooth Muscle
Muscle cells
NERVE TISSUE
Brain
Spinal Cord
Nerves
Nerve cells
EPITHELIAL TISSUE
Lining of Gastrointestinal tract and other hollow organs
Cilliated Columnar
Simple Columnar
Simple Cuboidal
Simple Squamous
Skin Surface
Basement Membrane
CONNECTIVE TISSUE
Tendon
Bone
Fat and other soft padding tissue
Fat cells

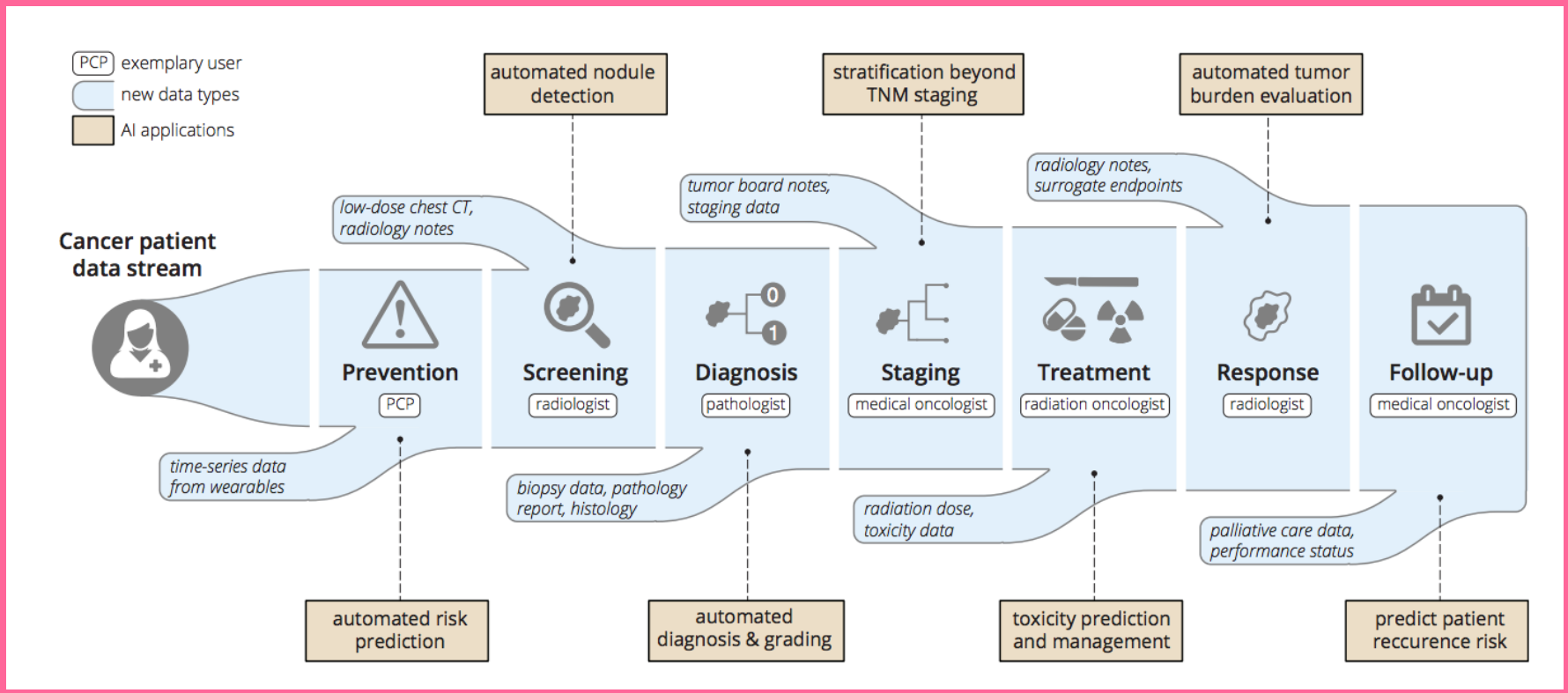
Brain
Esophageal
Lung
Gastric
Kidney
Colorectal
Myeloma
Lymphoma
Leukemia
Gallbladder &
Pancreatic
Gynecological
Testicular
Prostate

# Advances in Cancer Research

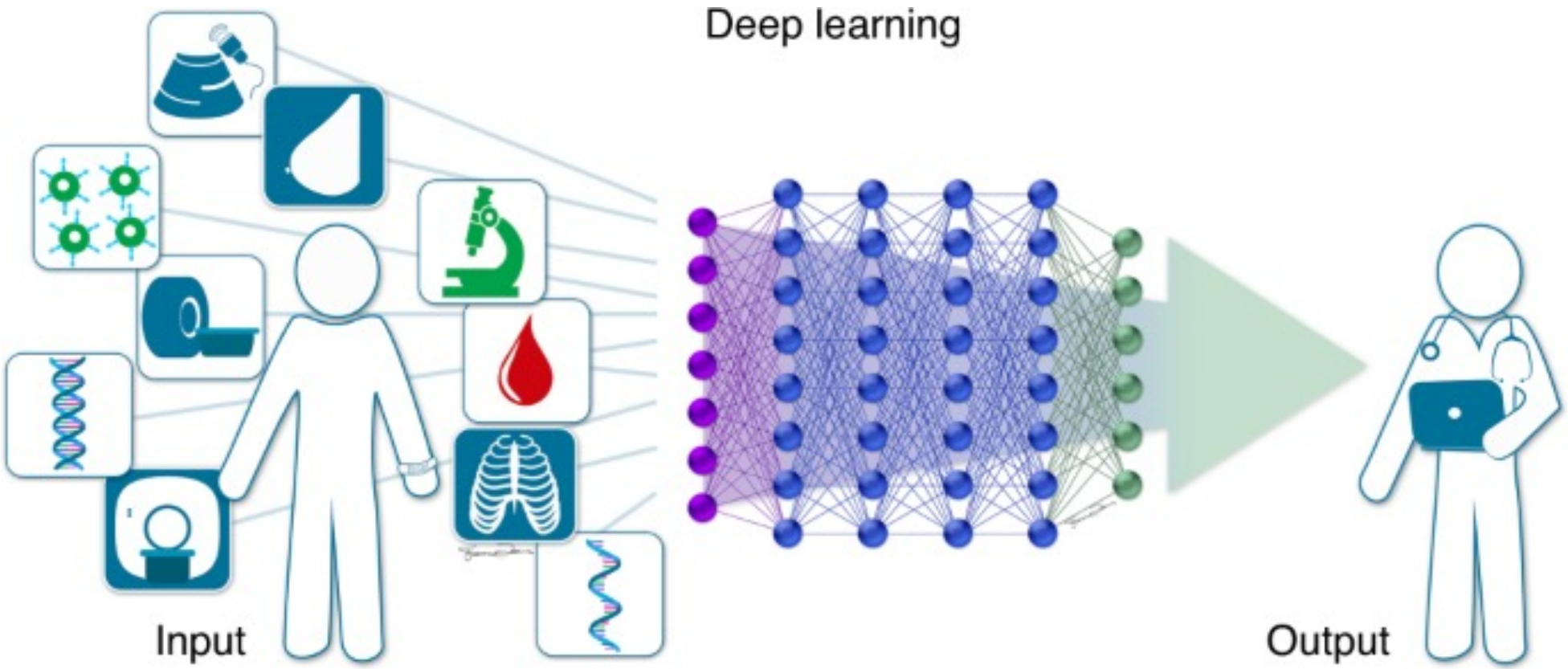


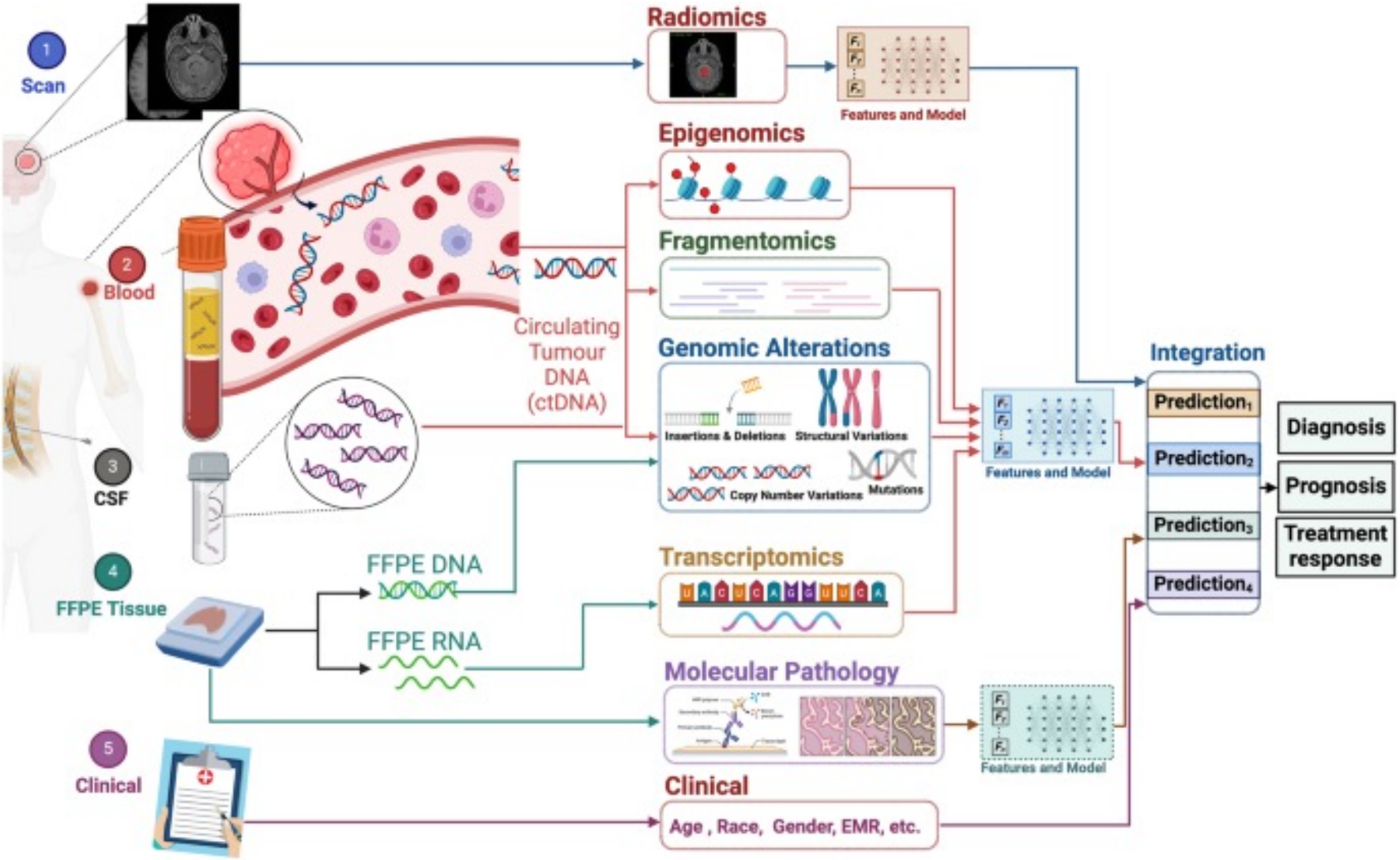
# Intelligent Oncology



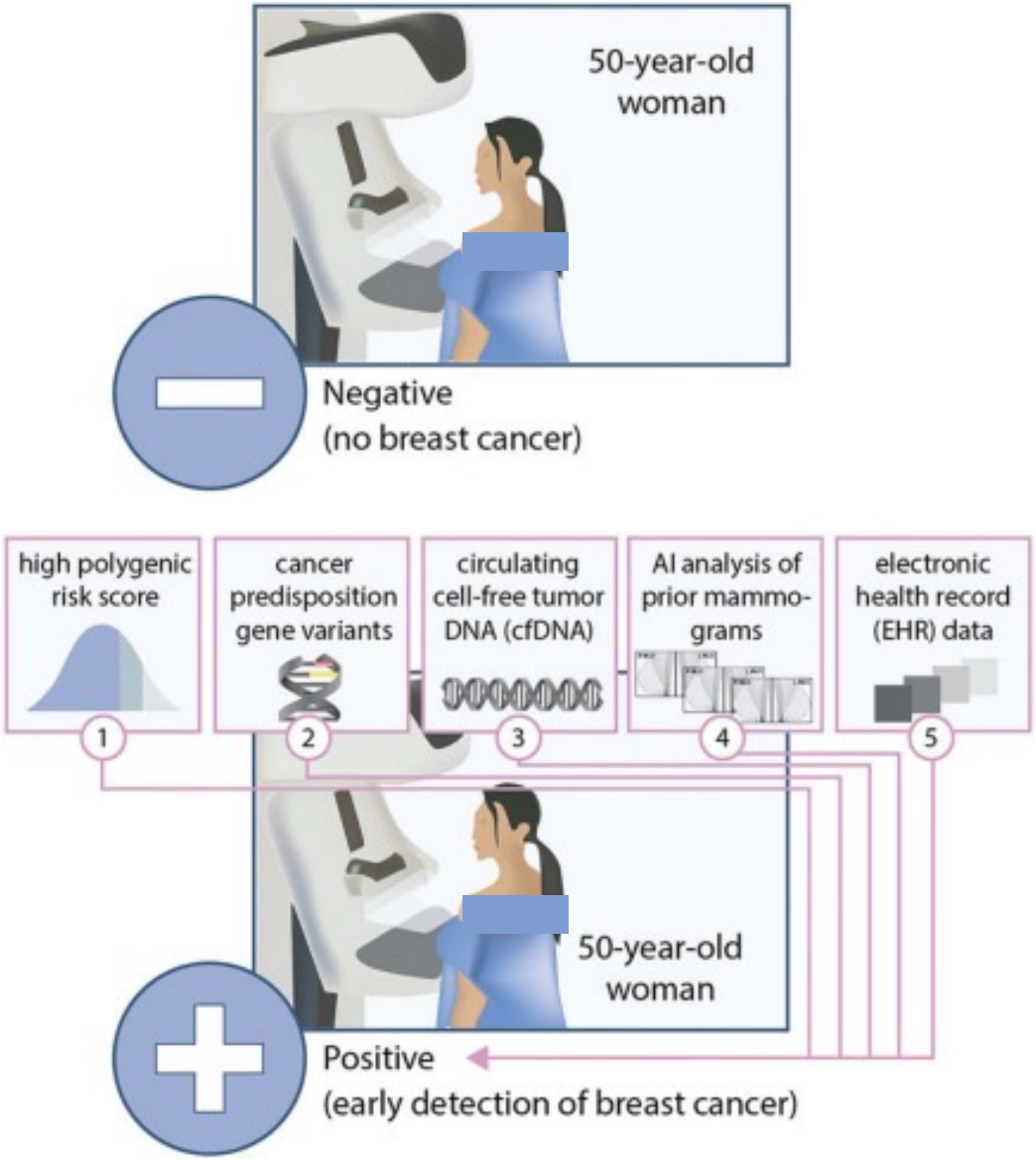
# Translating big data into meaningful oncology pipelines with AI



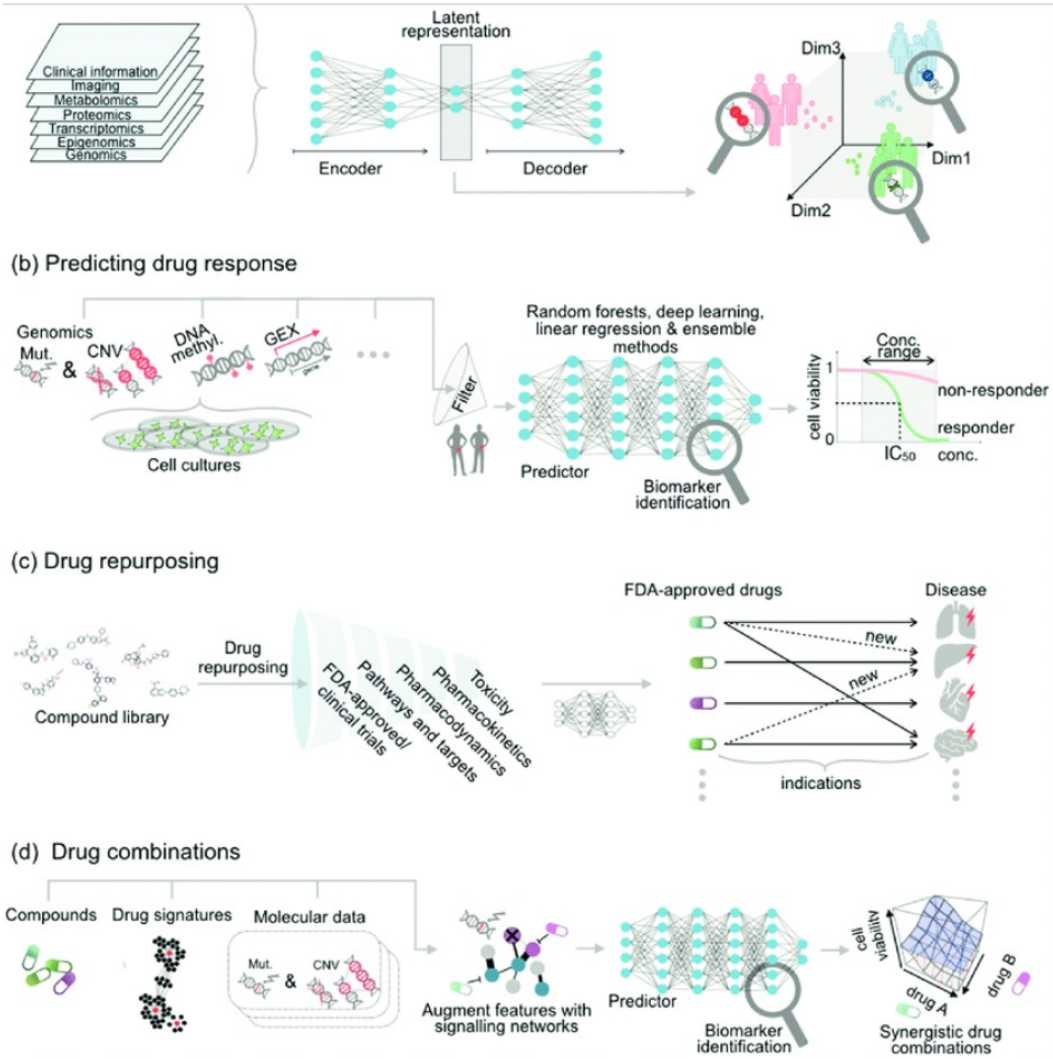
# Multimodal integration for enhanced diagnosis, prognosis, and treatment response prediction in brain tumors

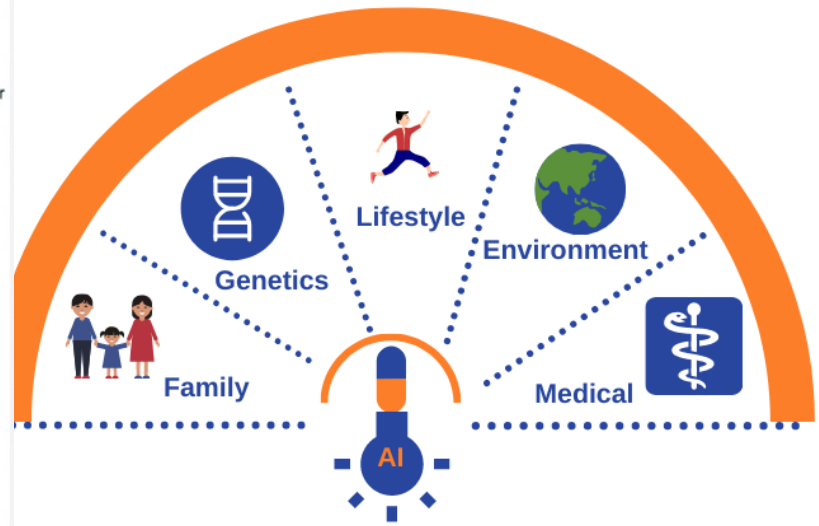


# Why Multimodal

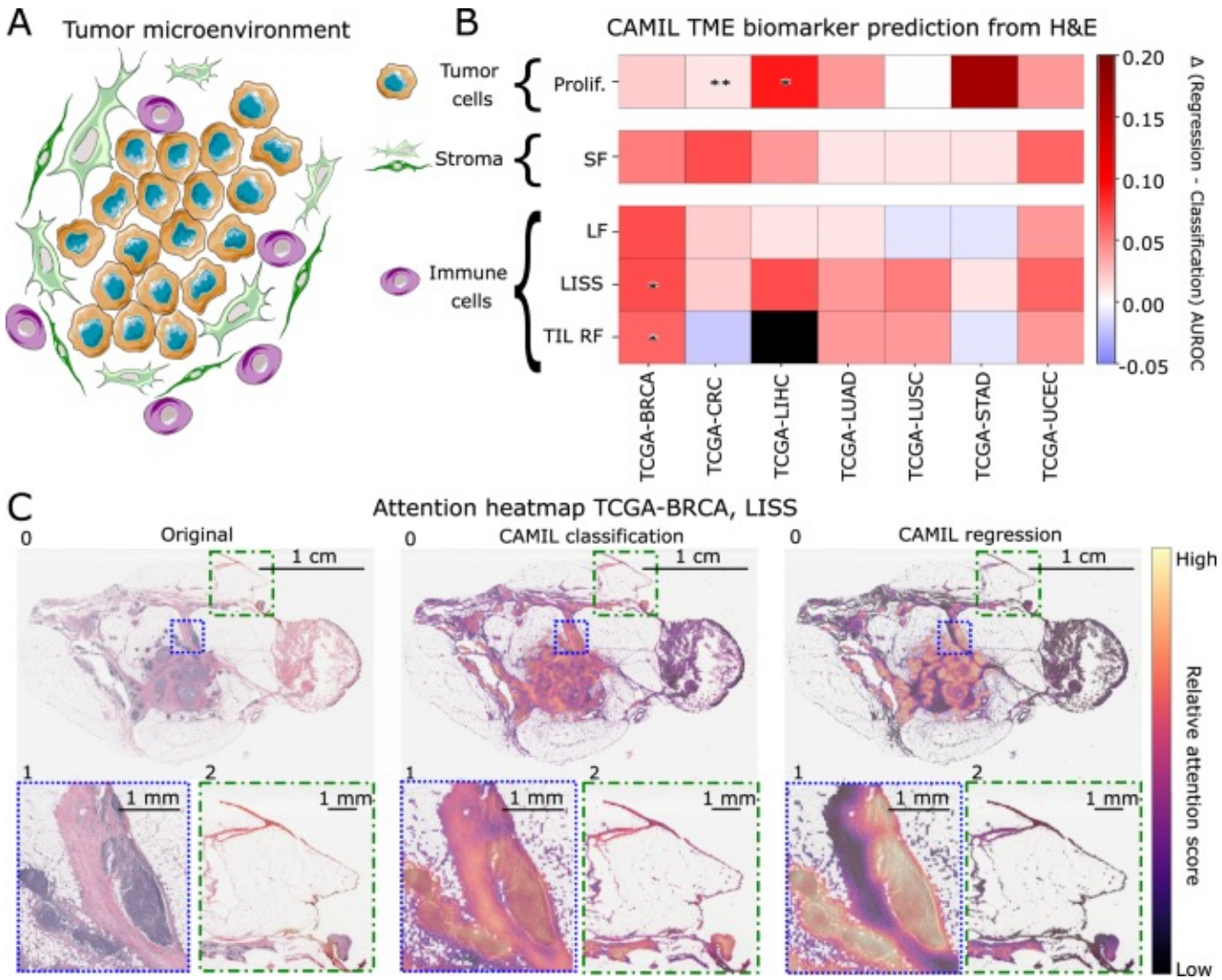


# AI in early drug and biomarker discovery



# Regression-based Deep-Learning predicts molecular biomarkers from pathology slides




*Nature Communications* **volume 15**, Article number: 1253 (2024)

# Why Cancer Biomarker

Questions that can be answered by cancer biomarkers

**Prognostic**

Is it likely to develop this cancer?

**Diagnostic**

What type of cancer is it?

**Predictive**

Is this the optimal drug for my cancer?

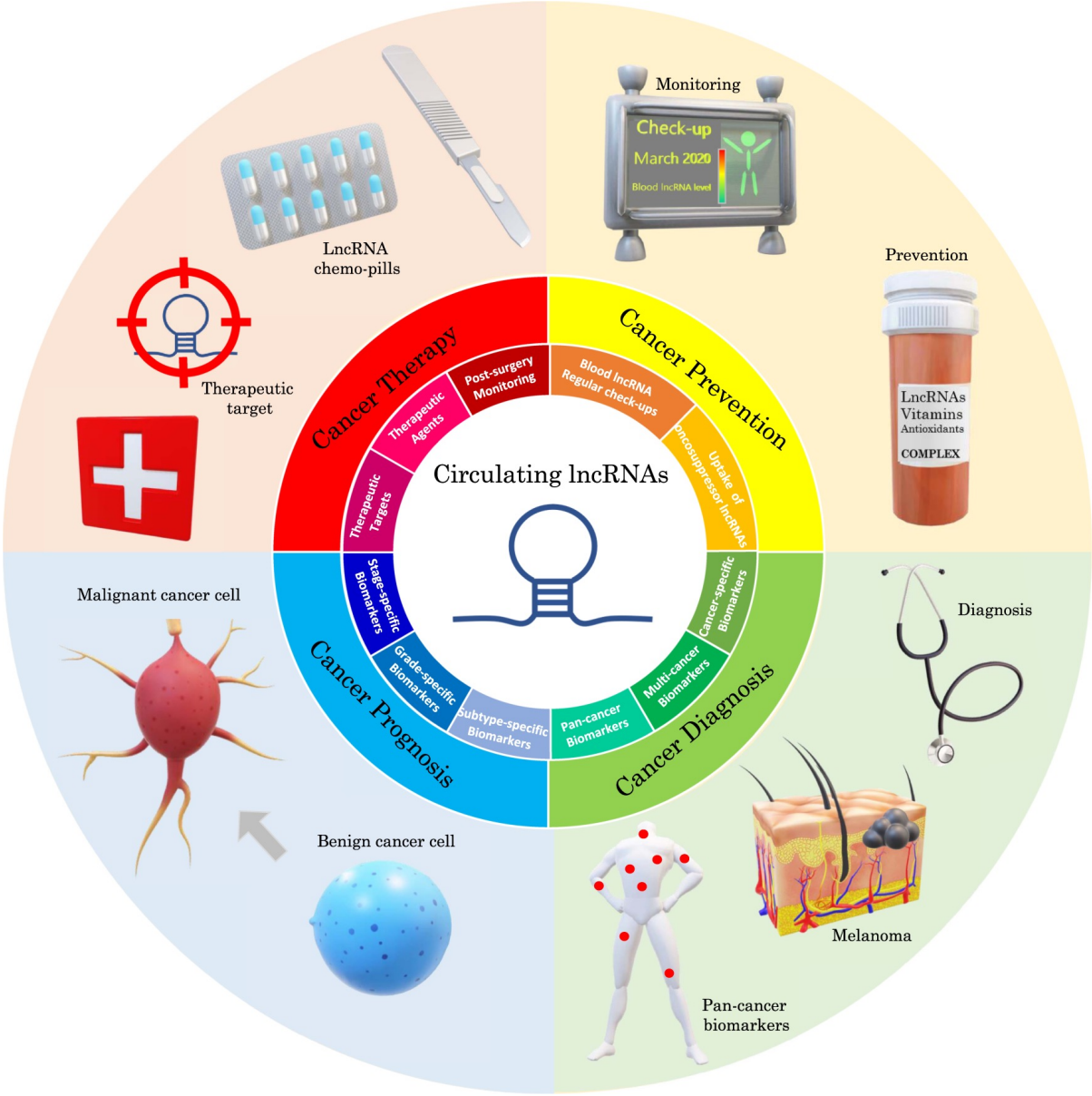
**Pharmacodynamics**

What's the optimal dose for my body?

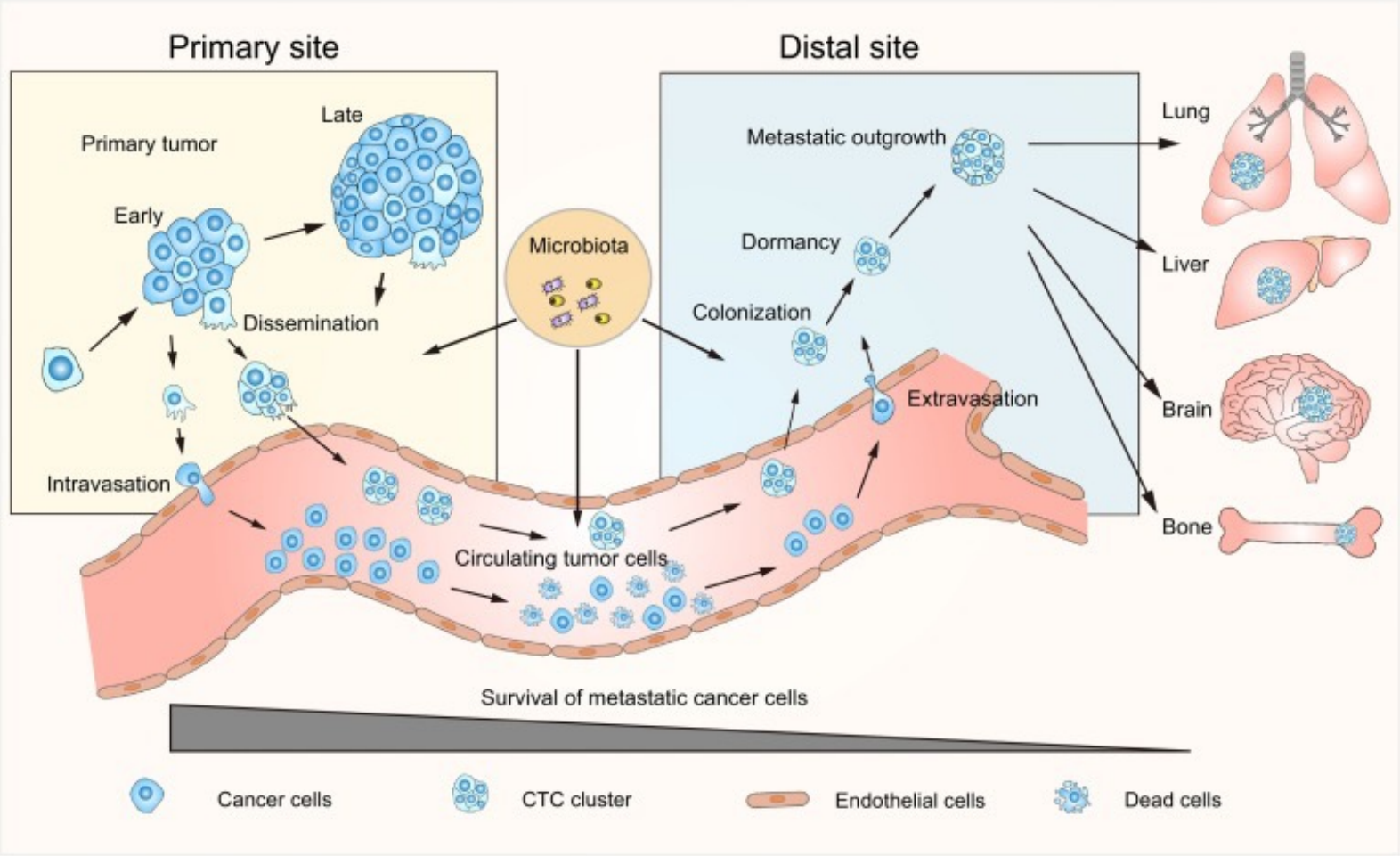
**Recurrence**

Will the cancer return?

# For example


LncRNA
chemo-pills
Monitoring
Check-up
March 2020
Blood lncRNA level
Prevention
LncRNAs
Vitamins
Antioxidants
COMPLEX
Therapeutic
target
Cancer Therapy
Post-surgery Monitoring
Therapeutic Agents
Therapeutic Targets
Cancer Prevention
Blood lncRNA Regular check-ups
Uptake of oncosuppressor lncRNAs
Circulating lncRNAs
Malignant cancer cell
Stage-specific Biomarkers
Grade-specific Biomarkers
Subtype-specific Biomarkers
Cancer Prognosis
Pan-cancer Biomarkers
Multi-cancer Biomarkers
Cancer-specific Biomarkers
Cancer Diagnosis
Diagnosis
Benign cancer cell
Melanoma
Pan-cancer
biomarkers

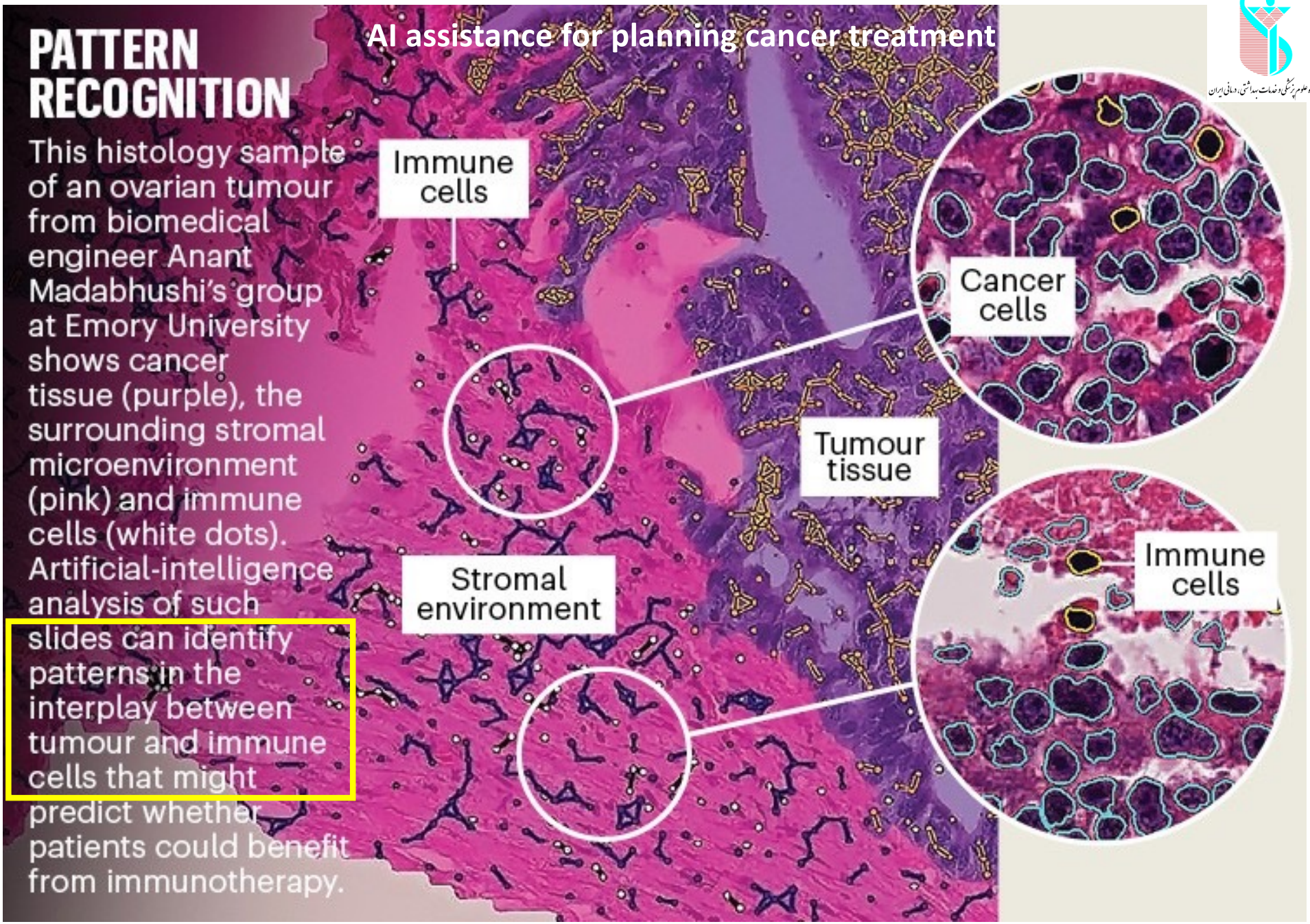
# AI traces mysterious metastatic cancers to their source




Trends in Cell Biology

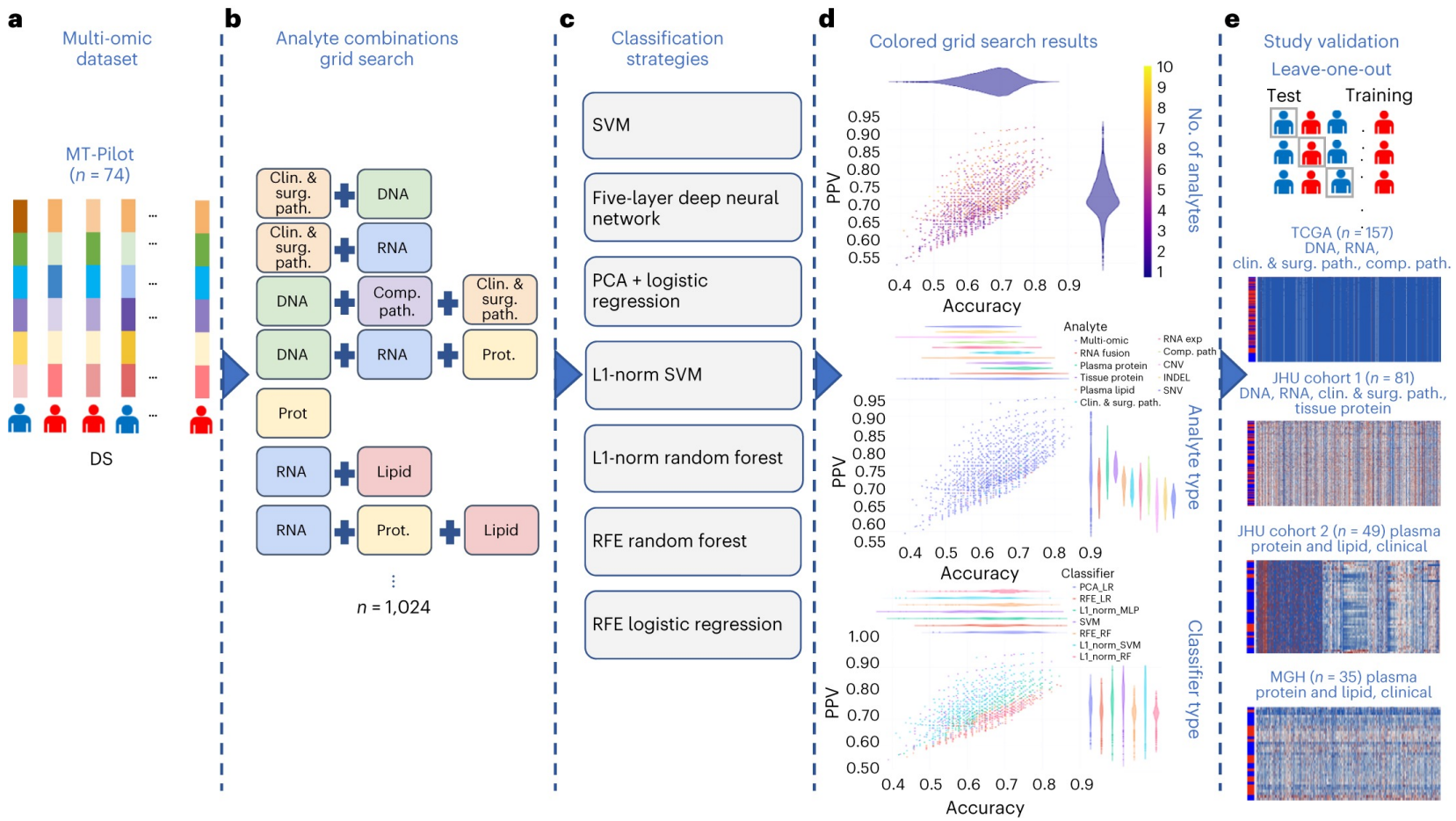
*Nature* **628**, 699-700 (2024)

# AI assistance for planning cancer treatment



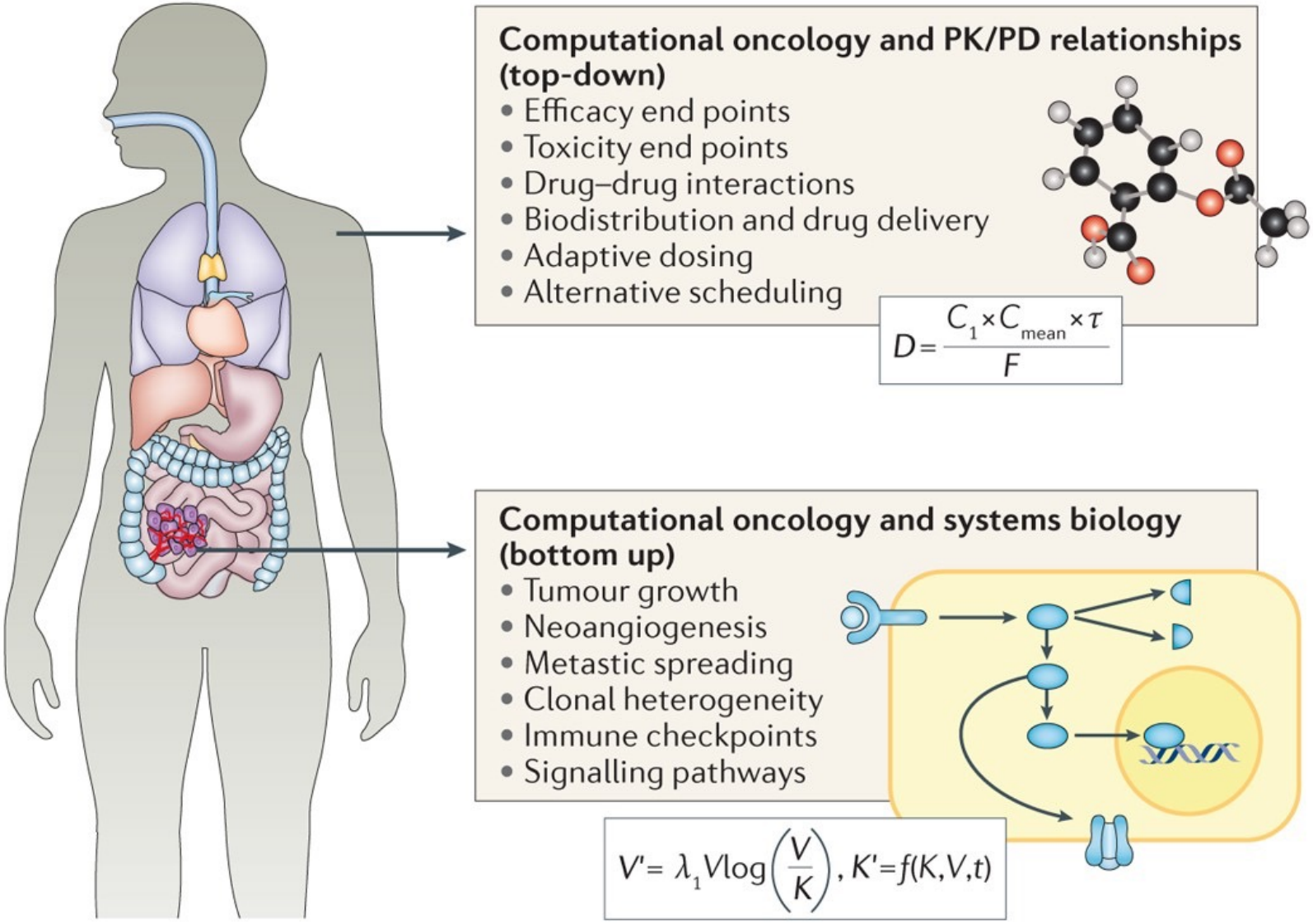

*Nature* **629**, S14-S16 (2024)

# The Molecular Twin artificial-intelligence platform integrates multi-omic data to predict outcomes for pancreatic adenocarcinoma patients



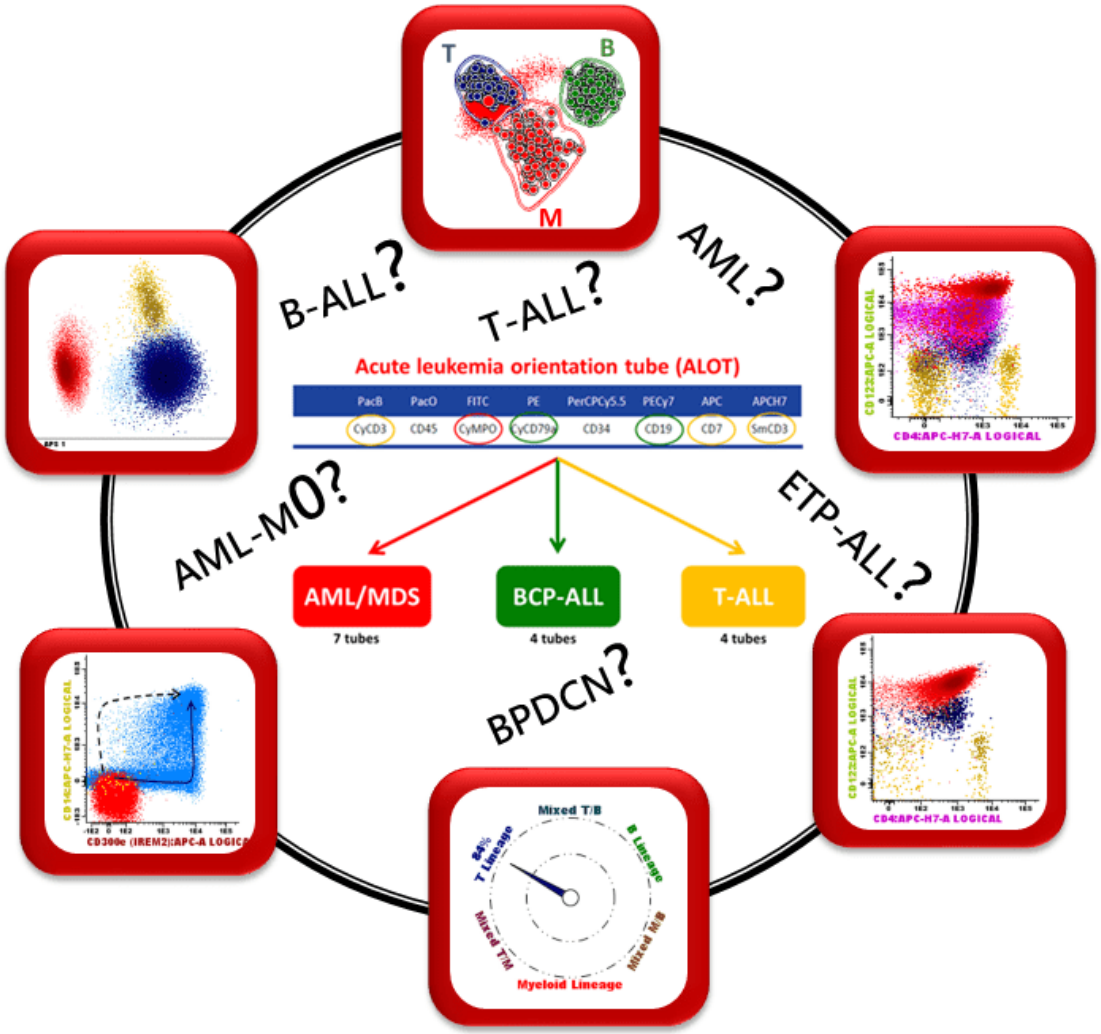

*Nature Cancer* **volume 5**, pages299–314 (2024)

# Computational oncology — mathematical modelling of drug regimens for precision medicine



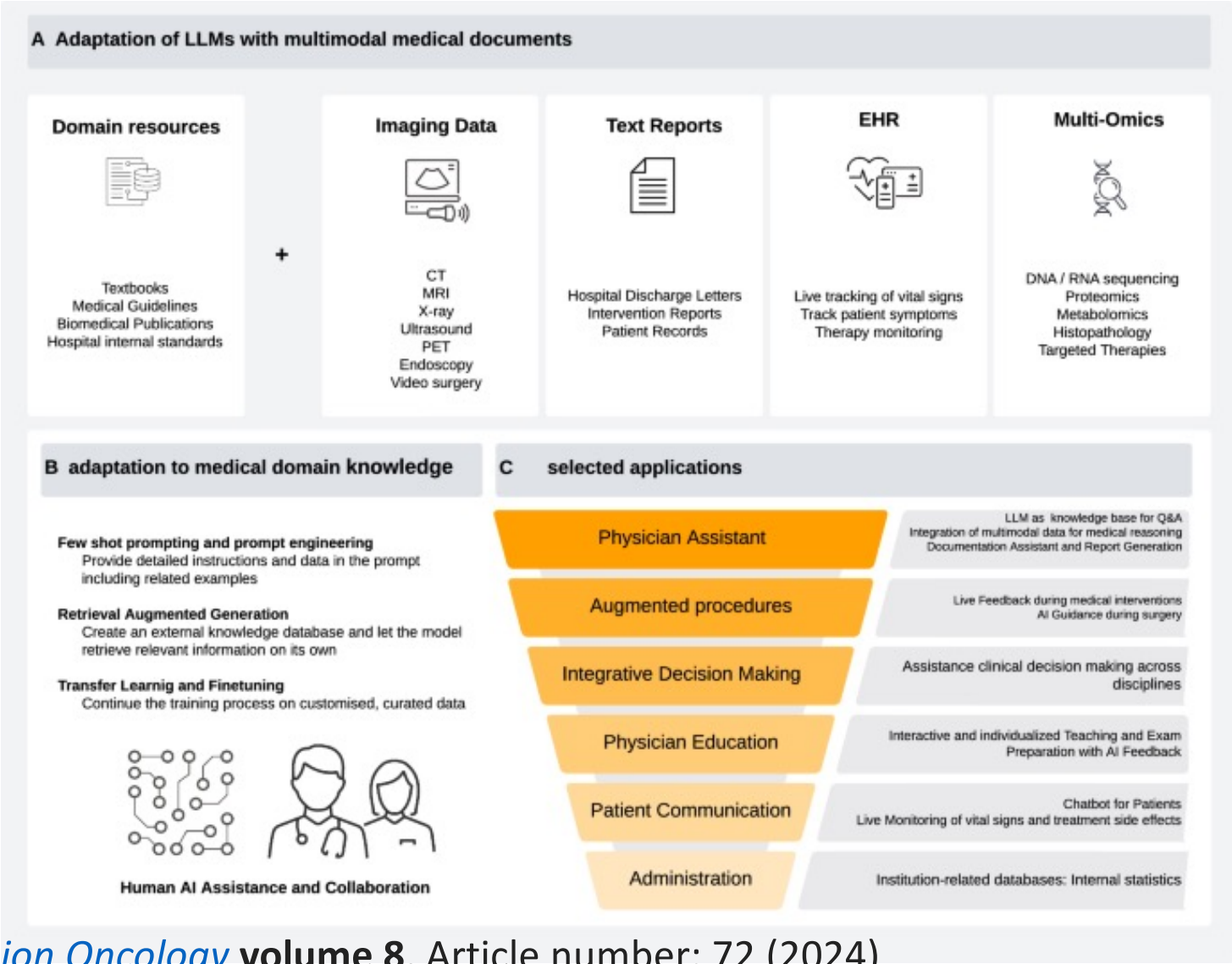

Nature Reviews | Clinical Oncology

# Deep learning assists in acute leukemia detection and cell classification via flow cytometry using the acute leukemia orientation tube



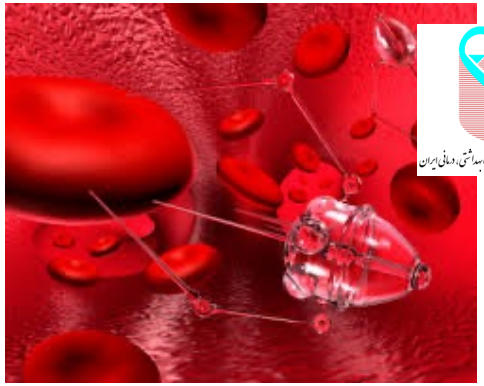

*Scientific Reports* **volume 14**, Article number: 8350 (2024)

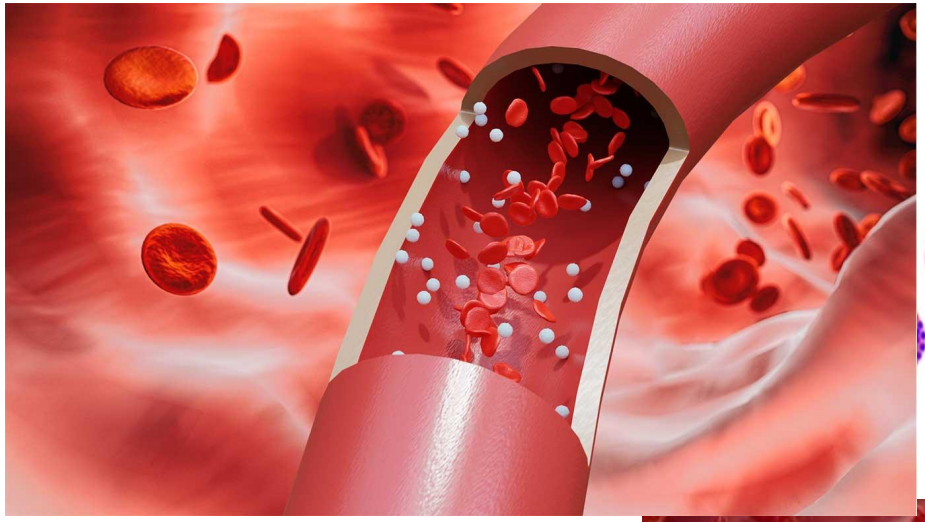
# Large language models and multimodal foundation models for precision oncology

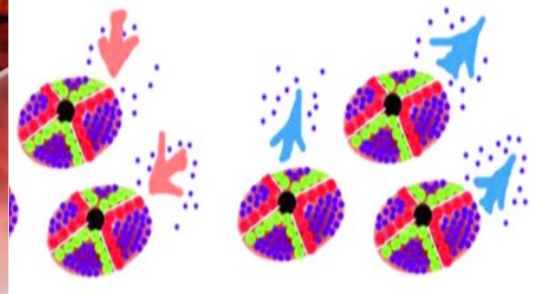


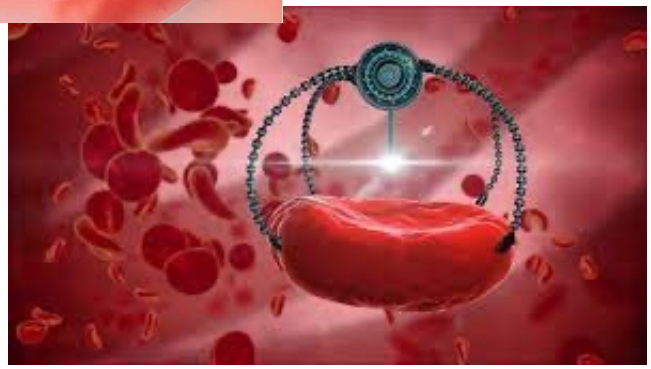

*npj Precision Oncology* **volume 8**, Article number: 72 (2024)

# Nanomedicine









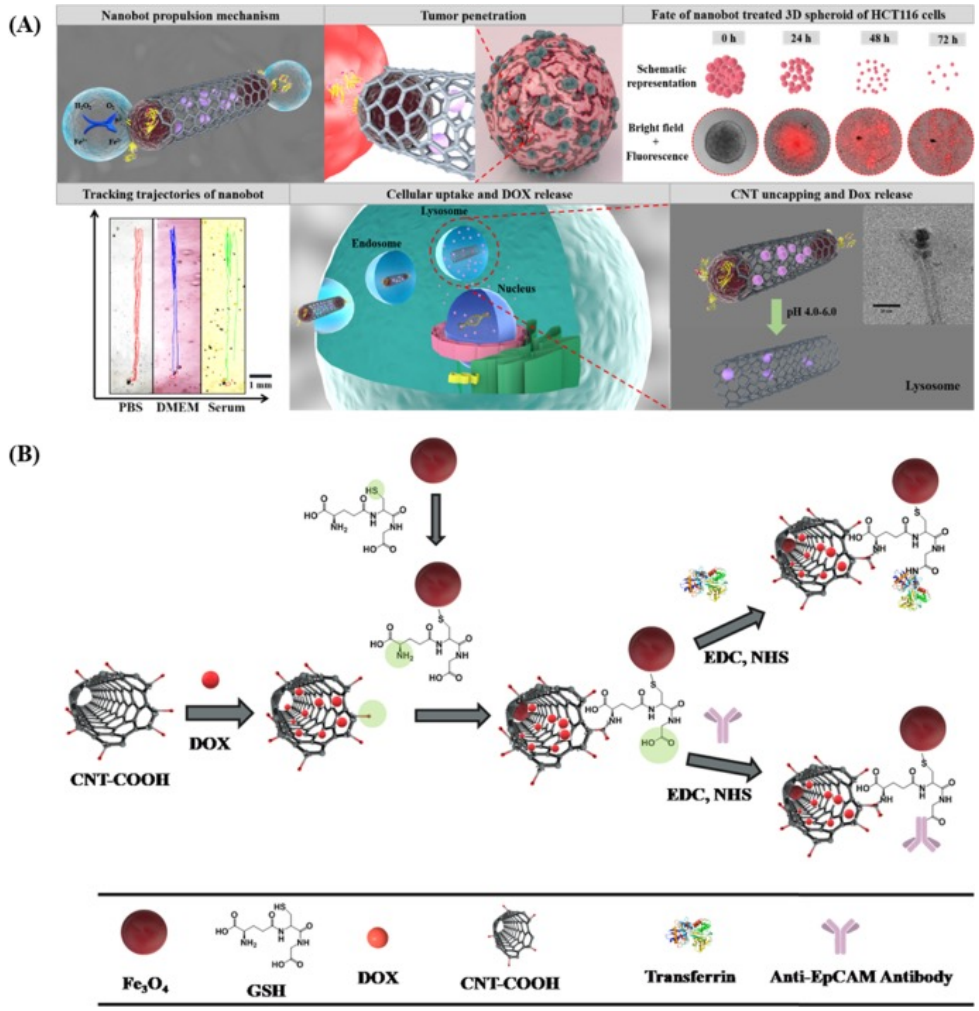
[1] N. Rady Raz, M. -R. Akbarzadeh-T and S. Setayeshi, "Influence-Based Nano Fuzzy Swarm Oxygen Deficiency Detection and Therapy," *in IEEE Transactions on Systems, Man, and Cybernetics: Systems*, vol. 53, no. 8, pp. 4994-5005, Aug. 2023, N. Rady Raz, M. R. Akbarzadeh T., "Target Convergence Analysis of Cancer Inspired Swarms for Early Disease Diagnosis and Targeted Collective Therapy,"*IEEE Transactions on Neural Networks and Learning Systems*, 2022.

[2] N. Rady Raz, M. R. Akbarzadeh T., "Swarm-Fuzzy Rule-Based Targeted Nano Delivery Using Bioinspired Nanomachines,"*IEEE Transactions on NanoBioscience*,Vol.18, No.3, pp. 404 - 414, July 2019.

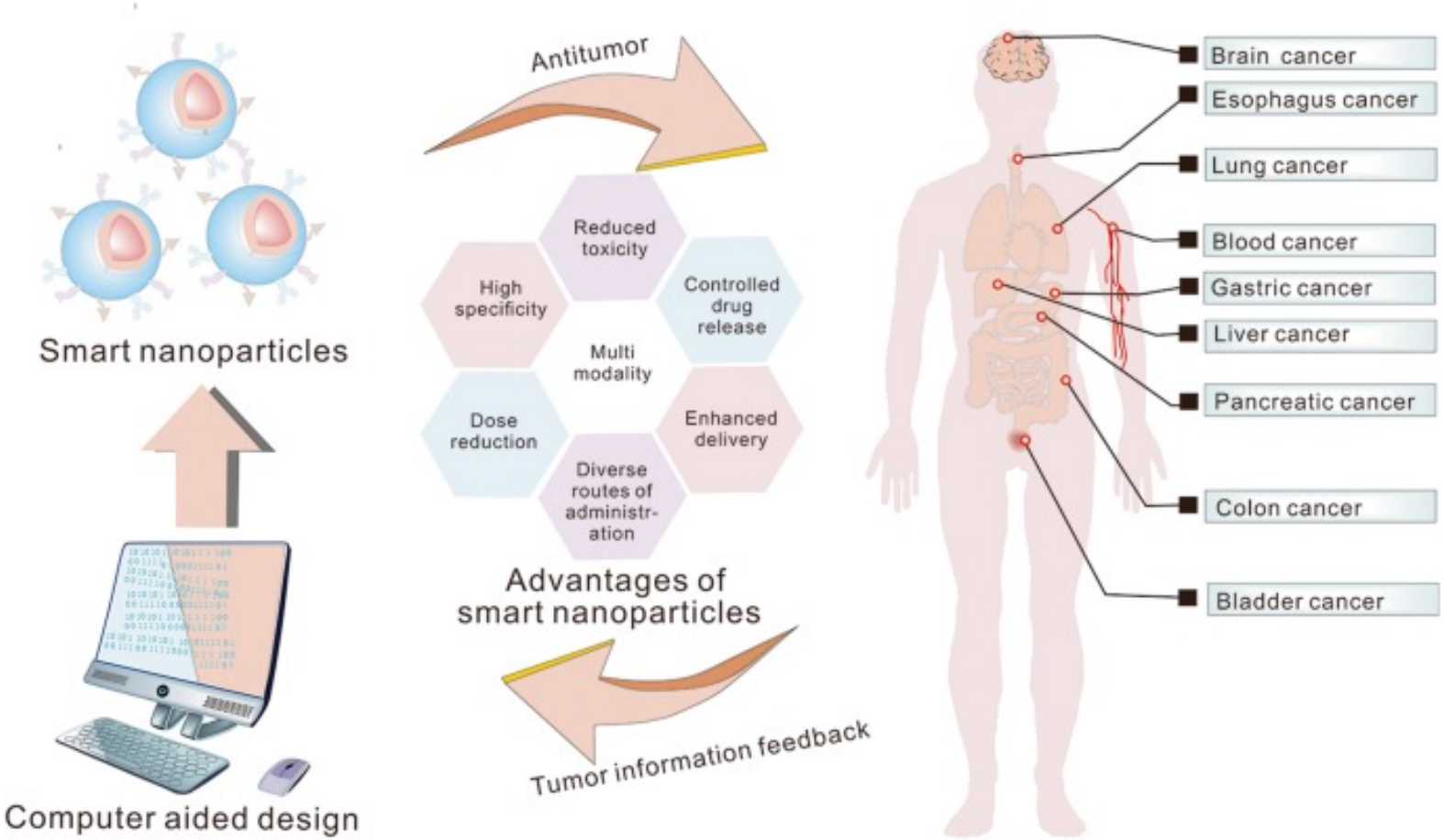
[3] N. Rady Raz, M. R. Akbarzadeh T., M. Tafaghodi, "Bio-Inspired Nanonetworks for Targeted Cancer Drug Delivery,"*IEEE Transactions on NanoBioscience*,Vol.14, No.8, pp. 894-906, Dec. 2015.

# Self-Propelling Targeted Magneto-Nanobots for Deep Tumor Penetration and pH-Responsive Intracellular Drug Delivery

Self-propelling magnetic nanorobots capable of intrinsic-navigation in biological fluids with enhanced pharmacokinetics and deeper tissue penetration implicates promising strategy in targeted cancer therapy.

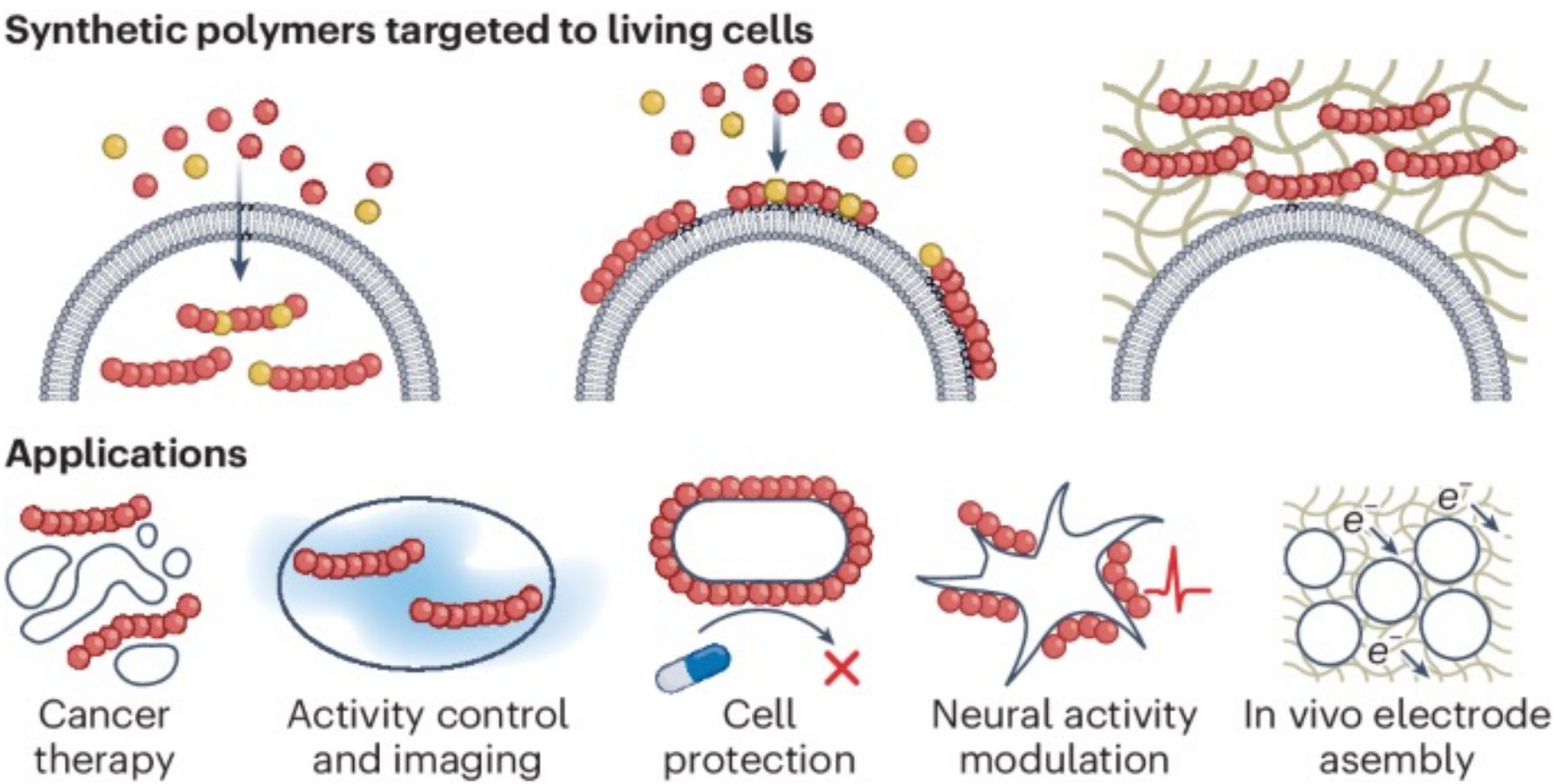


# Smart nanoparticles for cancer therapy



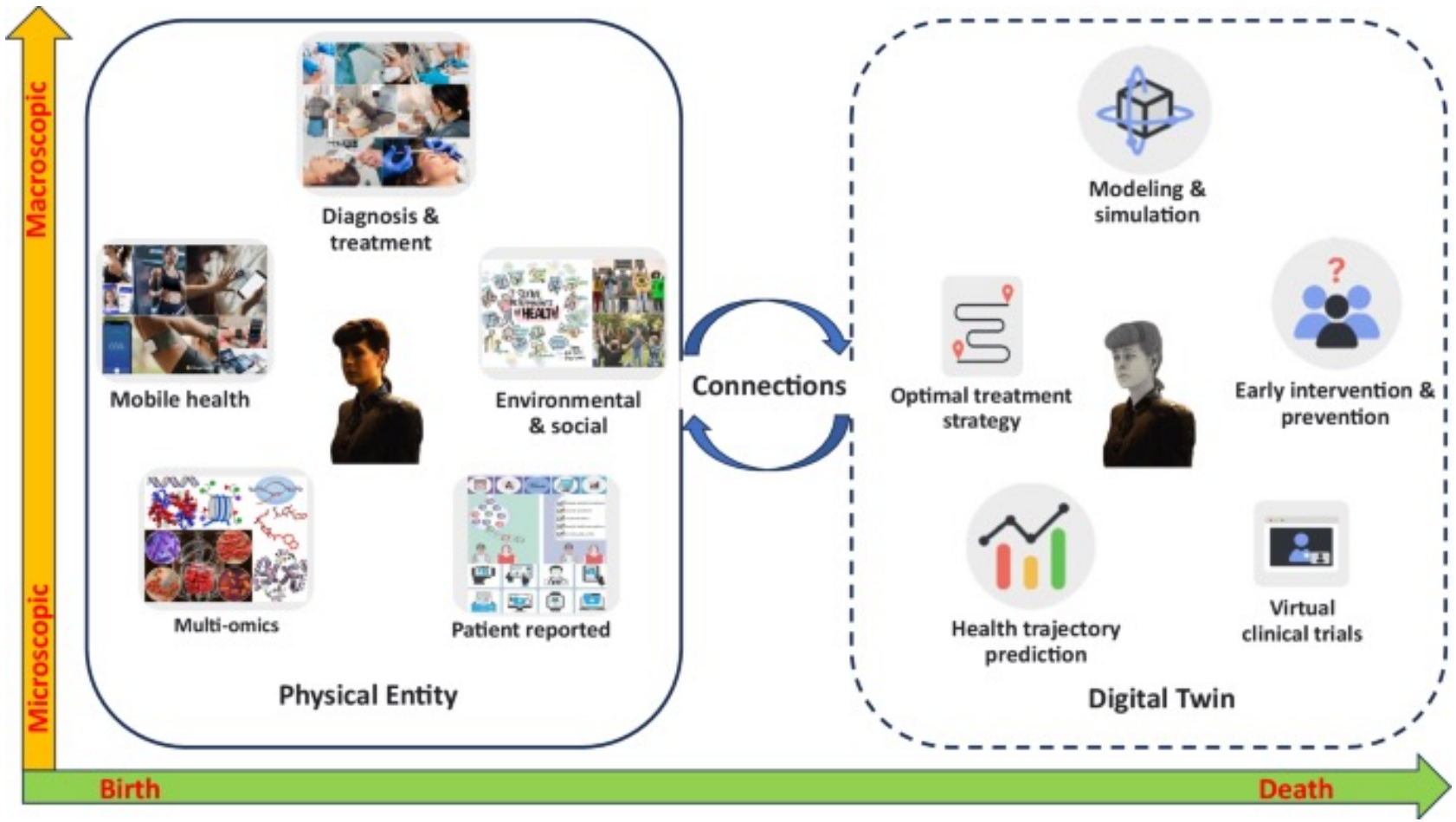

*Signal Transduction and Targeted Therapy* **volume 8**, Article number: 418 (2023)

# Applications of synthetic polymers directed toward living cells




*Nature Synthesis* (2024)

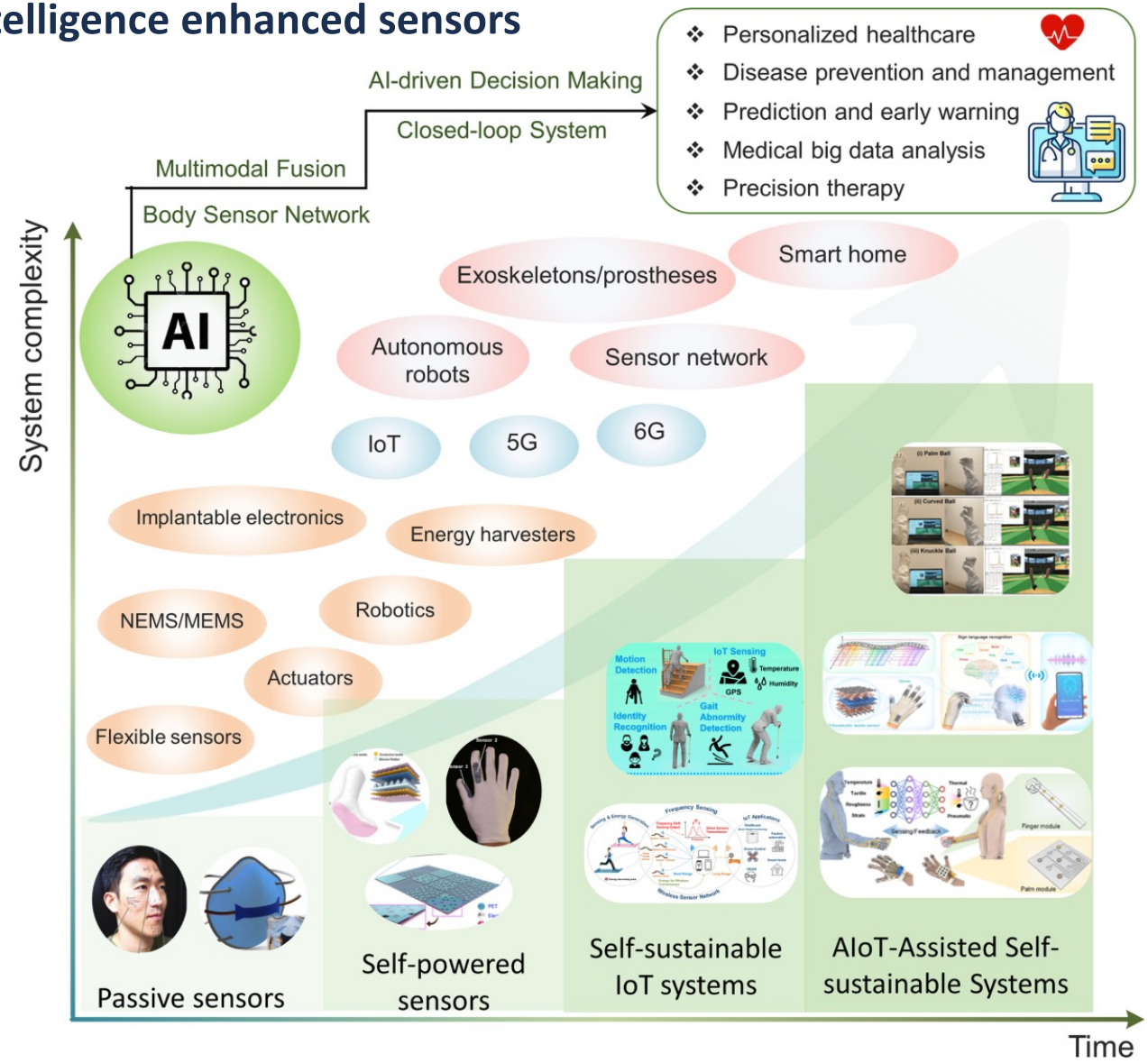
# digital twin for health



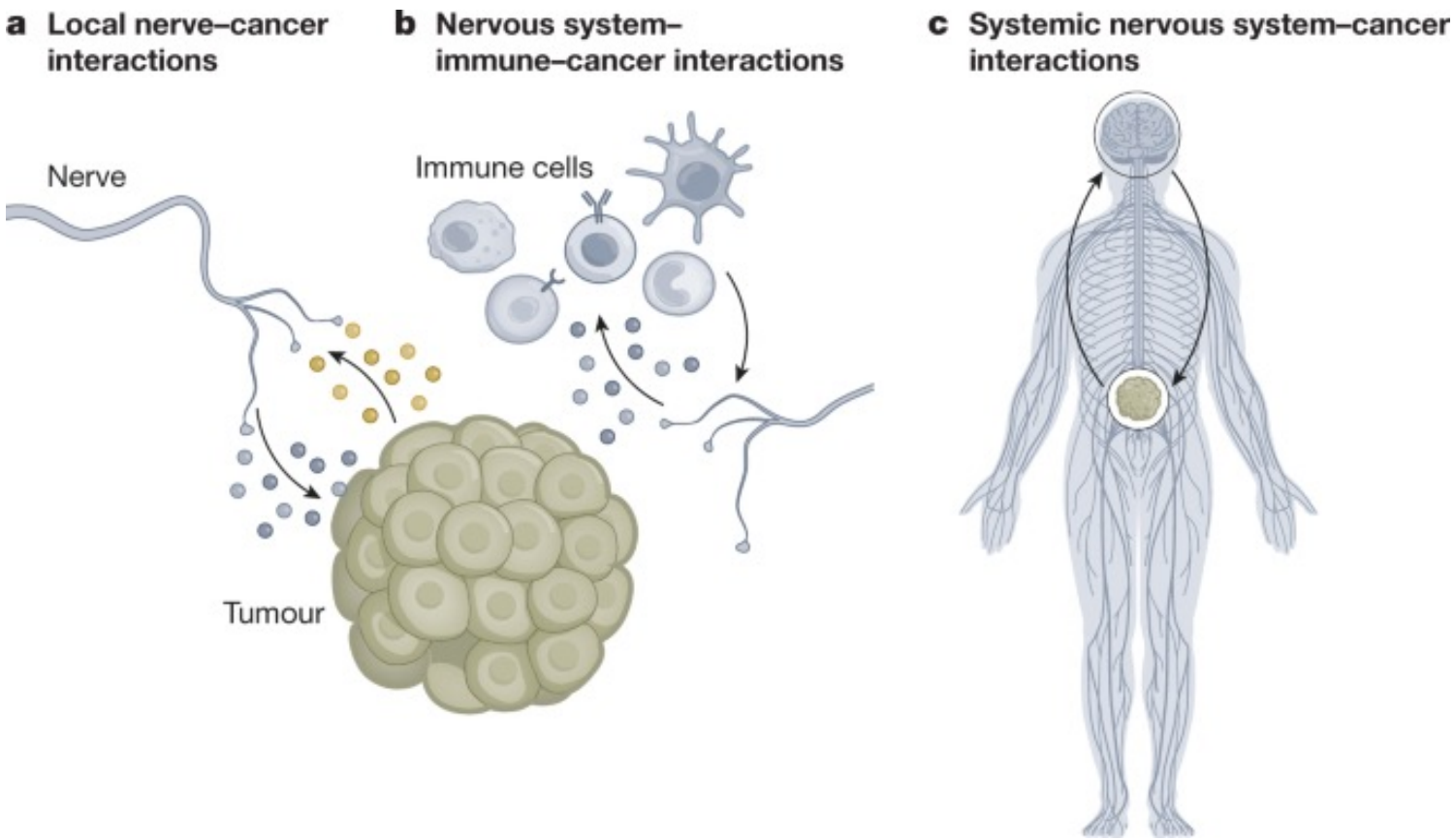

*npj Digital Medicine* **volume 7**, Article number: 77 (2024)

# AI - based Monitoring

**Artificial intelligence enhanced sensors**



# The neuroscience of cancer




*Nature* **volume 618**, pages467–479 (2023)

# Challenges and Questions

- How do we ensure the ethical use of AI in healthcare?
- What are the regulatory frameworks that need to be in place for the safe and effective use of AI?
- How do we measure the quality and accuracy of AI in healthcare?

# Note that!!

AI is not your replacement — it is an assistant

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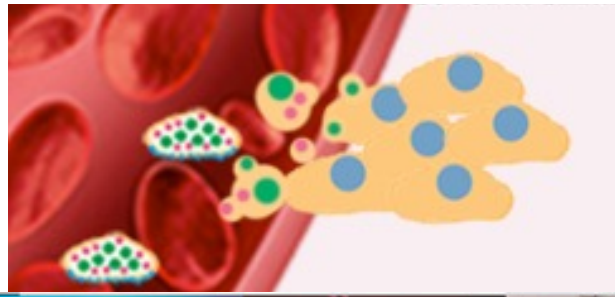
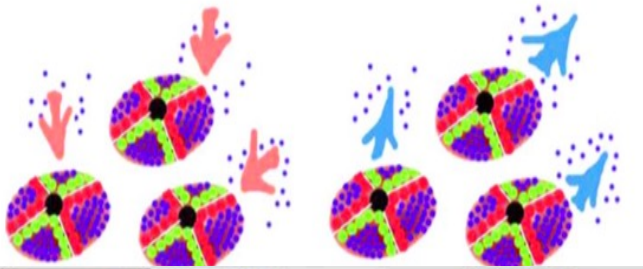
## عنوان دوره آنلاین:

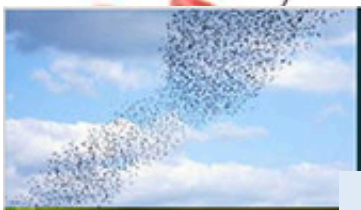
# هوش مصنوعی در پزشکی با رویکرد بالینی

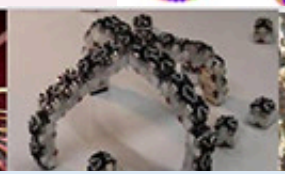
# Online Course: Artificial Intelligence in Medicine with Clinical Approach

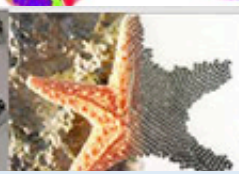
| Course Topics | عناوین بیست و چهار جلسه | تاریخ جلسات |
|---|---|---|
| Artificial Intelligence (AI) in medicine | معرفی هوش مصنوعی در پزشکی | ۲۸ بهمن ۱۴۰۲ |
| AI and Fuzzy systems and its applications in medicine | هوش مصنوعی و سیستم های فازی در پزشکی | ۵ اسفند ۱۴۰۲ |
| Machine Learning and its applications in medicine | یادگیری ماشین و کاربردهای آن در پزشکی | ۱۲اسفند۱۴۰۲ |
| Evolutionary systems and its applications in medicine | الگوریتم های بهینه سازی تکاملی و کاربردهای آن در پزشکی | ۱۹اسفند ۱۴۰۲ |
| Neural networks and deep neural networks in medicine | شبکه های عصبی و شبکه های عصبی عمیق در پزشکی | ۲۵فروردین ۱۴۰۳ |
| Application of AI in Early Detection of Disease | کاربرد هوش مصنوعی در تشخیص زودهنگام بیماری ها | ۱ اردیبهشت ۱۴۰۳ |
| Swarm Intelligence and multi-agent/swarm in medicine | هوش ازدحامی، سیستم های چند عامله/ازدحامی در پزشکی | ۸اردیبهشت ۱۴۰۳ |
| Application of AI in Cancer | کاربردهای هوش مصنوعی در سرطان | ۲۲اردیبهشت ۱۴۰۳ |
| Application of AI in surgery | کاربردهای هوش مصنوعی در جراحی | ۲۹ اردیبهشت ۱۴۰۳ |
| Applications of AI in Neurology | کاربردهای هوش مصنوعی در مغز و اعصاب | ۵ خرداد ۱۴۰۳ |
| Application of AI in Internal Medicine | کاربردهای هوش مصنوعی در پزشکی داخلی | ۱۲ خرداد ۱۴۰۳ |
| Applications of AI in cardiovascular | کاربردهای هوش مصنوعی در قلب و عروق | ۱۹ خرداد ۱۴۰۳ |
| Applications of AI in Breast Disease | کاربردهای هوش مصنوعی در بیماری های پستان | ۲۶ خرداد ۱۴۰۳ |
| Application of AI in Ophthalmology | کاربردهای هوش مصنوعی در چشم پزشکی | ۲ تیر ۱۴۰۳ |
| Application of AI in Nephrology | کاربردهای هوش مصنوعی در نفرولوژی | ۹ تیر ۱۴۰۳ |
| Application of AI in Otorhinolaryngology | کاربردهای هوش مصنوعی در گوش و حلق و بینی | ۱۶ تیر ۱۴۰۳ |
| Application of AI in Gynecology and obstetrics | کاربردهای هوش مصنوعی در زنان و مامایی | ۲۳ تیر ۱۴۰۳ |
| Application of AI in pediatric medicine | کاربردهای هوش مصنوعی در پزشکی اطفال | ۳۰ تیر ۱۴۰۳ |
| Application of AI in anesthesia | کاربردهای هوش مصنوعی در بیهوشی | ۶ مرداد ۱۴۰۳ |
| Application of AI in emergency medicine | کاربردهای هوش مصنوعی در پزشکی اورژانس | ۱۳ مرداد ۱۴۰۳ |
| Applications of artificial intelligence in orthopedics | کاربردهای هوش مصنوعی در ارتوپدی | ۲۰ مرداد ۱۴۰۳ |
| Application of AI in pain management | کاربردهای هوش مصنوعی در مدیریت درد | ۲۷ مرداد ۱۴۰۳ |
| Application of AI in pharmacology | کاربردهای هوش مصنوعی در داروسازی | ۳ شهریور ۱۴۰۳ |
| Application of AI in dentistry | کاربردهای هوش مصنوعی در دندان پزشکی | ۱۰ شهریور ۱۴۰۳ |











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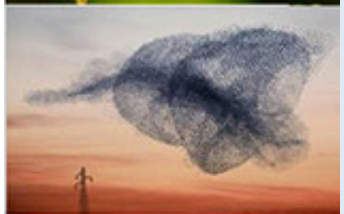
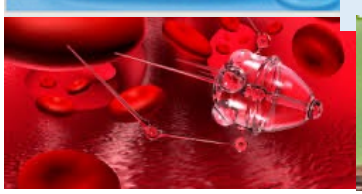
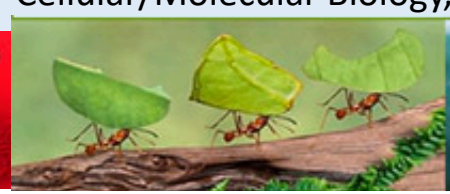
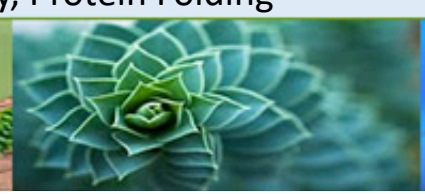
**Research Interest:**

Artificial Intelligence, Artificial Intelligence in Medicine, Complex Systems, Biomimicry, Cognitive Science, Swarm Intelligence, Nanomedicine, Targeted Drug Delivery, Early Detection of Disease, Swarm Nano Robotics, Cancer Research, Fuzzy Logic and Control, Soft Computing, Neural Networks, Machine Learning, Multi-agent Systems, Distributed Decision Making, Biomarkers, Biophysics, Nature Inspired Algorithms, Computational Cellular/Molecular Biology, Protein Folding









Artificial Intelligence for Good (AI for Good)