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TOWARDS PRECISION HEALTH: HARNESSING MULTI-MODAL EXPLAINABLE AI

AI+X SUMMIT 02.10.2025

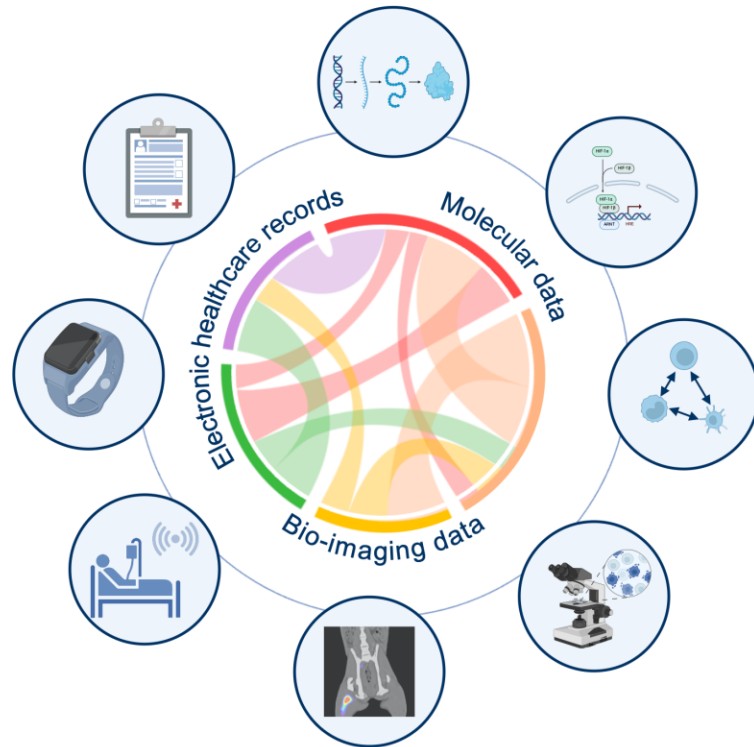


Customized AI for your needs

We tailor predictive AI solutions by integrating and contextualizing multi-modal data to accelerate innovation in Life Sciences.



CUSTOMIZED AI SOLUTIONS

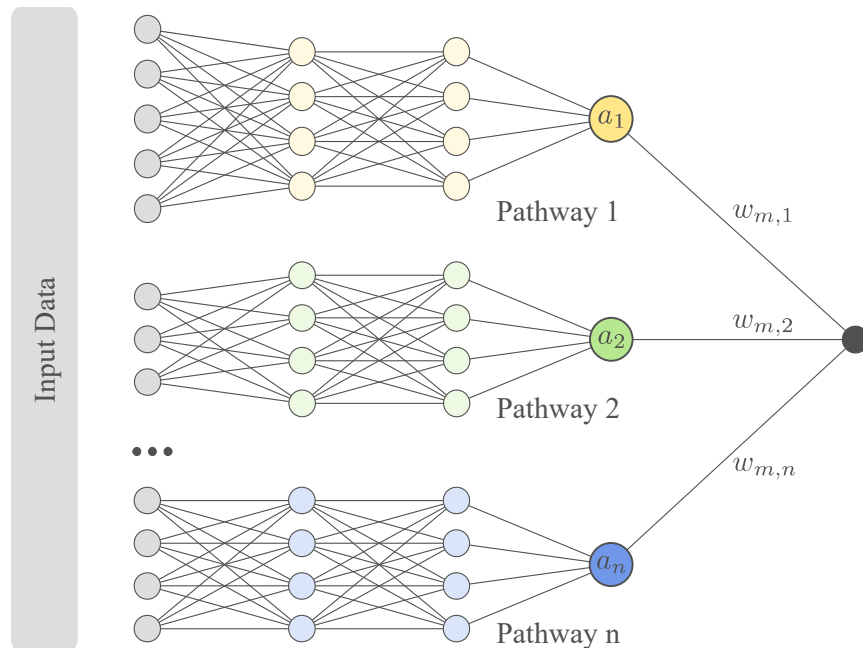


Interpretable and explainable

INTERPRETABLE AND EXPLAINABLE AI

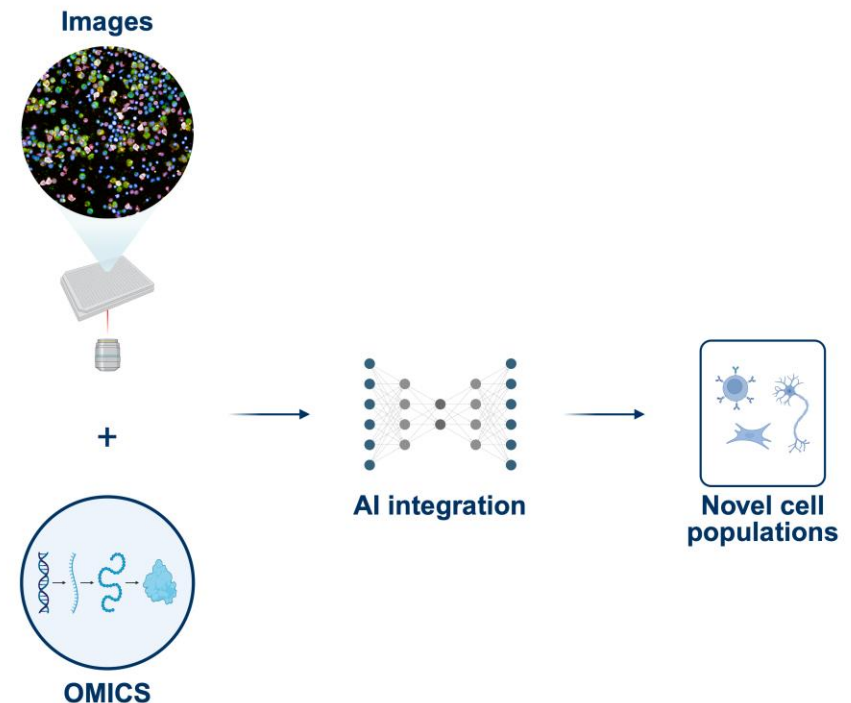
Interpretable AI

The model is **understandable by design**.



Explainable AI

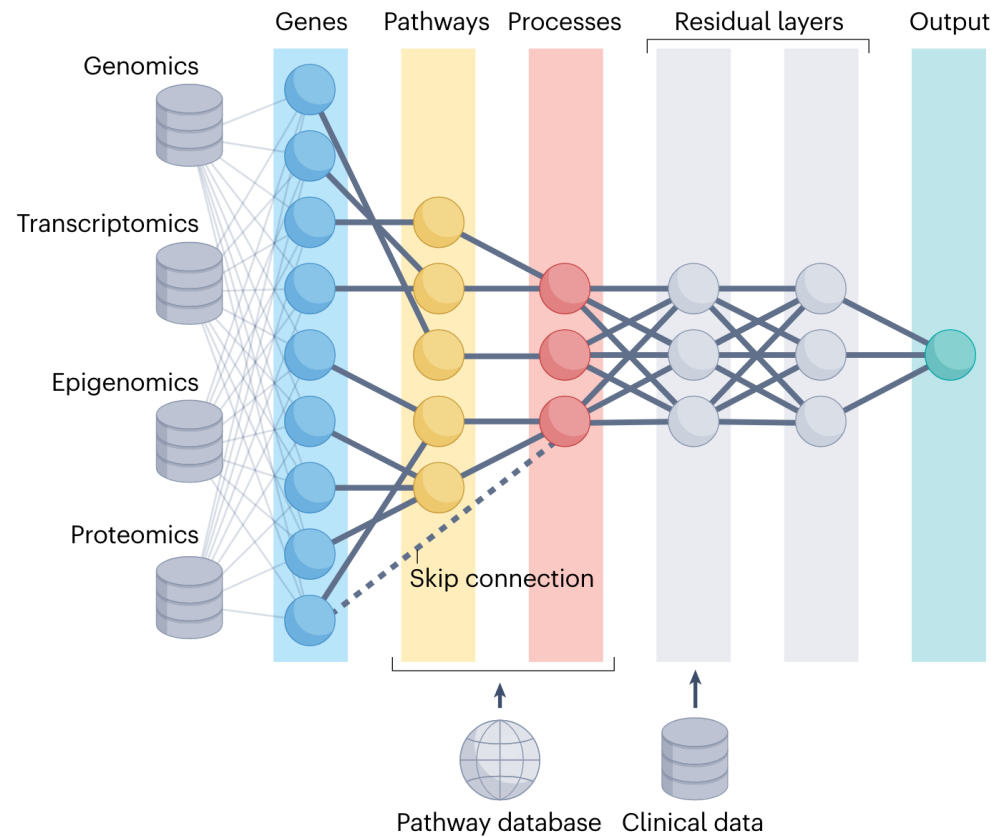
The model is a “black box” by nature, but we apply **post-hoc methods** to generate explanations.



Use-case 1

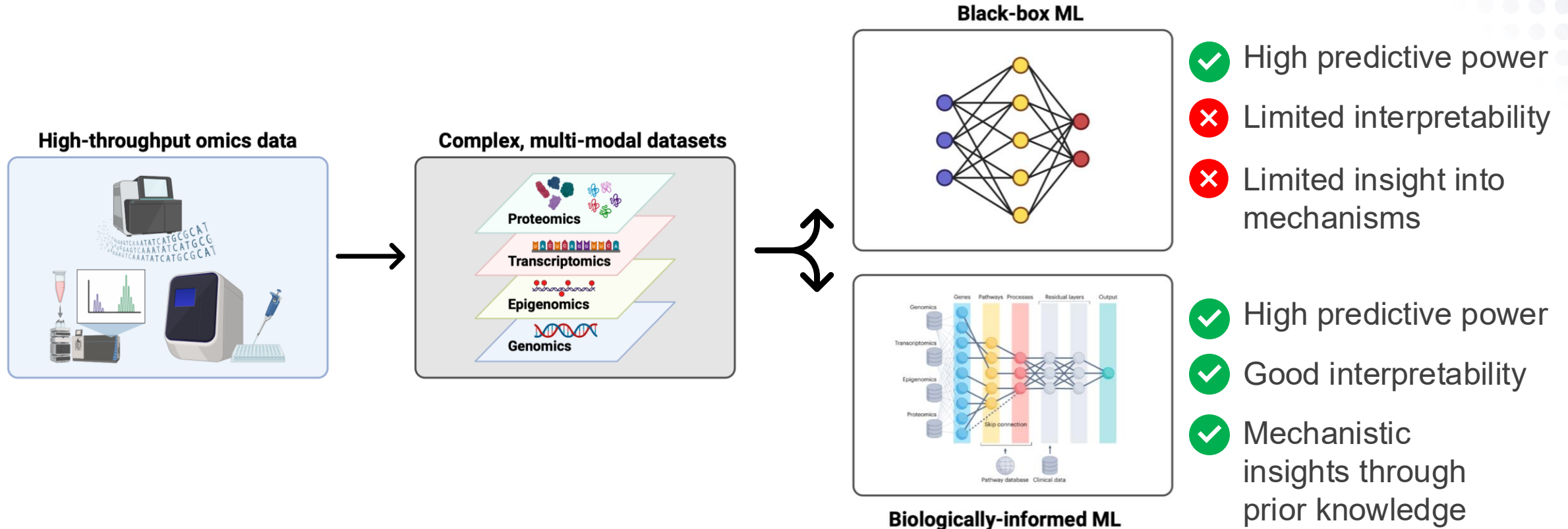
Biologically-informed AI

BIOLOGICALLY-INFORMED NEURAL NETWORKS



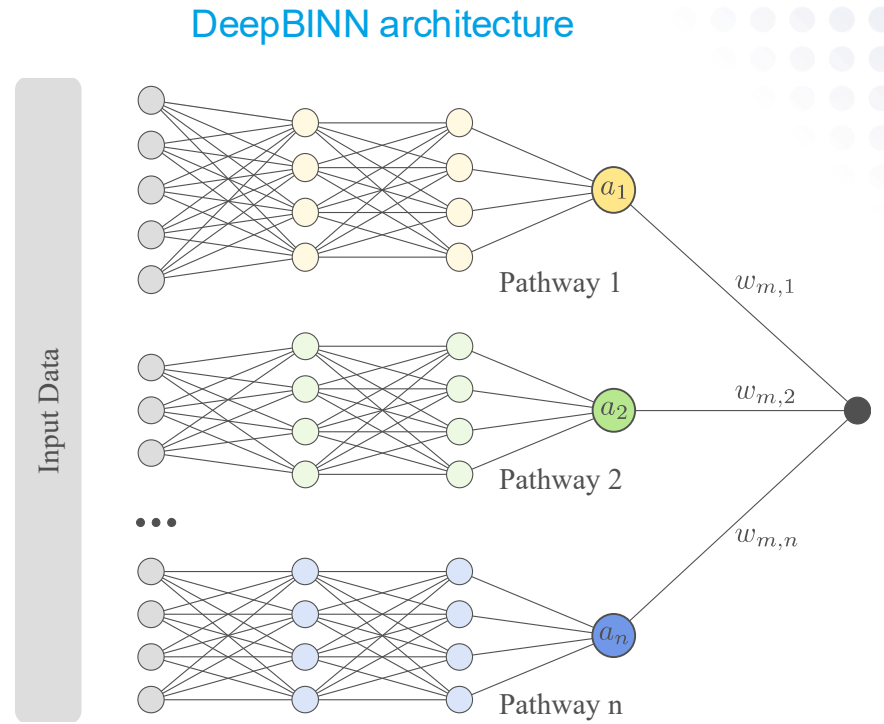
By integrating prior biological knowledge, BINNs **reduce model complexity** and help **derive biologically meaningful interpretations** at different biological scales

AI ARCHITECTURES SHAPED BY BIOLOGICAL KNOWLEDGE

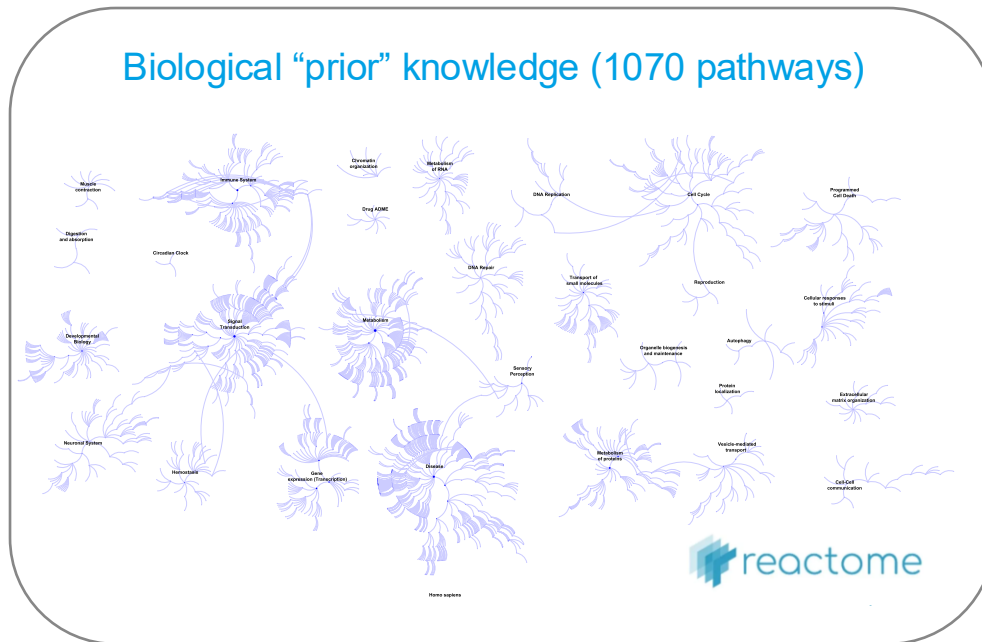


Biologically-informed neural networks (BINNs) overcome bottlenecks in standard ML models while maintaining flexibility in dealing with complex biological data

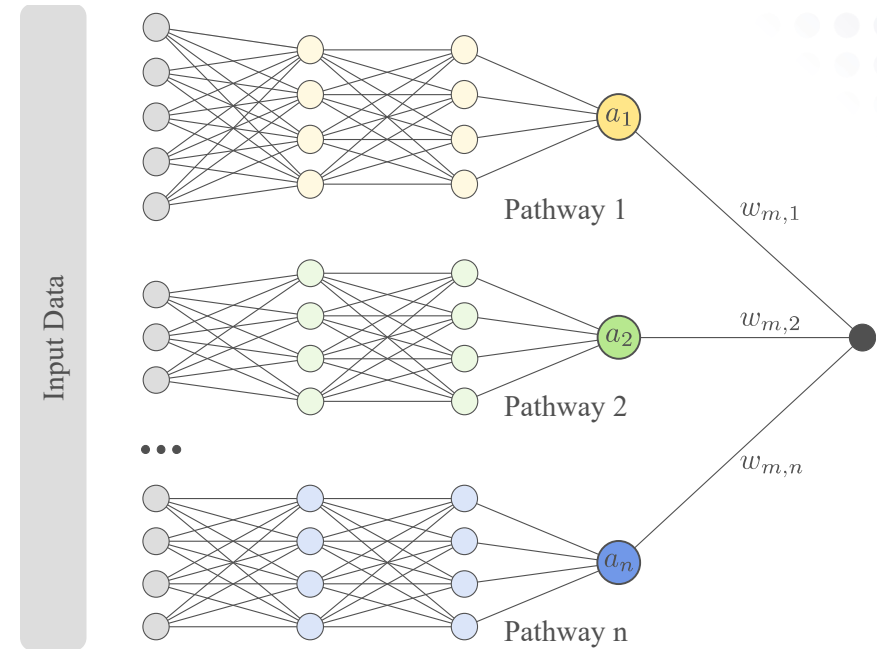
DEEPBINN – A CASE STUDY



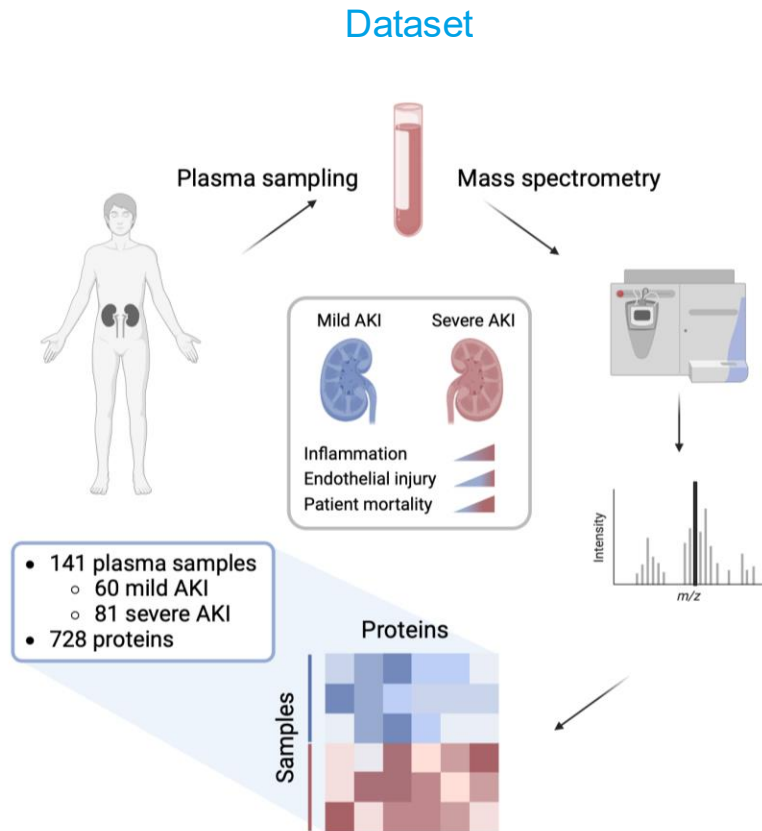
DEEPBINN – A CASE STUDY



DeepBINN architecture

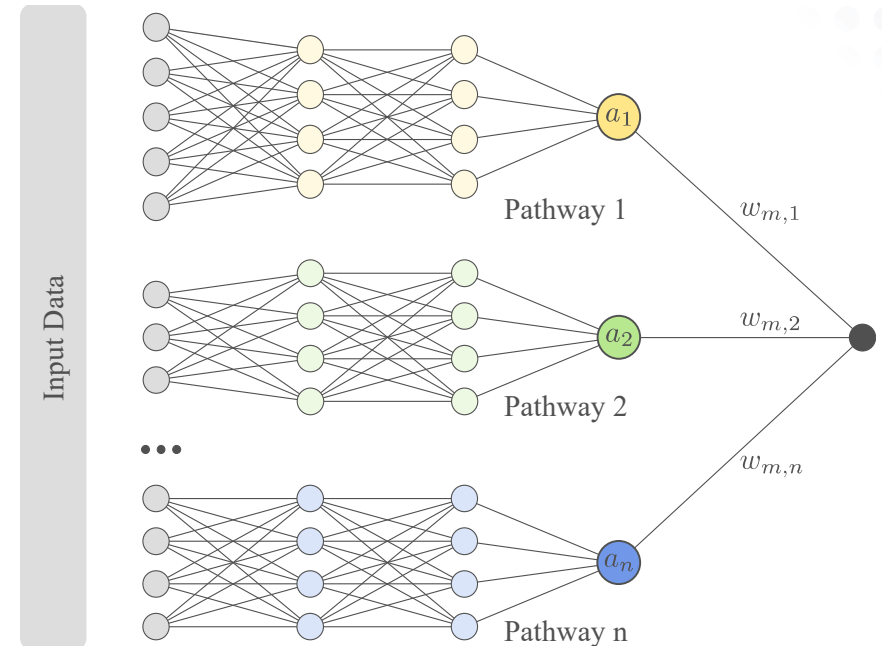


ACCURATE AND INTERPRETABLE CLASSIFICATION OF ACUTE KIDNEY INJURY (AKI)



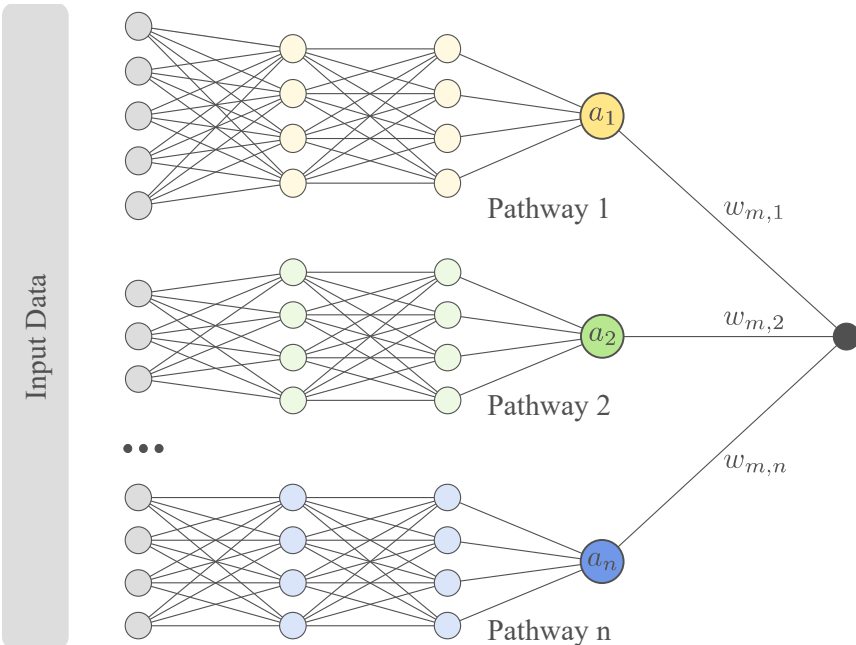
Dataset by Scott et al., Commun. Biol. 2023

DeepBINN architecture

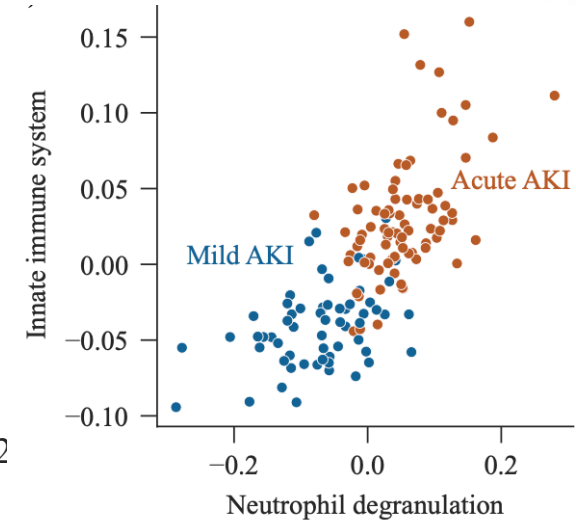
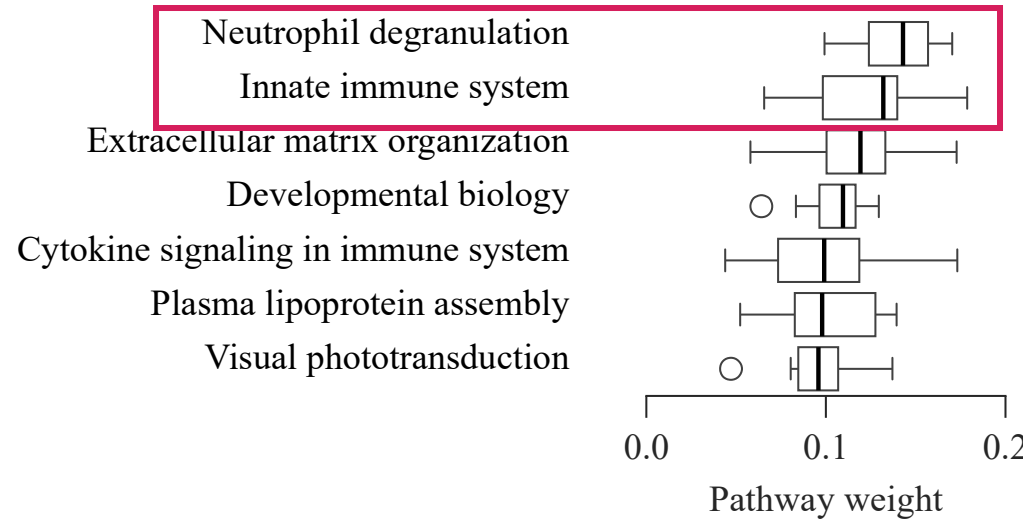


ACCURATE AND INTERPRETABLE CLASSIFICATION OF ACUTE KIDNEY INJURY (AKI)

DeepBINN architecture



Pathway activation



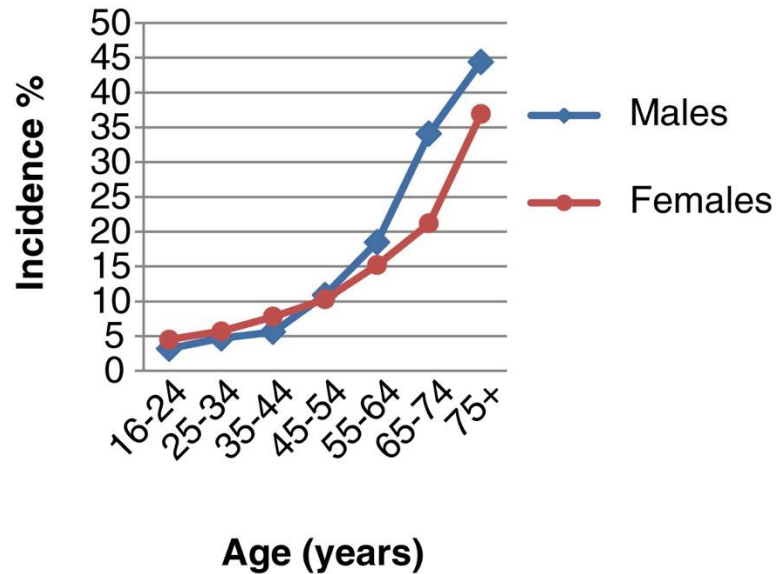
Best Short
Paper Award
SDS2024

IEEE SWISS CONFERENCE
ON DATA SCIENCE

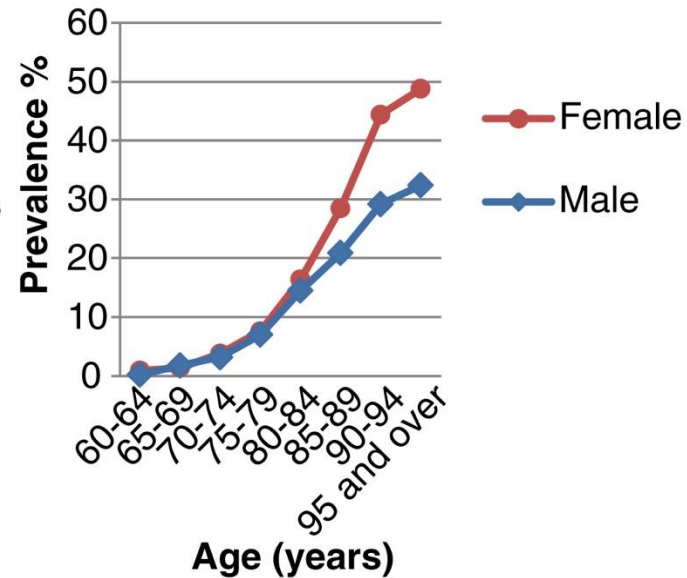
Use-case 2 **Personalized immune-rejuvenation**

AGE IS A KEY RISK FACTOR FOR DISEASE AND DISABILITY

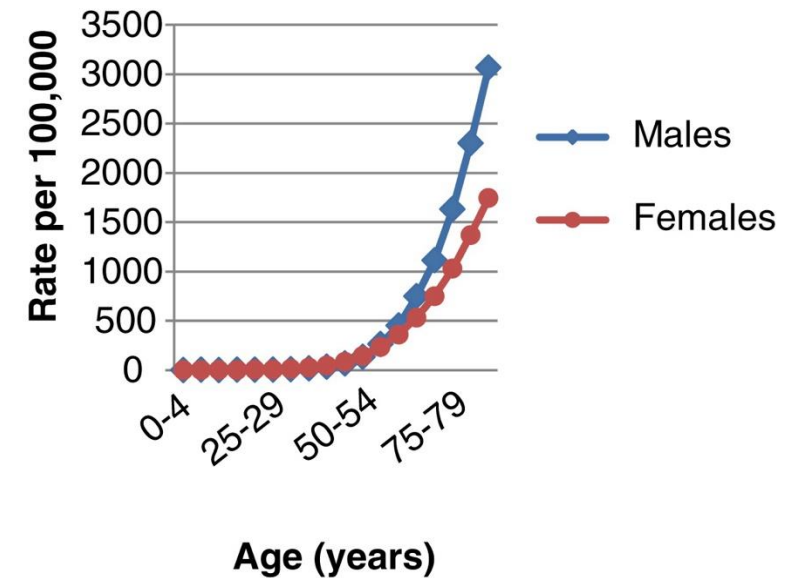
England cardiovascular disease rates



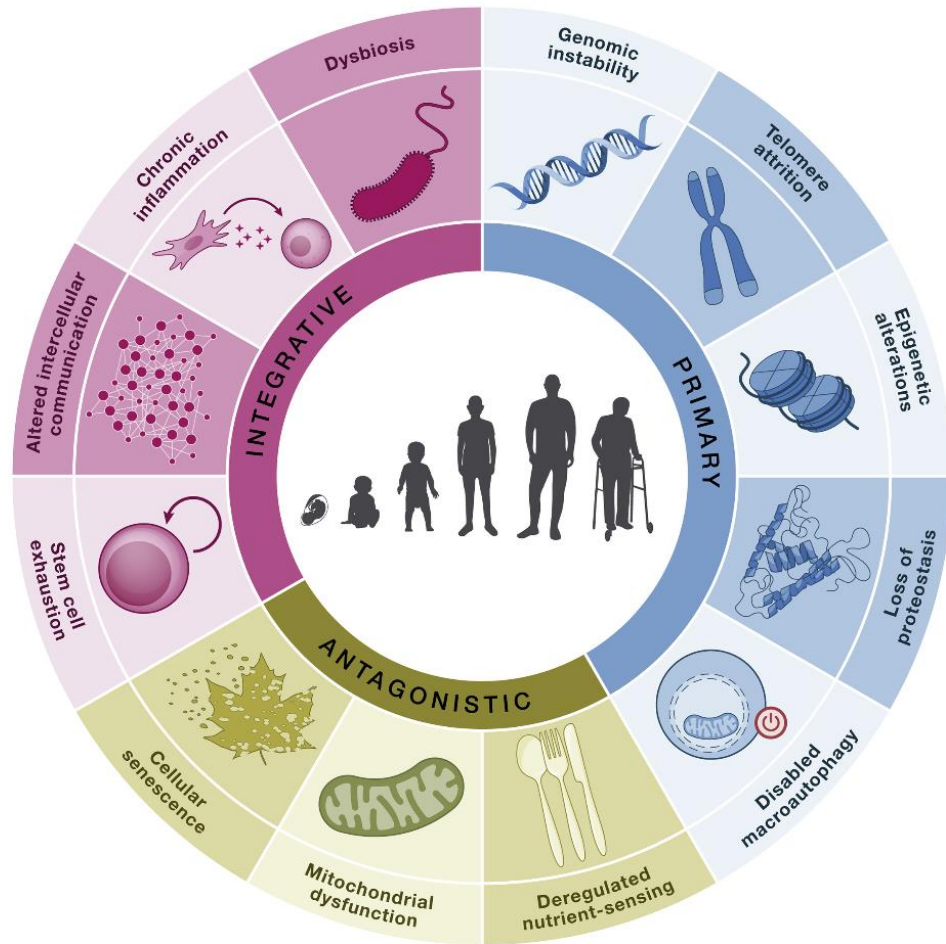
Europe dementia rates



UK cancer rates

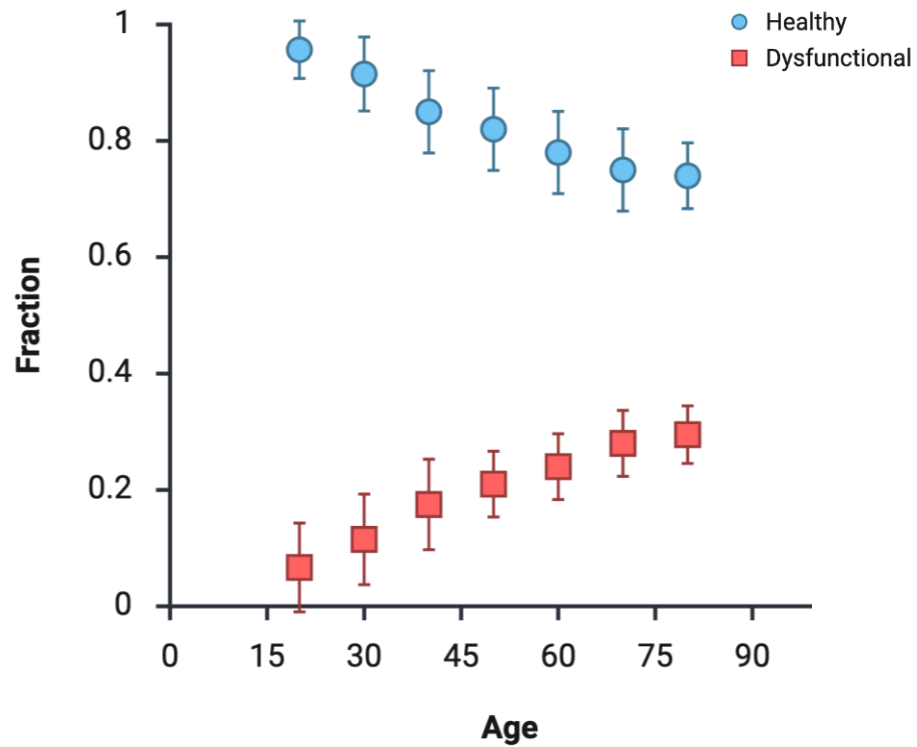


BIOMEDICAL HALLMARKS OF AGING



RESHAPING OF THE IMMUNE LANDSCAPE

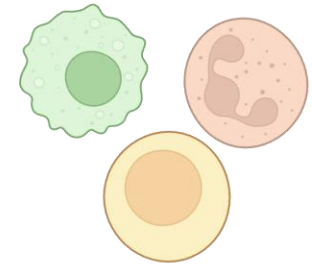
Aging immune cell populations



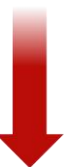
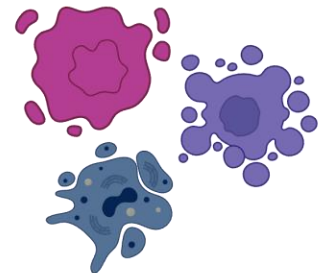
Drug intervention



Healthy immune cells

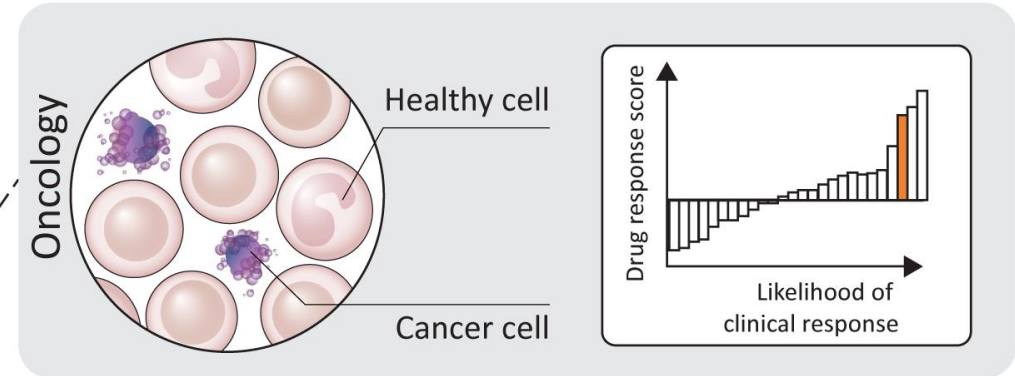
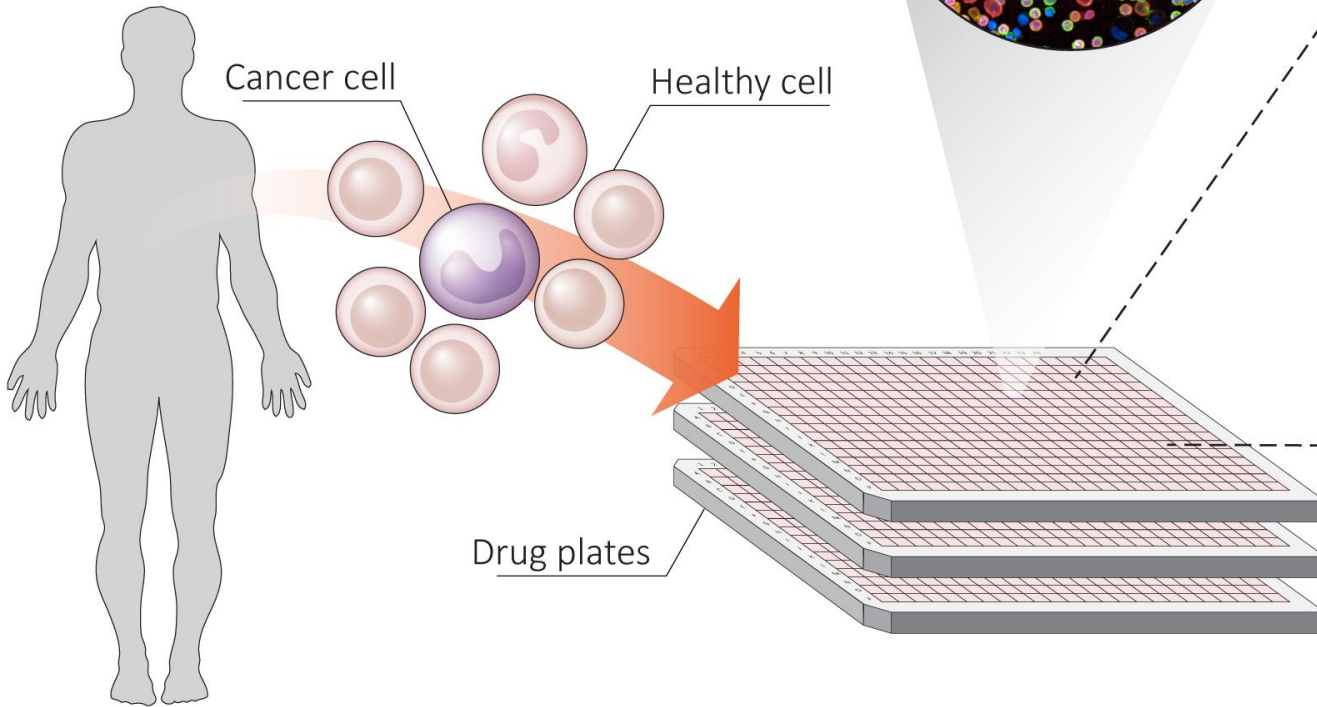
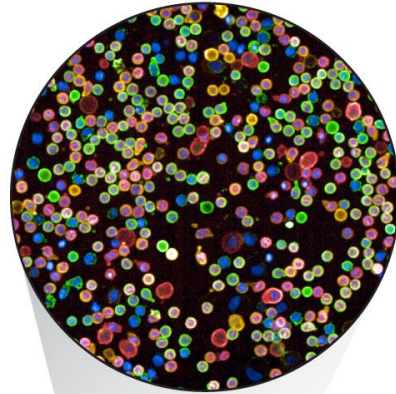


Dysfunctional cells

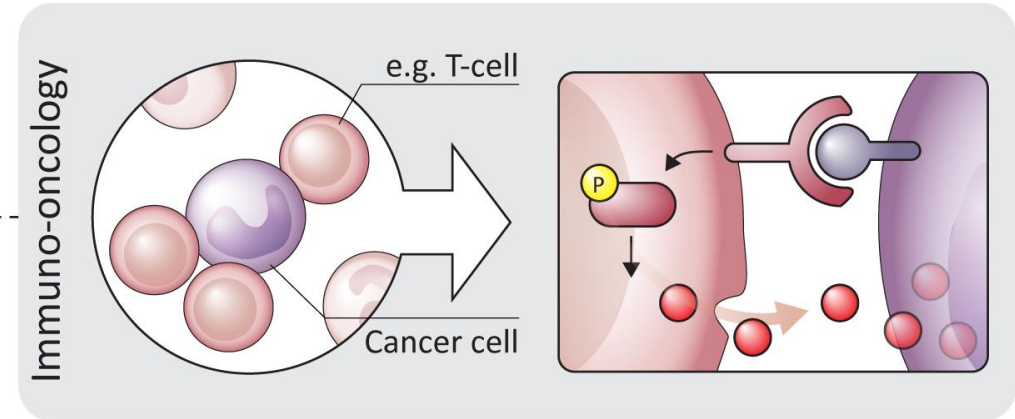


PHARMACOSCOPY: PERSONAL IMAGE-BASED DRUG SCREENING

- Multiplexed staining
- Automated microscopy
- Single-cell image analysis
- Deep learning
- Big data

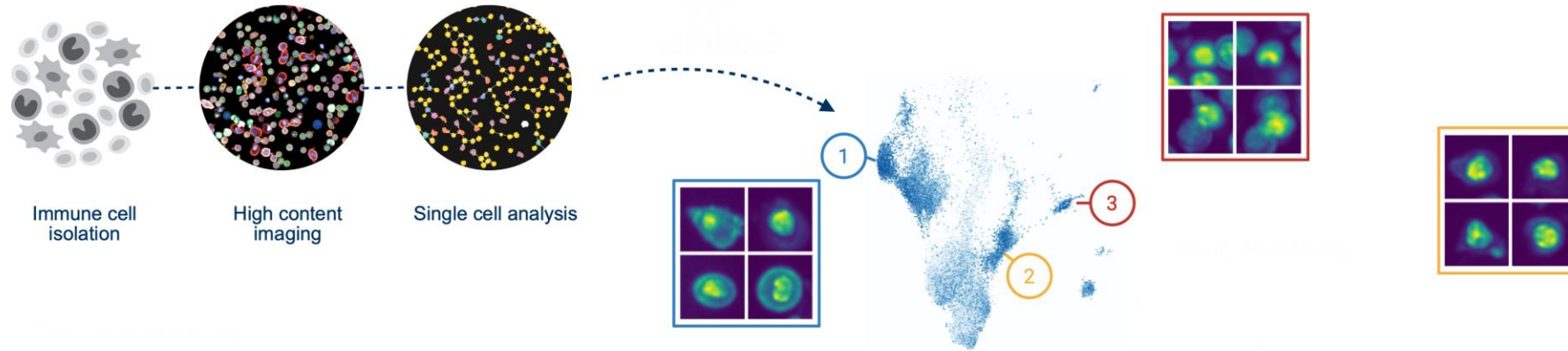


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 Kornauth, ..., Snijder & Staber, *Cancer Discovery*, 2022
 Heinemann et al., *Blood Cancer Discovery*, 2022
 Wildschut et al., *Nature Communications*, 2023
 Schmid et al., *Haematologica*, 2024



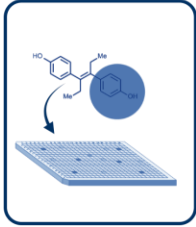
Vladimer & Snijder et al., *Nature Chemical Biology*, 2017
 Severin et al., *Science Advances*, 2022
 Shilts et al., *Nature*, 2022
 Kropivsek et al., *Nature Cancer*, 2023
 Hale et al., *Science*, 2024

CHRONOTYPE: FUNCTIONAL PROFILING OF CELLULAR AGING FOR PERSONALIZED IMMUNE HEALTH

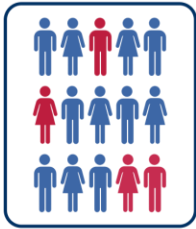


FORESEEN APPLICATIONS & BENEFITS

APPLICATIONS



Screen of immune modulatory drugs *ex vivo*



Measure the impact of immune therapy in clinical settings



Assess personal immune system strength and biological age

BENEFITS

Accelerate drug/therapy discovery

Personalized monitoring and clinical decision support

Predict disease risk and guide preventive care

KEY TAKEAWAYS

- **Interpretability:** Biologically informed neural networks (BINNs) offer a promising solution, combining predictive accuracy with explainability by incorporating decades of accumulated prior biological knowledge
- **Explainability:** By integrating multimodal data, AI moves from black-box predictions to transparent, biologically meaningful insights, where signals in one modality can be explained and validated through complementary evidence in another.

CONNECT WITH US!



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FACING THE CHALLENGES OF OUR TIME