AI'S ROLES AND POTENTIAL IN ONCOLOGY PRACTICE

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OUTLINE

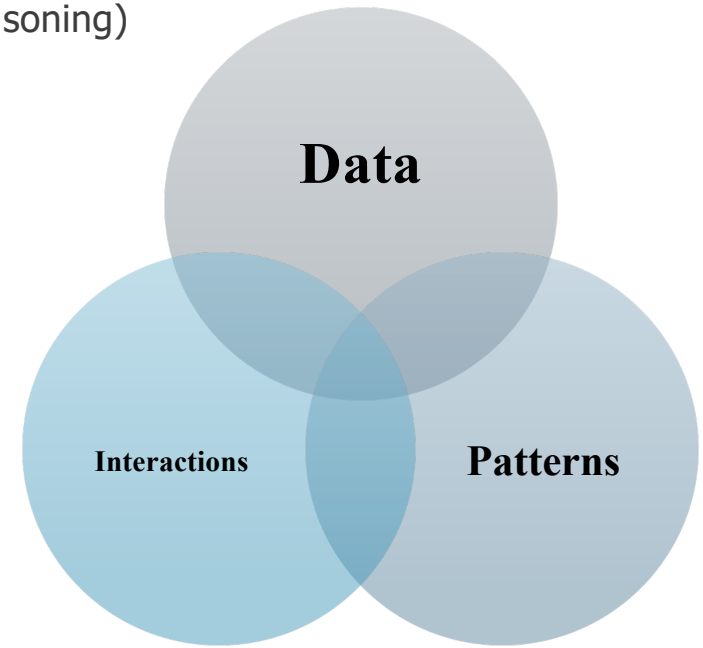
- Why artificial intelligence
- How AI helps in cancer
- AI applications in oncology
- Some considerations
- Prospects

WHY ARTIFICIAL INTELLIGENCE

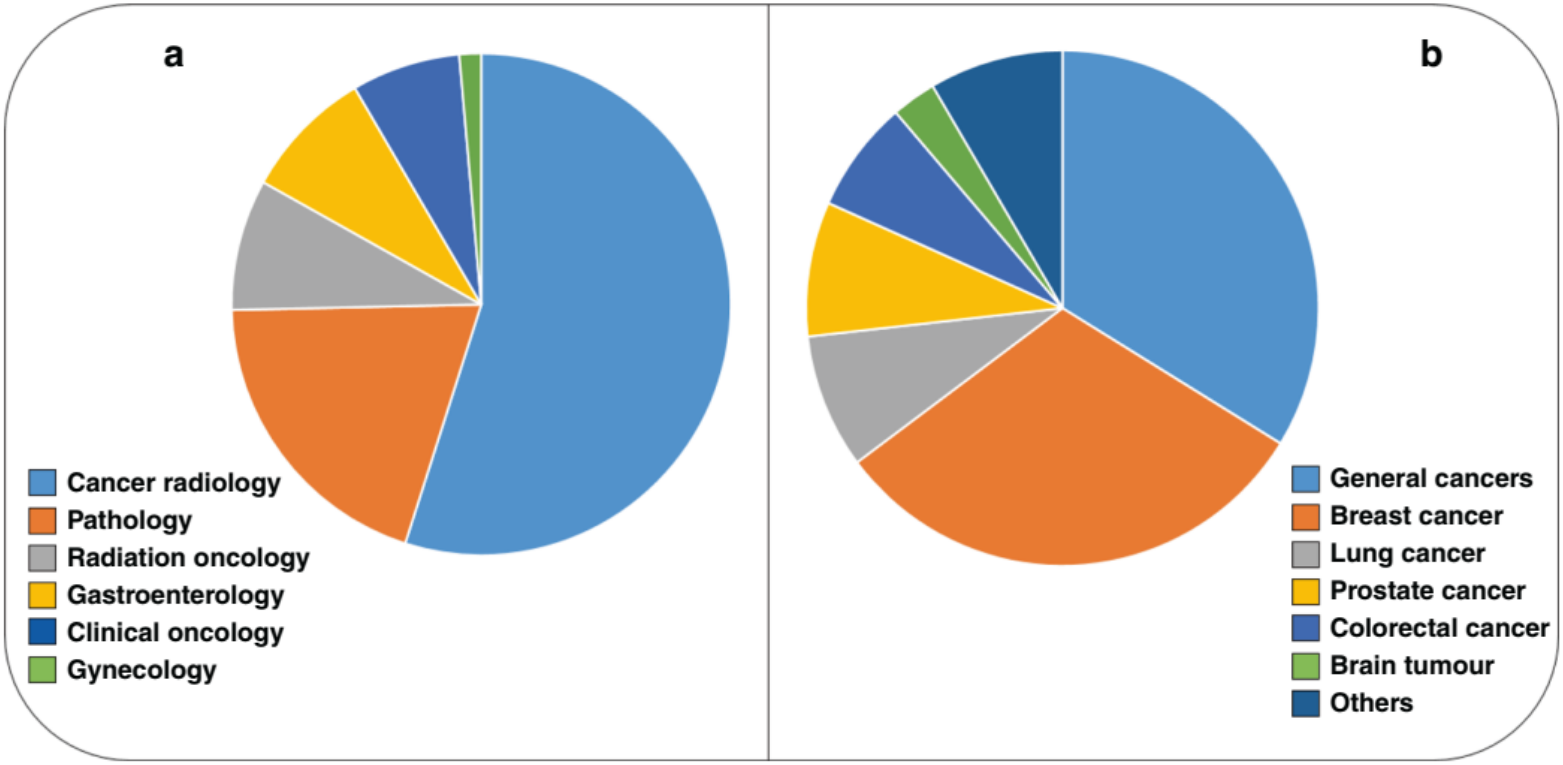
- Cancer is still a worrisome public health concern
- Cancer has the largest number of clinically relevant mutations and the most multimodality treatment options
- Oncology has the greatest need for individualized care, given the numerous types of malignancy and the heterogeneity of presentations
- Applying artificial intelligence (AI) to sort out the complexities of medicine is a long-term desire

WHY ARTIFICIAL INTELLIGENCE

- AI consists of computer programs trying to simulate and reproduce human thinking and action (e.g., speaking, feeling, and reasoning)



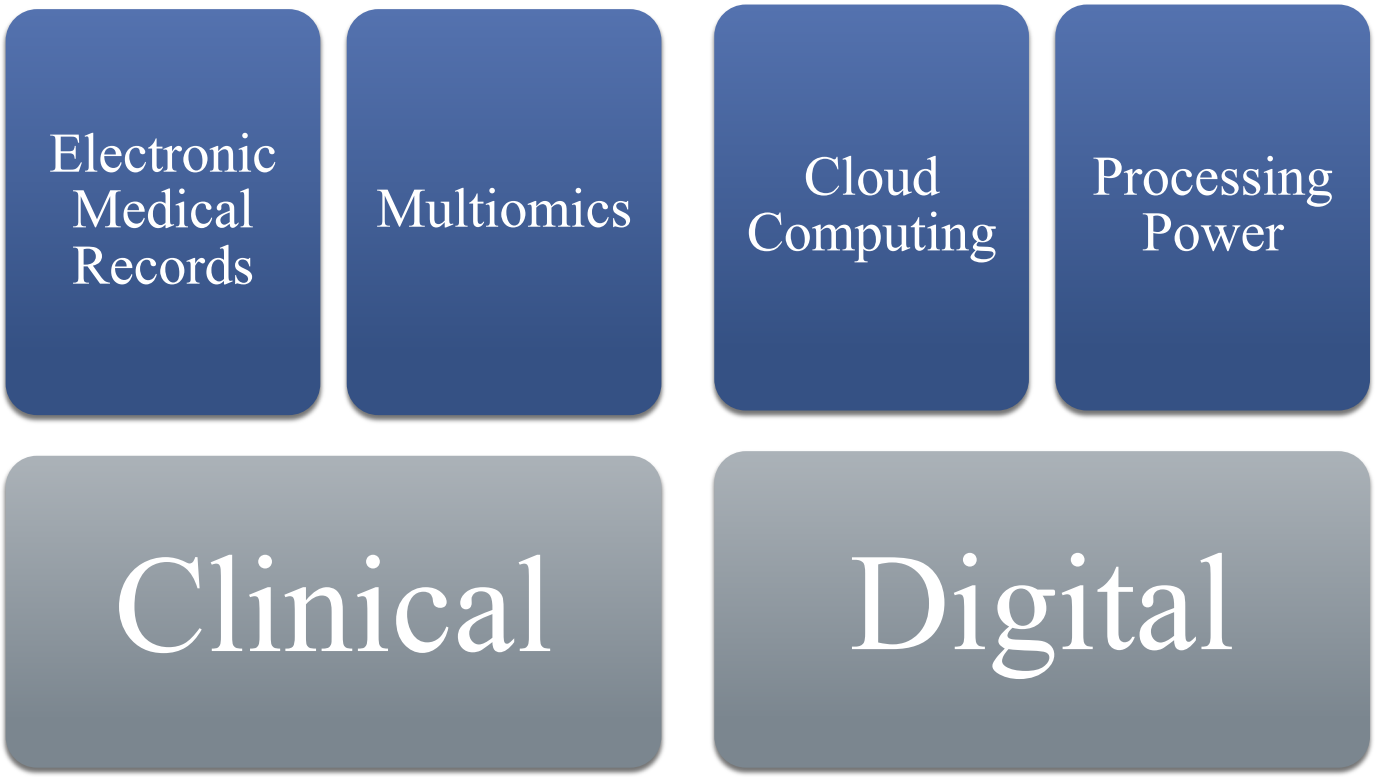
HOW AI HELPS

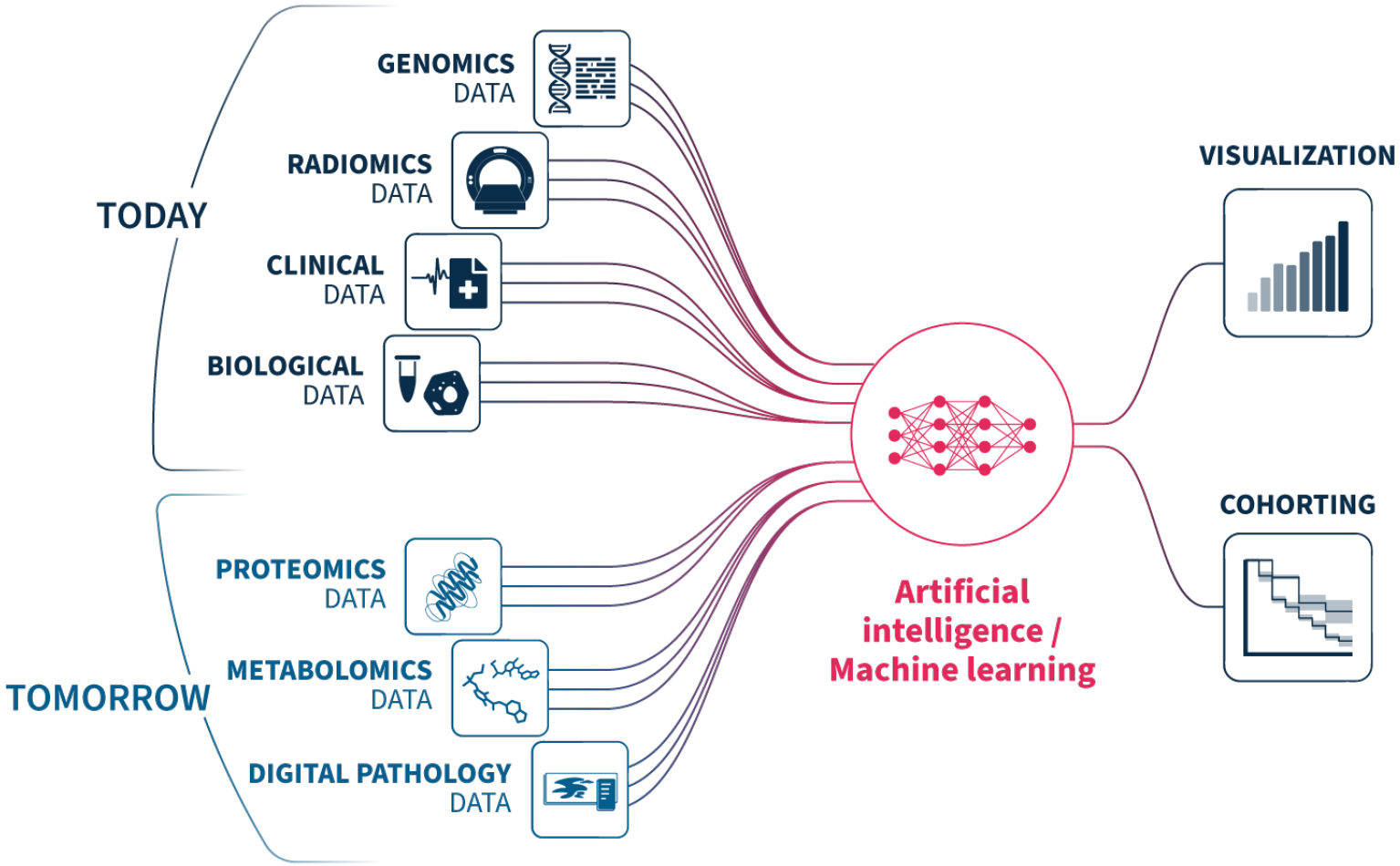

a
Cancer radiology
Pathology
Radiation oncology
Gastroenterology
Clinical oncology
Gynecology
b
General cancers
Breast cancer
Lung cancer
Prostate cancer
Colorectal cancer
Brain tumour
Others

HOW AI HELPS

- Never become distracted, forgetful, or tired
- Duplicate and preserve the expertise of scarce or retiring experts
- Create consistency in decision making
- Improve the decision-making skills of nonexperts

HOW AI HELPS


Electronic Medical Records
Multiomics
Cloud Computing
Processing Power
Clinical
Digital


TODAY
GENOMICS DATA
RADIOMICS DATA
CLINICAL DATA
BIOLOGICAL DATA
TOMORROW
PROTEOMICS DATA
METABOLOMICS DATA
DIGITAL PATHOLOGY DATA
Artificial intelligence / Machine learning
VISUALIZATION
COHORTING

AI APPLICATIONS IN ONCOLOGY

- Image Analysis
- Virtual Biopsy
- Early Diagnosis
- WB Pan-Cancer Detection
- Genome Sequencing
- NLP
- Clinical Decision Support Sys

AI APPLICATIONS IN ONCOLOGY

- Patient-facing chat bots
- Augmented reality surgical visualization tools
- Surgical robotics
- Hospital scheduling systems
- Surveillance systems
- Tele-medicine

SURGERY: robotic sugery (da Vinci surgery robot)

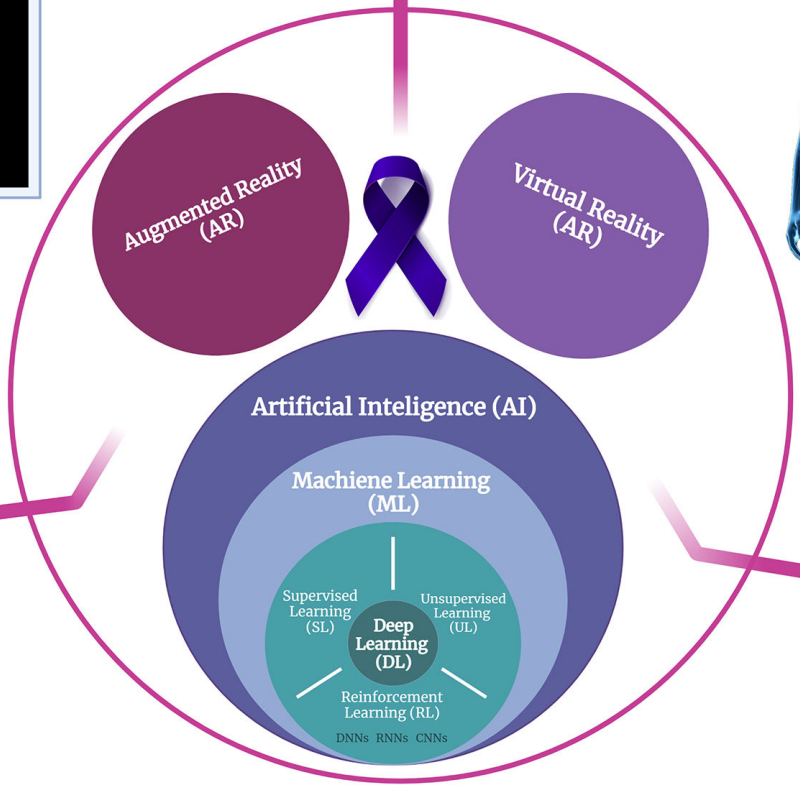
CHEMOTHERAPY: automated preparation of personalized therapy (APOTECAchemo automated system)

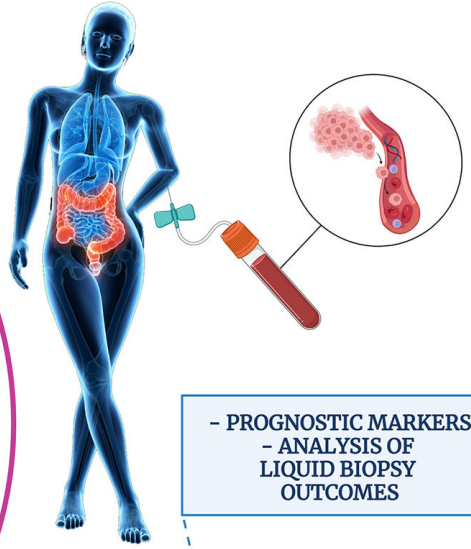
RESEARCH: drug navigation (NamiRobot)

TREATMENT

IMAGISTIC PROCEDURES
PATHOLOGY
GENOMIC DATA ANLYSIS

DIAGNOSTIC





- PROGNOSTIC MARKERS
- ANALYSIS OF LIQUID BIOPSY OUTCOMES

PROGNOSTIC

AI APPLICATIONS IN ONCOLOGY

frontiers in Oncology

Development and external validation of a transfer learning-based system for the pathological diagnosis of colorectal cancer: a large emulated prospective study

Our transfer learning approach has successfully yielded an algorithm that can be validated for CRC histological localizations in whole slide imaging. The outcome advocates for the integration of the AI system into histopathological diagnosis, serving either as a diagnostic exclusion application or a computer-aided detection (CADe) tool. This integration has the potential to alleviate the workload of pathologists and ultimately benefit patients.

AI APPLICATIONS IN ONCOLOGY

Longitudinal ultrasound-based AI model predicts axillary lymph node response to neoadjuvant chemotherapy in breast cancer: a multicenter study

The model also enhanced sonographer's diagnostic ability, increasing accuracy from 71.9% to 79.2%. The deep learning radiomics model accurately predicted the ALN response to NAC in breast cancer. Furthermore, the model will assist sonographers to improve their diagnostic ability on ALN status before surgery.

AI APPLICATIONS IN ONCOLOGY

Clinical Validation of Artificial Intelligence-Powered PD-L1 Tumor Proportion Score Interpretation for Immune Checkpoint Inhibitor Response Prediction in Non-Small Cell Lung Cancer

In comparing PD-L1 TPS assessed by AI analyzer and by pathologists, a significant positive correlation was observed (Spearman coefficient = 0.925; $P < .001$).

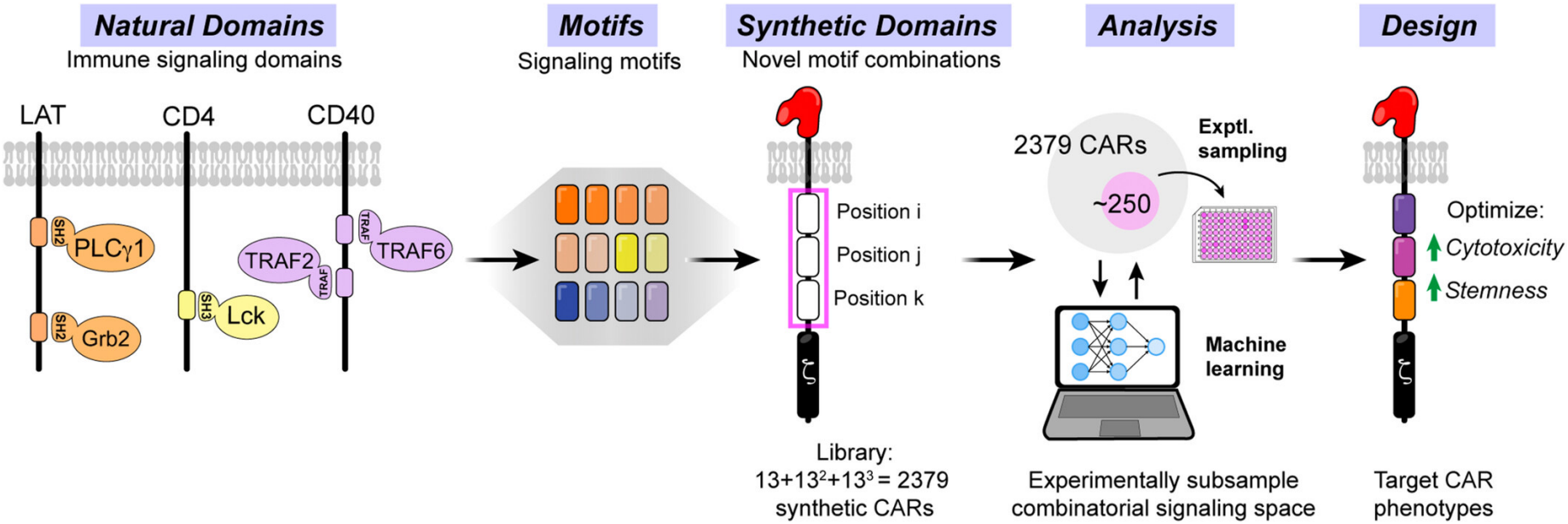
PD-L1 TPS assessed by AI analyzer correlates with that of pathologists, with clinical performance also being comparable when referenced to PFS. The AI model can accurately predict tumor response and PFS of ICI in advanced NSCLC via assessment of PD-L1 TPS.

AI IN CELLULAR THERAPY

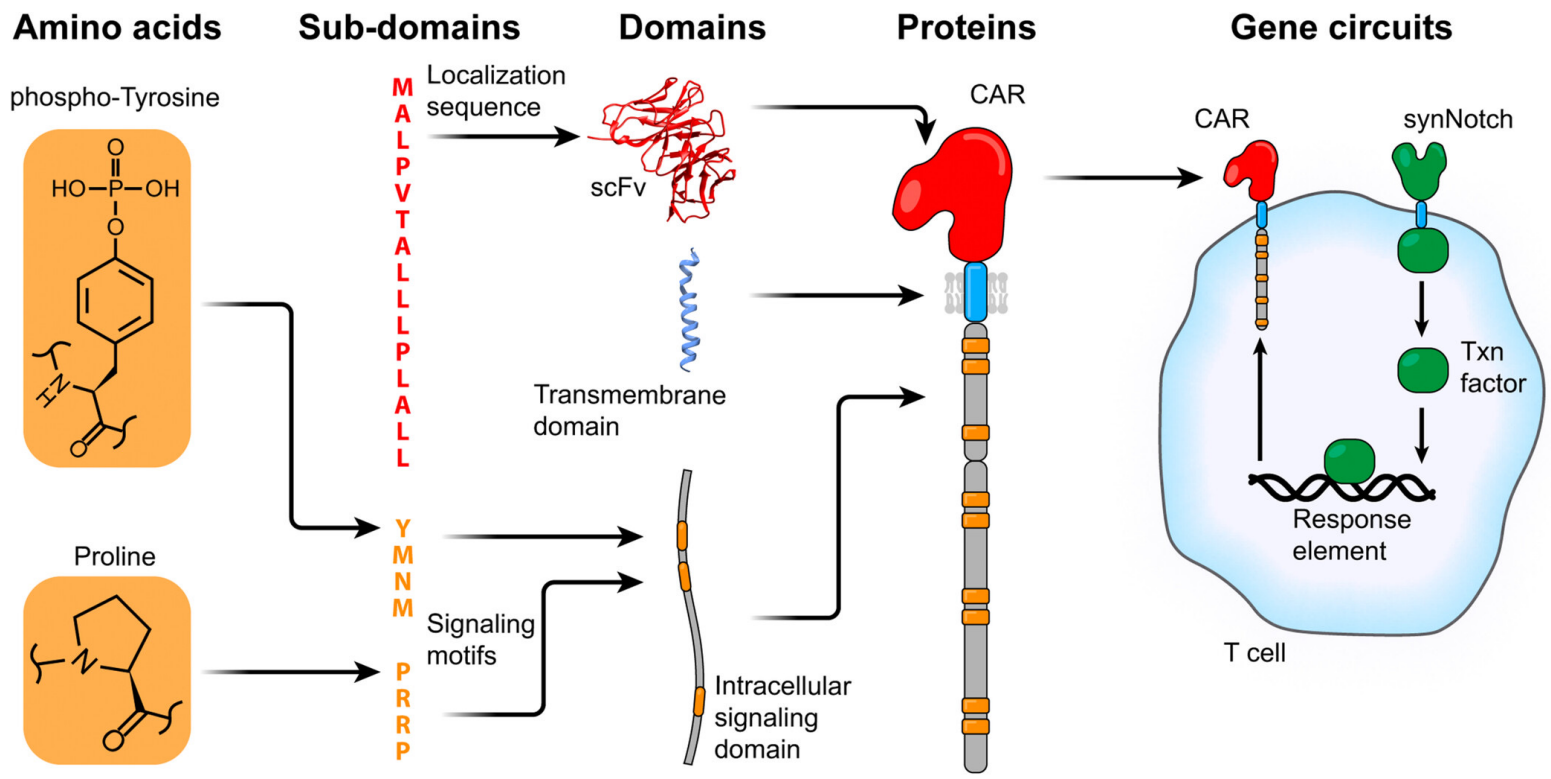
- Personalized medicine
- Tissue engineering

Biological challenges	Engineering challenges
Suitable cell source selection	Selection of biocompatible material
Provide repeatable cell differentiation	Optimal physicochemical & mechanical properties
Bioactive agent selection	Scaffold fabrication

AI IN CELLULAR THERAPY



AI IN CELLULAR THERAPY



AI IN CELLULAR THERAPY

- Cellular therapy

Cell source –patient matching

Administration optimization

Monitoring outcome

- Clinical trial design
- Patient monitoring

SOME CONSIDERATIONS

- Unorganized health records | No standardization
- Infrastructure & resources
- Black Box
- Legal / Ethical / Security matters

PROSPECTS

- External validation
- Adaptability
- Ultimate purpose of prevention, better OS, better QOL