Artificial Intelligence-Driven Anticancer Peptide Discovery

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Introduction

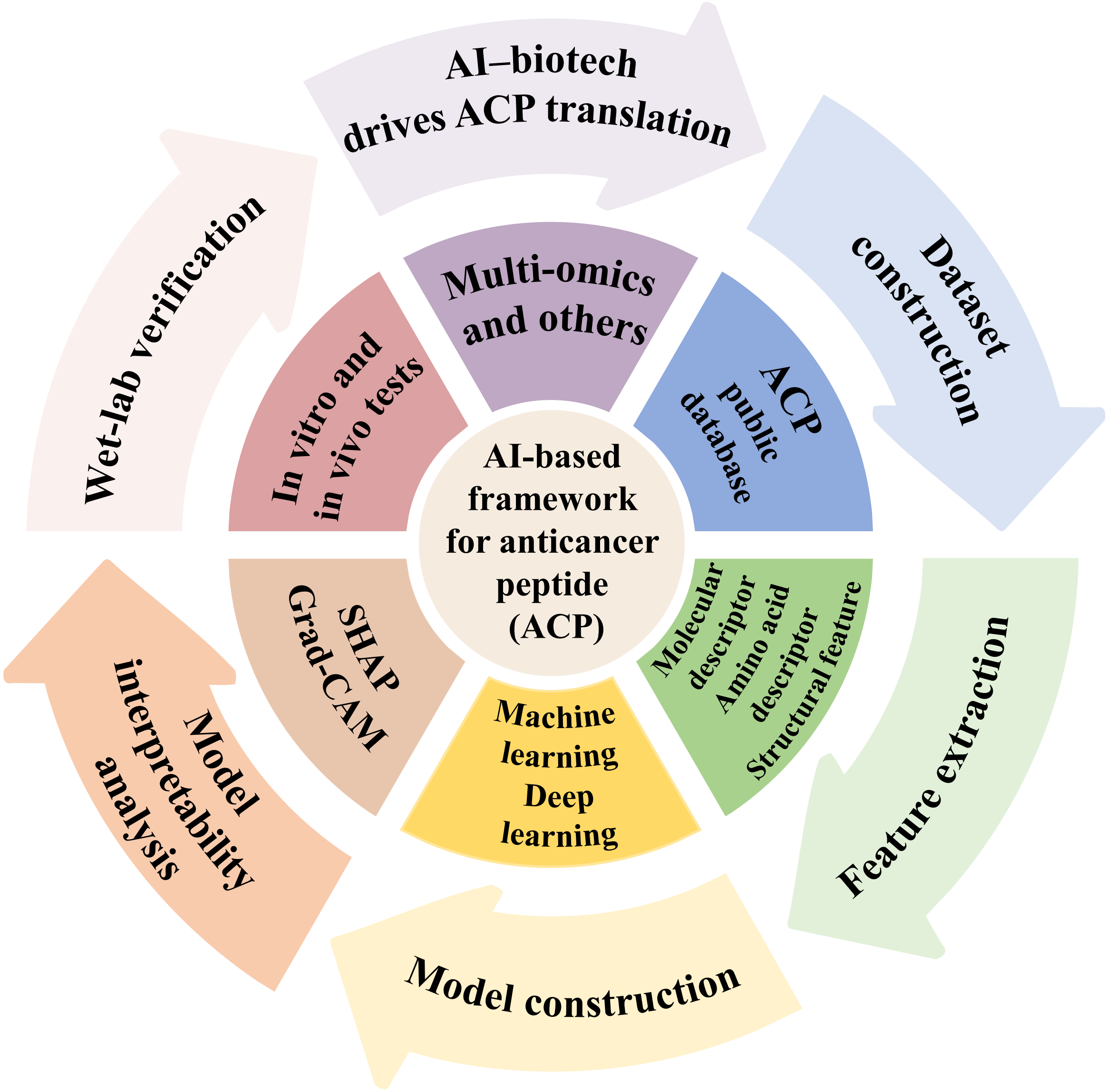

Table S1. Summary of 68 ACP prediction models

Model name	Dataset size	Feature extraction method	Model	Interpretability
-	Positive: 650 Negative: 650	one-hot encoding physicochemical properties	2D CNN	-
G-ACP	Positive: 468 Negative: 600	PAAC	Extra Trees (ET)	-
-	Positive: 1151 Negative: 1139	Extended Dipeptide Composition (EDPC)	SVM Decision Tree RF KNN	-
ACP_DA	Positive: 859 Negative: 859	Ordinal Encoding (OE) AAC DPC Grouped Tripeptide Encoding	Light Gradient Boosting Machine (LGBM)	SHAP
ACPScanner	Positive: 551 Negative: 150	SVMProt-188D NetSurfP-3.0 ESM-1b PEP-FOLD3	LGBM-GAT	SHAP

Highlights

1. Summarized 68 anticancer peptide (ACP) models.

2. Artificial Intelligence (AI) interpretability and wet-laboratory validation enhance ACP mining trustworthiness.

3. AI combined with multi-omics and biotechnologies drives ACP clinical translation.

4. Summarized a comprehensive AI-driven ACP screening framework.

The establishment process of the ACP AI model

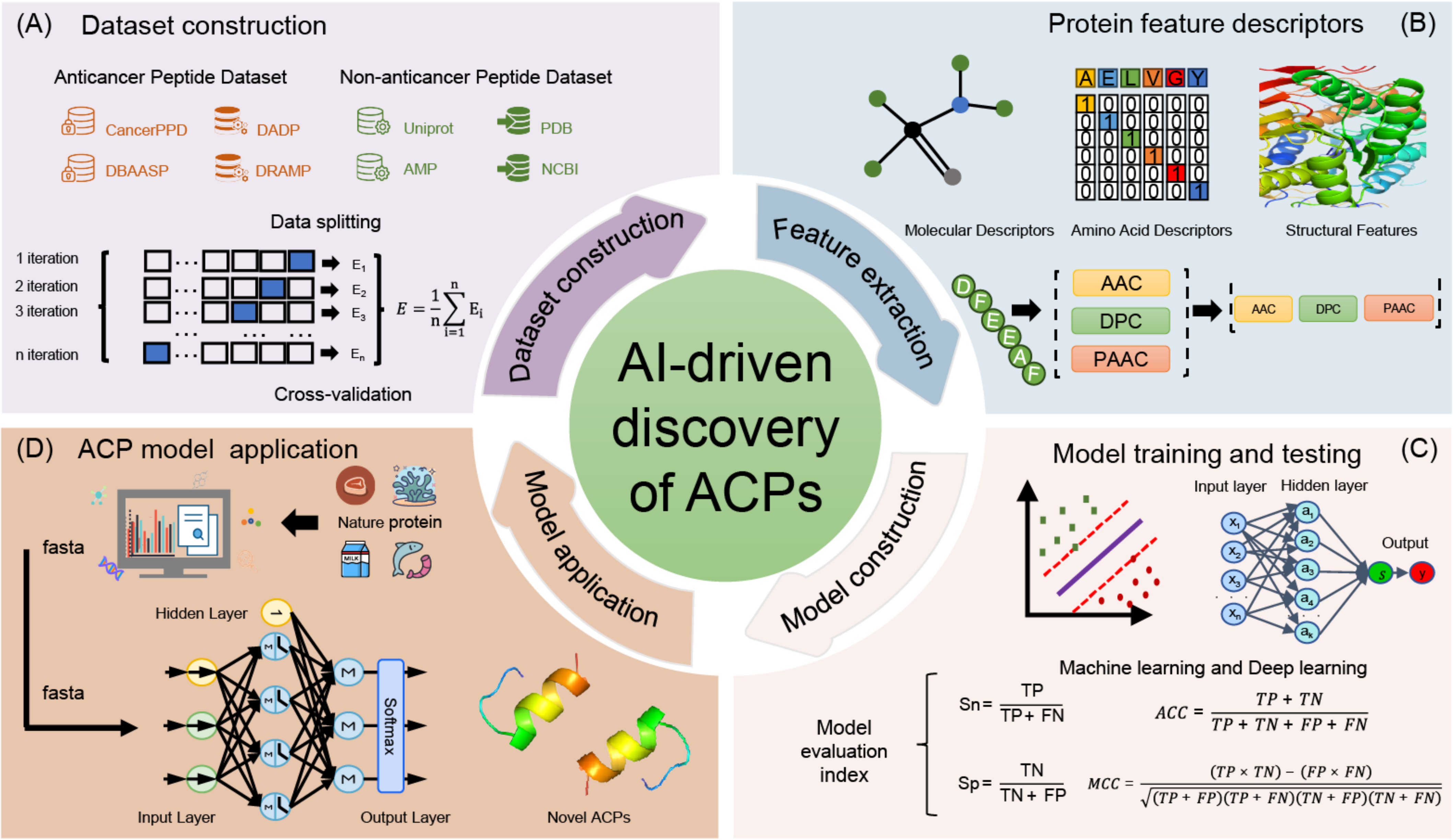

Figure 1. The establishment process of the ACP AI model.

Examples of commonly used traditional ML algorithms for ACP models

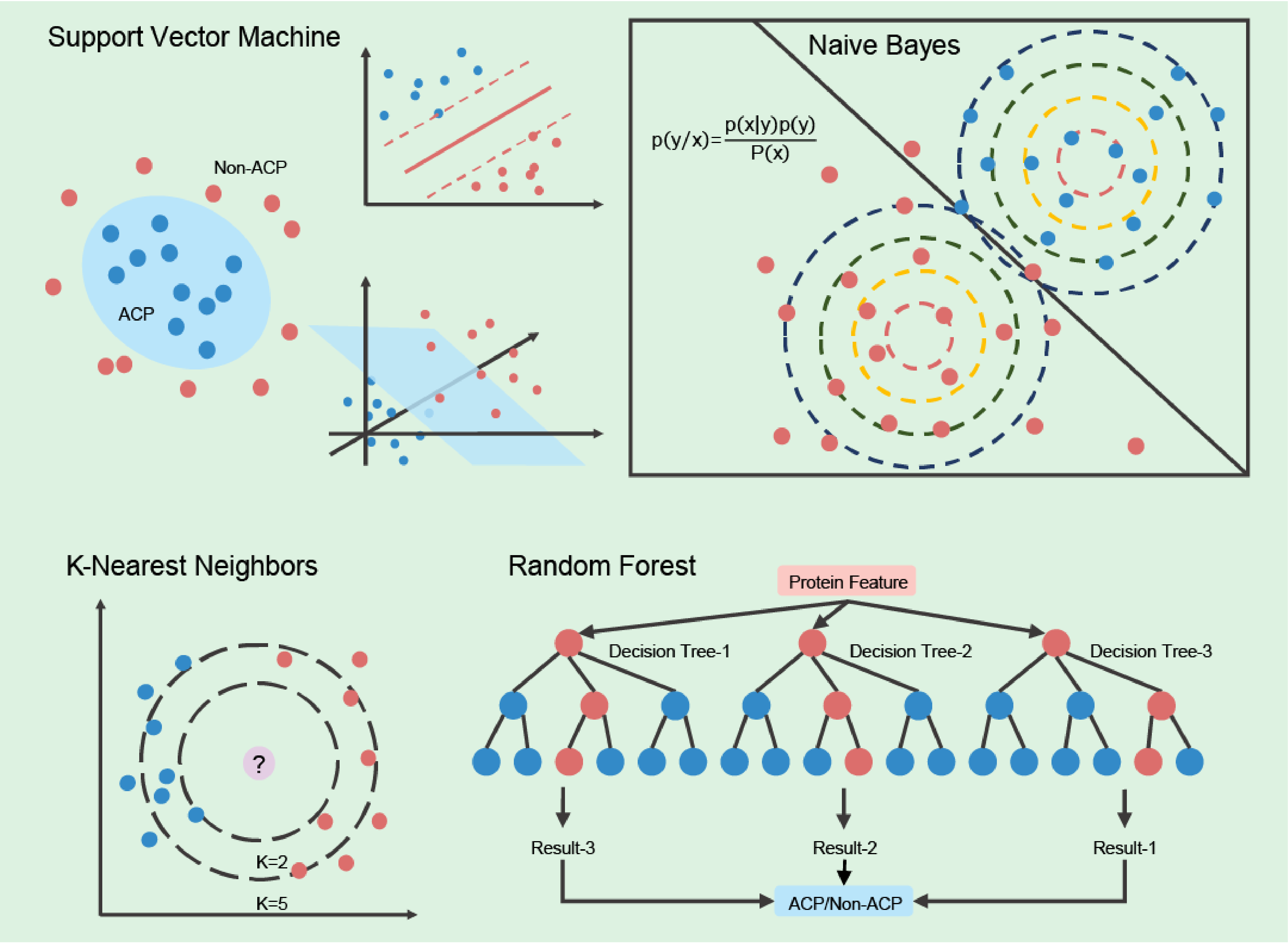

Figure 2. Examples of commonly used traditional ML algorithms for ACP models

Examples of commonly used deep learning algorithms for ACP models

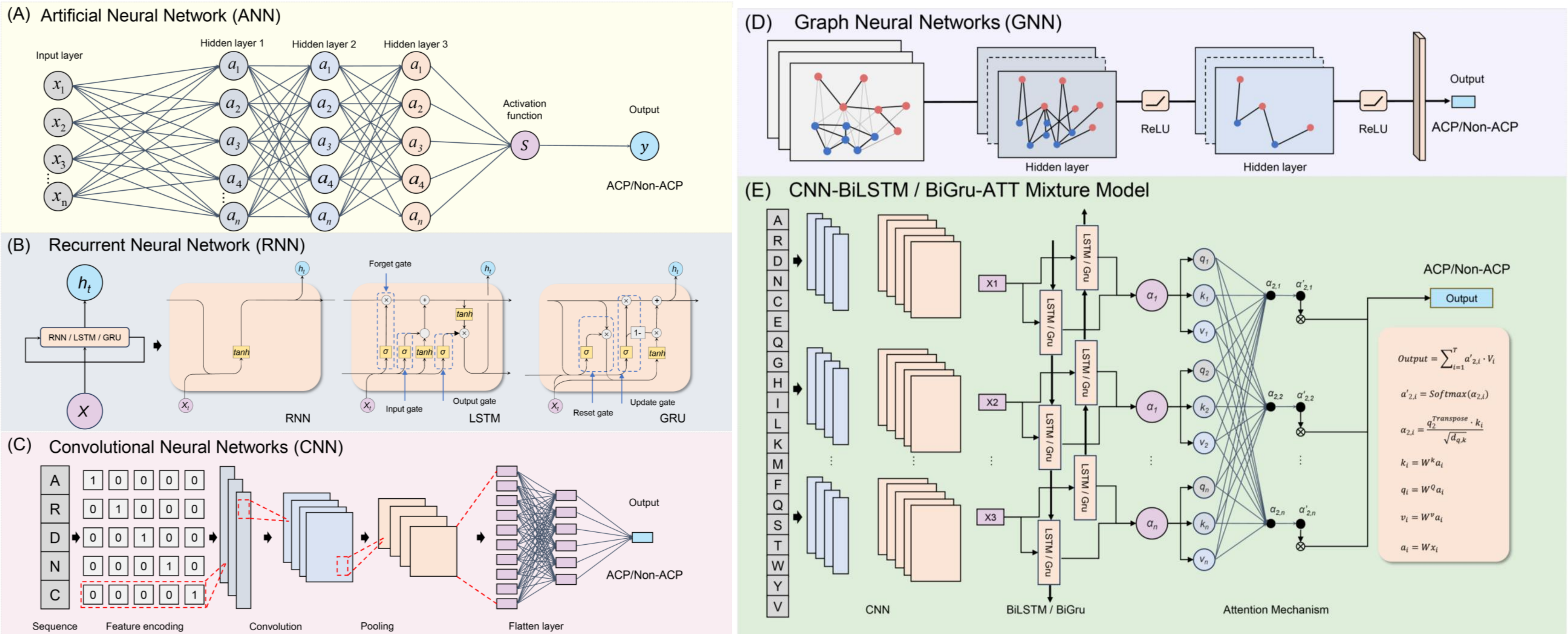

Figure 3. Examples of commonly used deep learning algorithms for ACP models

Schematic of AI interpretability analysis

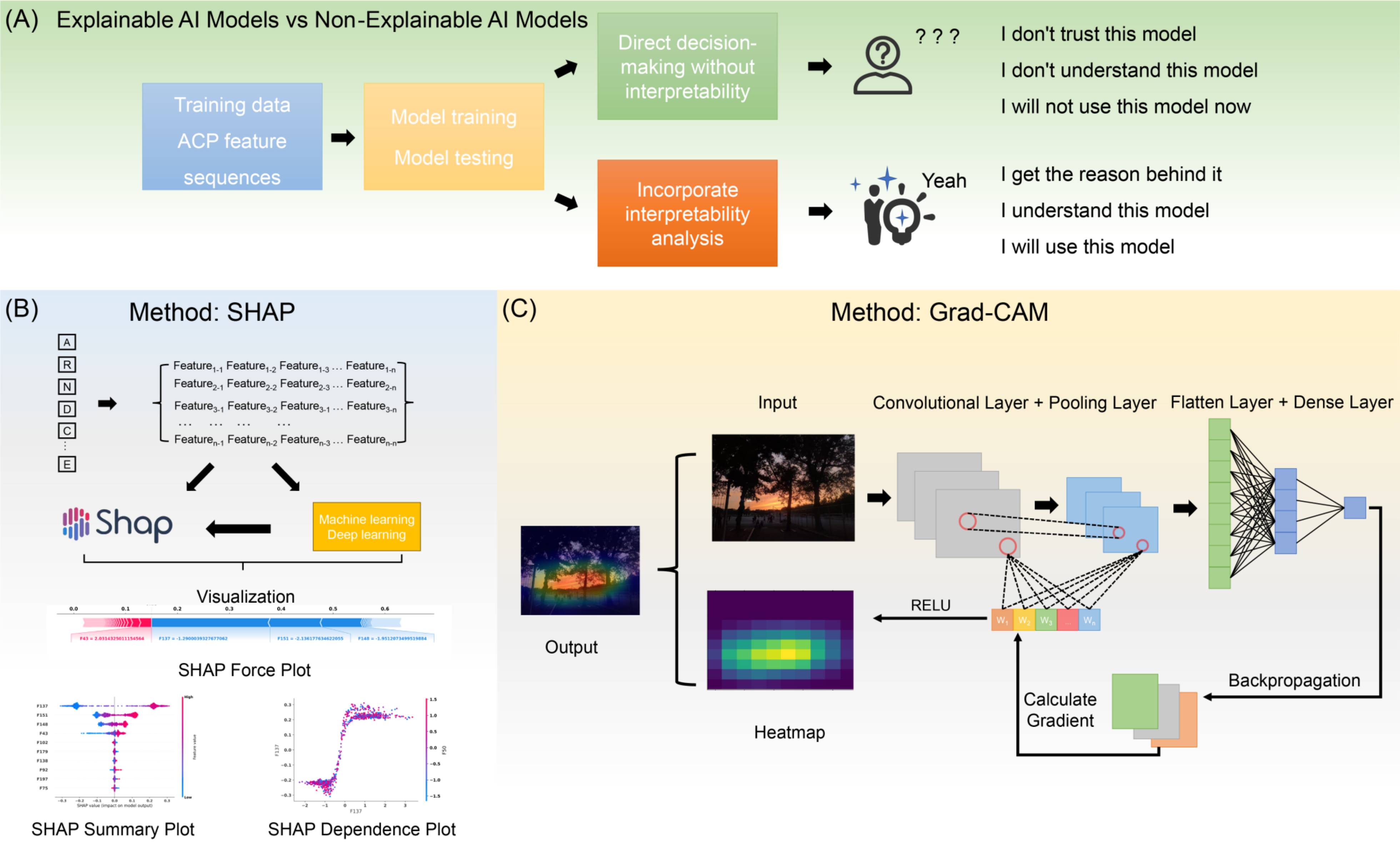

Figure 4. Schematic of AI interpretability analysis

Integrating AI-selected peptides with multi-omics technologies and other biotechnologies

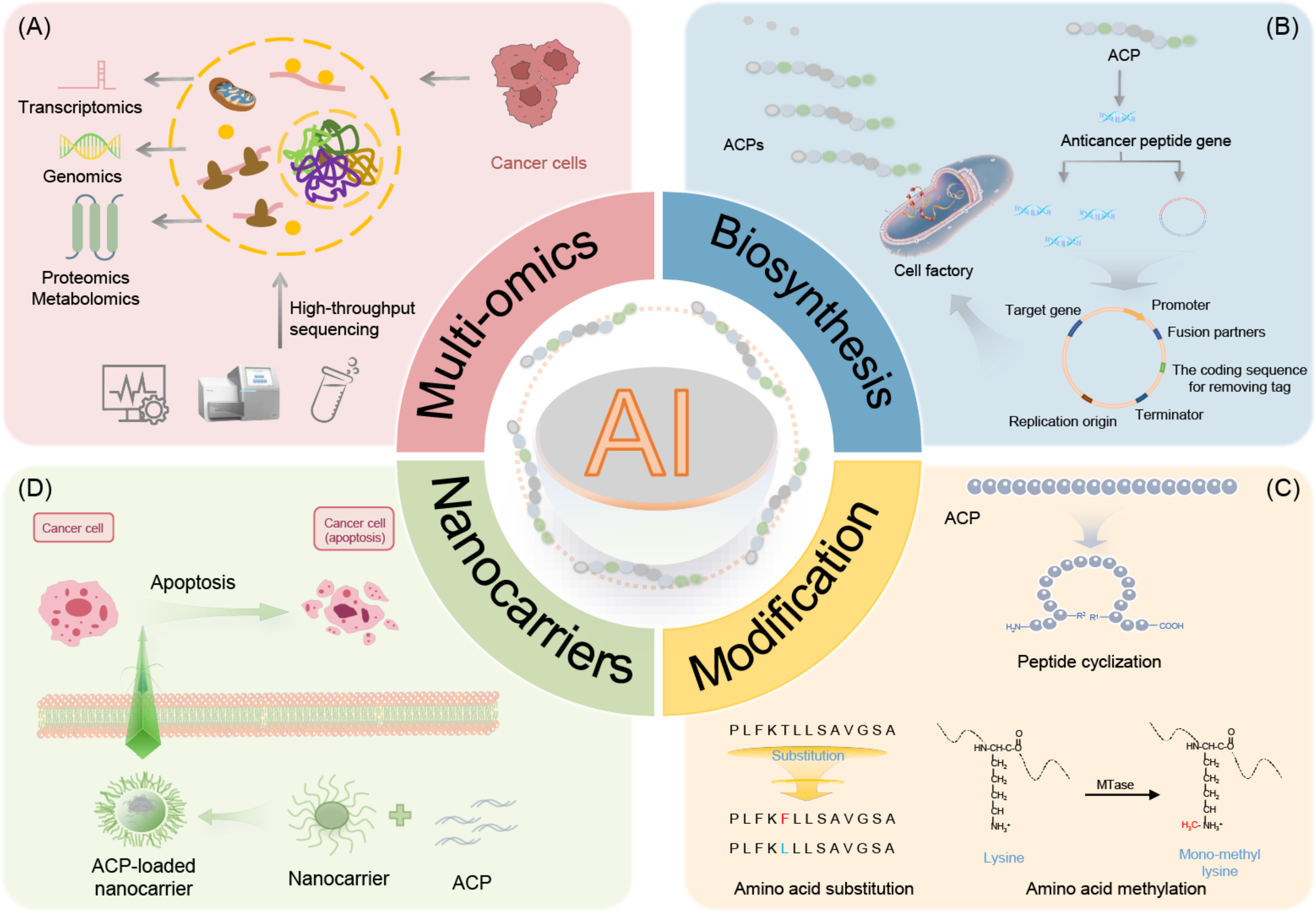

Figure 5. Integrating AI-selected peptides with multi-omics technologies and other biotechnologies

Comprehensive AI-based ACP screening framework

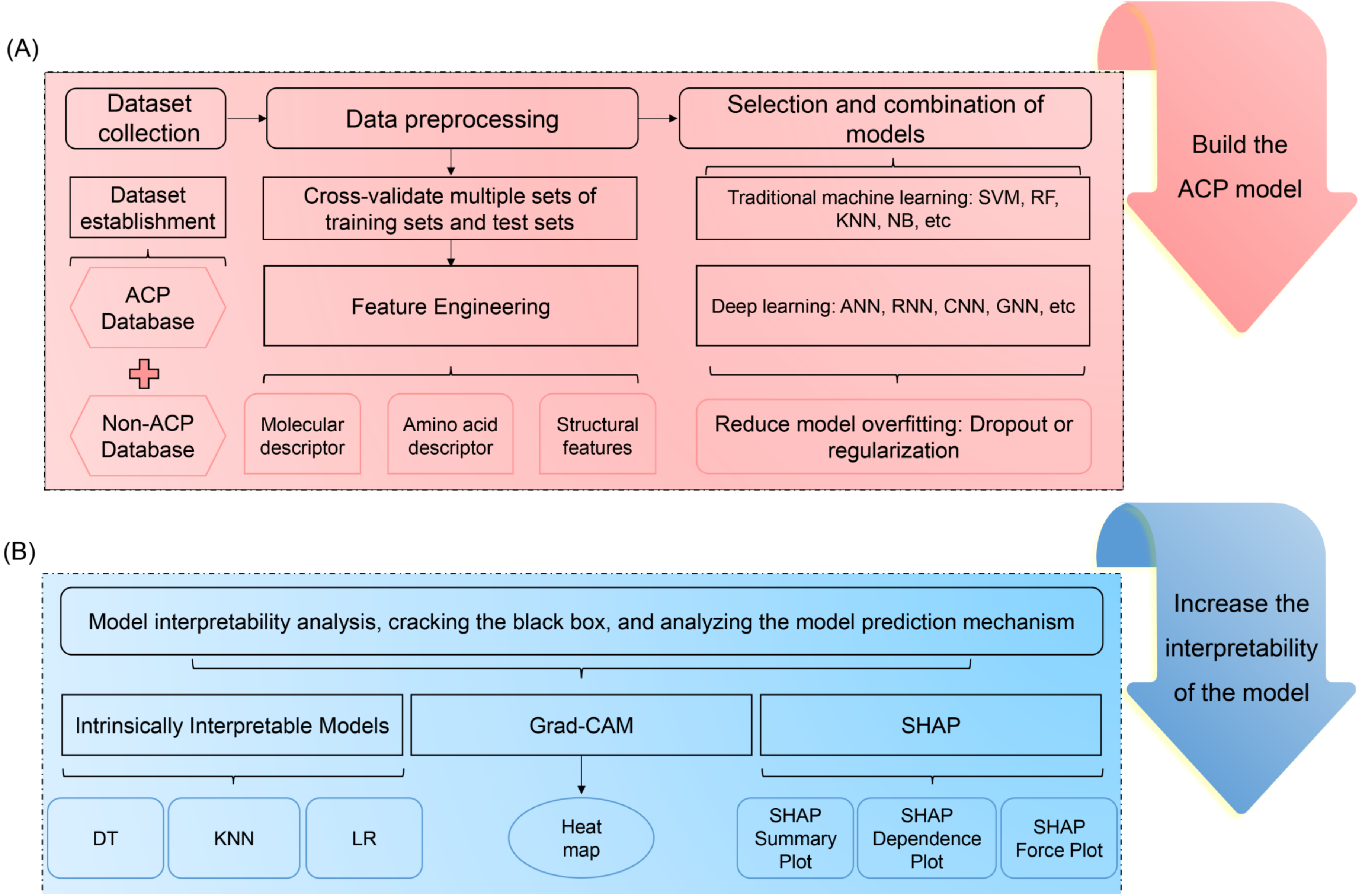

Figure 6. Illustrative diagram of the AI-driven comprehensive framework for ACP screening

Comprehensive AI-based ACP screening framework

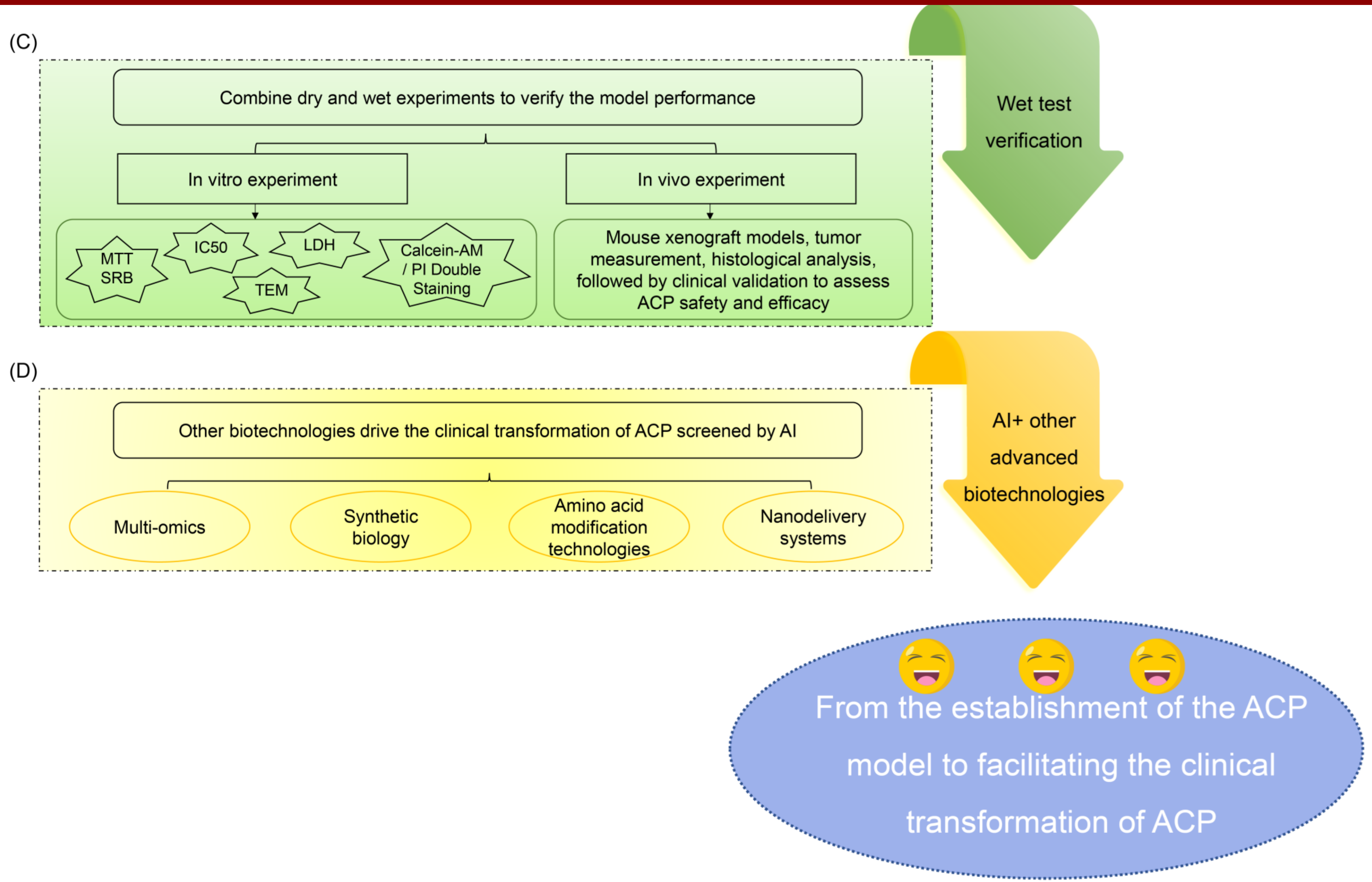

Figure 6. Illustrative diagram of the AI-driven comprehensive framework for ACP screening

Summary

- To outline a complete AI-based ACP screening framework, we detailed the summary of 68 ACP models. Based on the training processes and limitations of these 68 models, we presented a comprehensive ACP screening framework that includes dataset collection and organization, feature extraction, model training and optimization, interpretability analysis, and wet-laboratory validation.
- Additionally, this framework integrates multi-omics, synthetic biology, amino acid modification technologies, and nanocarrier technologies to facilitate the process from model development to clinical application. These technologies should be integrated to increase the biological activity, structural stability, and manufacturability of AI-selected ACPs.
- In conclusion, AI-driven ACP discovery holds great potential. It can expedite peptide screening and functional prediction, significantly enhancing the efficiency and accuracy of novel peptide-based anticancer drug development, thereby offering more diverse and effective treatment options for cancer.

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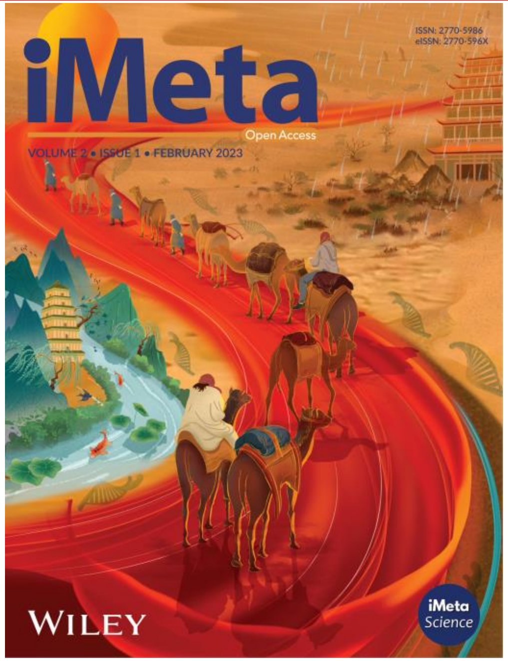

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