Ardigen

Design multi-epitope peptide-based vaccines with Artificial Intelligence

Design of more immunogenic and selective peptide-based vaccines with Artificial Intelligence

You can reduce the costs of your therapy development pipelines by leveraging our AI-driven technology

Learn about our technology, **Ardigen's ARDesign platform**, based on cutting-edge **computational immunology and machine learning**, and supported by experimentally-generated datasets. The platform enables the compilation of **the ranked list of peptide antigens for the vaccine composition**.

We build partnerships to improve therapy development pipelines.

In a nutshell...

- Determine **patients' HLAs**
- Detect putative **antigens**
- Predict the likelihood of **pHLA binding and presentation** on the cell surface
- Assess the probability of attracting T-cells to generate **functional responses**

Difficulties you may encounter…

- **Low efficacy** of the vaccine
- **Low specificity** of Tumor Associated Antigens (TAAs)
- **High toxicity** of the vaccine

- Targeting **only CD8+ T-cells**
- **Immune evasion** of the tumor
- **Lack of immunogenicity** of chosen epitopes
- Tumor **heterogeneity**

With Ardigen's ARDesign platform you can:

Identify specific **mutations** and **chromosomal aberrations**.

Determine **gene expression levels.**

Detect **Tumor-Specific Antigens** originating from indels and SNVs, or **Tumor-Associated Antigens** that are over-expressed in tumor tissues.

Include all essential steps needed for **target recognition** by the immune system, such as protein expression levels, pHLA binding affinity, **presentation on the cell surface with ARDisplay-I predictions**, or immunogenicity.

Only a tiny fraction of proteins fragments are displayed via HLA and our **state-of-the-art solution ARDisplay-I, outperforms significantly standard AI-based models** and achieves over 2 times higher score in Average Precision.

Pinpoint **off-targets presented on a patient's healthy tissue** that impose danger or cause various side effects.

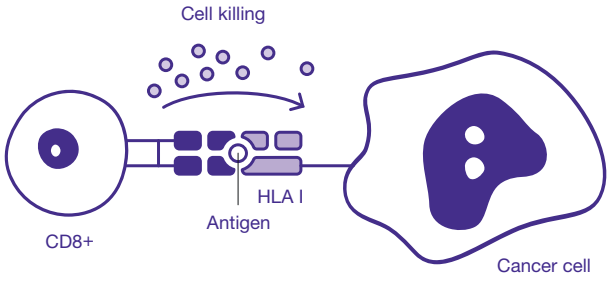
Analyze **tumor microenvironment** with RNA-seq data deconvolution and analysis of tumor-infiltrating immune cells to examine its influence on the **immune system response.**

Counter immune evasion by detecting **most common Immune Escape Mechanisms (IEMs)** related to HLA allele and antigen processing & presentation pathways.

Design of more immunogenic and selective peptide-based vaccines with Artificial Intelligence

Value we deliver...

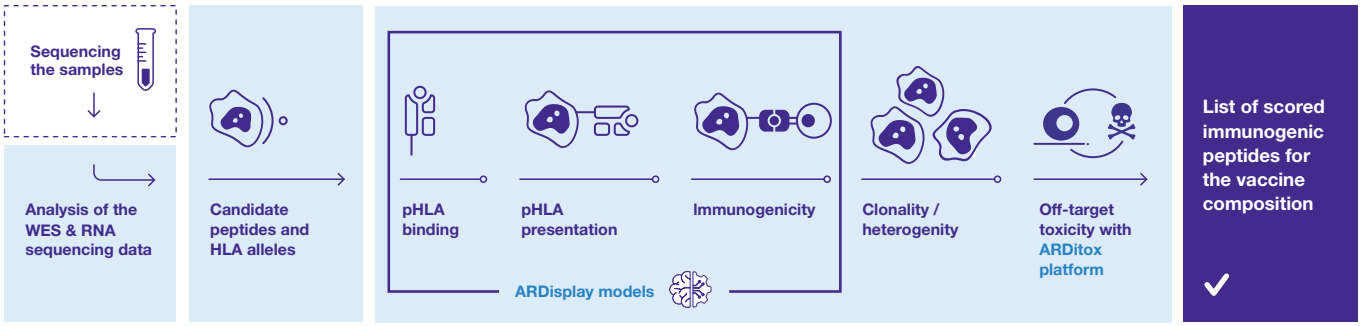
- ✔ Overcome the limitations of **laboratory screening**
- ✔ Design an off-the-shelf or personalized **cancer vaccines**
- ✔ Find ideal targets for therapy development that **address unmet clinical needs**
- ✔ With **ARDisplay-I model**, **select intracellular epitopes presented** on the cell surface
- ✔ Provide the **help of CD4+ T-cells** with **ARDisplay-II model**
- ✔ Avoid **off-target immunotoxicity**



ARDesign platform

Cancer vaccines development

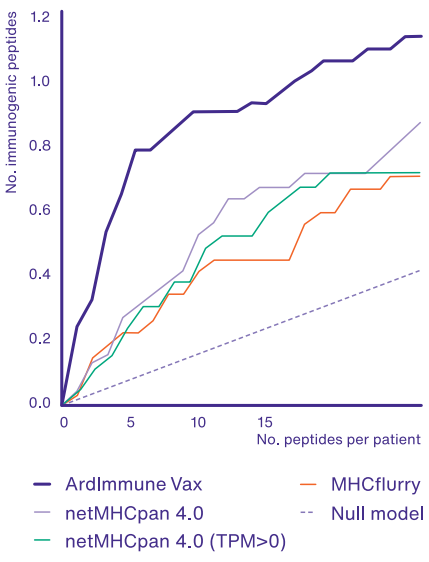
Augment your **cancer vaccine therapeutic process with Artificial Intelligence** to improve efficacy, avoid toxicity and speed up therapy development



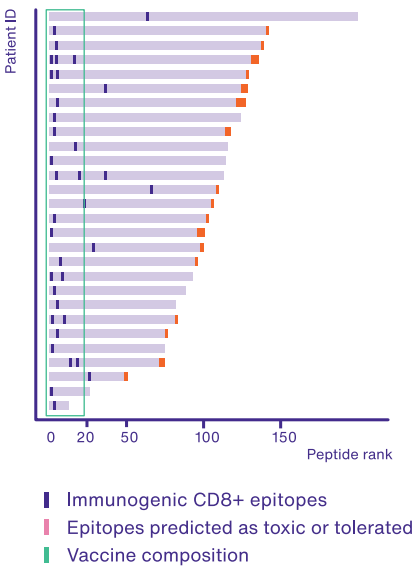
Check how Ardigen's ARDesign platform performs in predicting experimentally validated immunogenic epitopes detected in GI tract cancer patients

Dataset used for this analysis is a subset of 28 gastrointestinal tract cancer patients (38 responses) from *Unique Neoantigens Arise from Somatic Mutations in Patients with Gastrointestinal Cancers* Parkhurst M, et al. Cancer Discov. 2019.

Mean number of immunogenic peptides detected per patient



Performance of Ardigen's ARDesign platform for each patient



Design peptide-based vaccines
identify epitopes causing off-target toxicities

Address off-target toxicity in cancer immunotherapies long before it happens

Ardigen's ARDitox platform (patent pending, see EP22461636) is a powerful tool for augmenting toxicity evaluation designed to improve cancer immunotherapy development.

This computational approach is ideal for screening target epitopes **to assess the risk of potential off-target toxicity**.

Your goals

Identify therapeutic targets with **the lowest risk of off-target toxicity** events.

Select which epitopes, from a vast number of possible off-targets, should be **tested experimentally**.

Predict any **possible side-effects** and prevent them with the appropriate drugs.

Design your toxicity assays, based on the list of **potentially affected tissues.**

Check how we stand out from other solutions

Standard approach

- ✖ Time-consuming and laborious process
- ✖ Expensive
- ✖ Evaluating small subspace of potential off-targets
- ✖ Selective types of tissue

ARDitox based approach

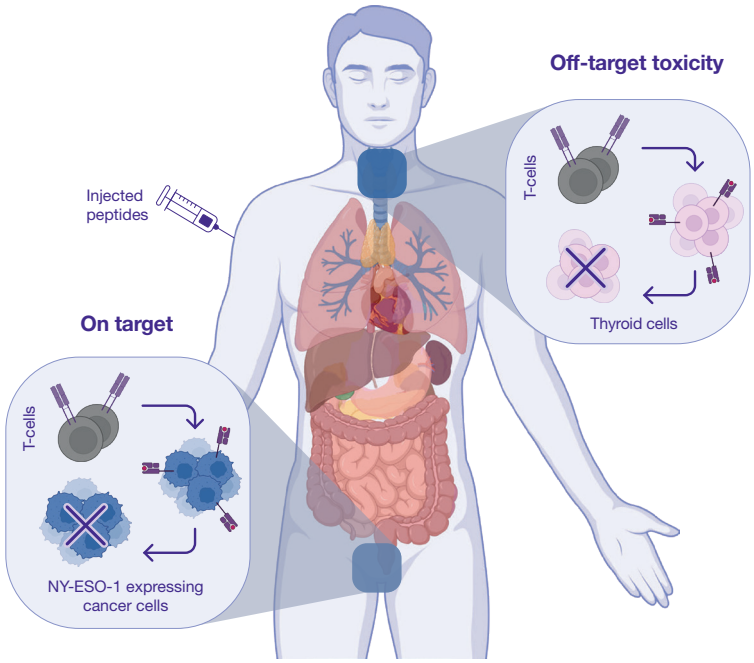
- ✔ Accelerated analysis and discovery
- ✔ Reduced cost of experiments
- ✔ Increased treatment safety with the evaluation of a large space of possible off-targets
- ✔ Unbiased analysis of all tissue types

Know the risks of off-target toxicity...

Peptide-based vaccines can lead to the development of autoimmune diseases caused by off-target toxicity. This occurs when the **similarity between the foreign and self-peptide** promotes the activation of autoreactive T- or B-cells initiated by the foreign one.

The clinical trials, based on peptide vaccination against **cancer-specific antigen NY-ESO-1**, have led to the development of **thyroid dysfunction** (Graves' disease) causing heart palpitations, weight loss, and feeling shaky or nervous[1].

The development of **autoimmune diseases** has also been observed in patients vaccinated against viruses, such as HBV, HPV, or H1N1[2].



[1] Anaya et al., Autoimmunity: From Bench to Bedside 2013
[2] Segal & Shoenfeld, Vaccine-induced autoimmunity: the role of molecular mimicry and immune cross-reaction, 2018

Design peptide-based vaccines
identify epitopes causing off-target toxicities

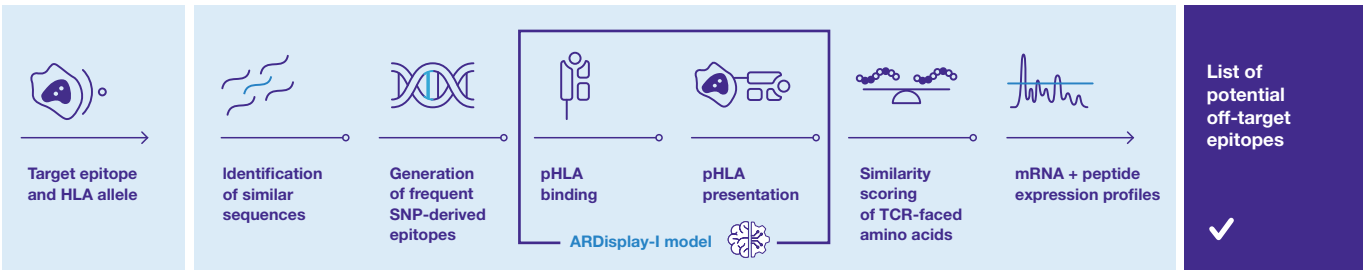
Experimentally verify epitopes pinpointed by ARDitox platform as likely to cause side effects

Model relevant biological events that contribute to off-target toxicity using state-of-the-art bioinformatics, AI-based components and our expertise. Simply provide the peptide sequence and HLA type of interest to **obtain a list of putative off-targets, prioritized according to their risk score**, along with the associated genes and their expression levels.

ARDitox platform

Off-target toxicity

Identify potential **off-target toxicities in cancer immunotherapies with Artificial Inteligence** to improve safety, and speed up therapy development



Check how we stand out compared to other solutions[1]

Typically, the **number of permitted mismatches** between the target peptide and the potential off-target epitopes is limited to only a few amino acids, while this **factor is the most important in safety evaluation.**

Extend the reference proteome (of the human population or your study cohort) with **genetic polymorphisms** to get a broader collection of possible cross-reactive epitopes.

Incorporate **Ardigen's ARDisplay-I model, our custom deep learning pHLA presentation model**, trained on mass-spectrometry data, that outperforms[2] standard models like MHCflurry or netMHCpan.

Recognize **TCR-facing amino acids** (epitope) from HLA-facing ones (agretope). Include this while comparing the target peptide with putative off-targets and **determine the risk of cross-reactivity** based on the physico-chemical properties of the selected amino acids.

Generate mRNA and protein **expression levels** of selected cross-reactive peptides.

Our method **directly pinpoints off-target epitope sequences** that might impose danger.

Ardigen's ARDitox platform interactive dashboard

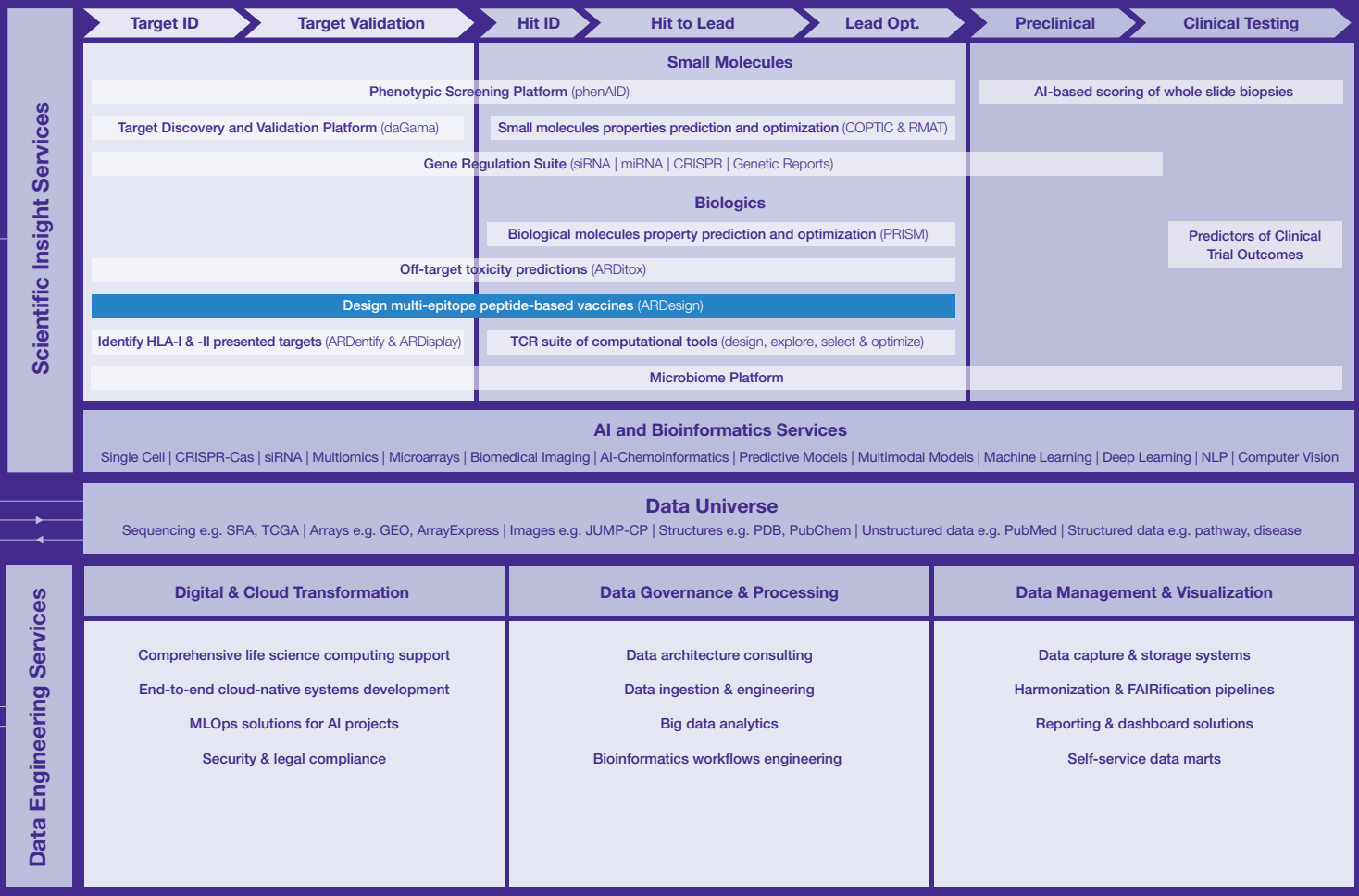
Scan to watch the video:

[1] see solutions like Expitope 2.0, iVax (JanusMatrix), Dhanik et al. (2016), or Lee et al. (2020)
[2] with a benchmark on a set of 22 CRC patients, **ARDisplay-I, Ardigen model** for prediction of HLA-I presented peptides, achieves over two times higher Average Precision than standard solutions (also trained on eluted ligands)

Ardigen

Artificial Intelligence & Bioinformatics for Precision Medicine

Discover Our Cutting-Edge Services and Accelerate Your Drug Discovery Process



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