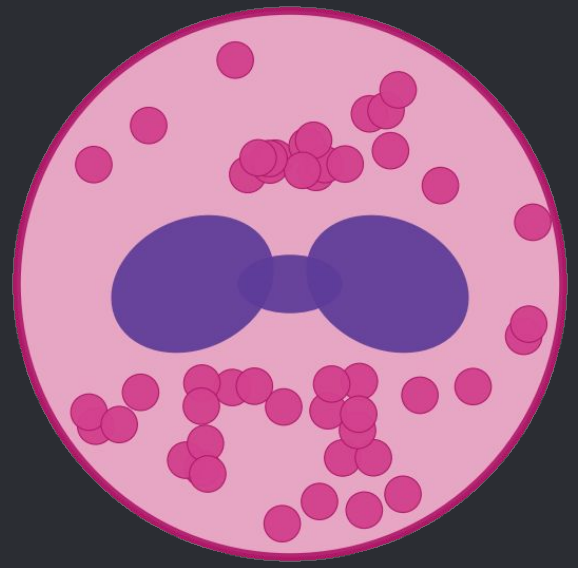
BUILT WITH CLAUDE · LIFE SCIENCES HACKATHON · RESEARCHER TRACK

I have EoE.

This week I designed a therapy for it.



A PhD scientist and rare-disease advocate who doesn't code —
empowered by Claude Science to build from the bench.

Ruth-Anne Pai, PhD · Project Tolera

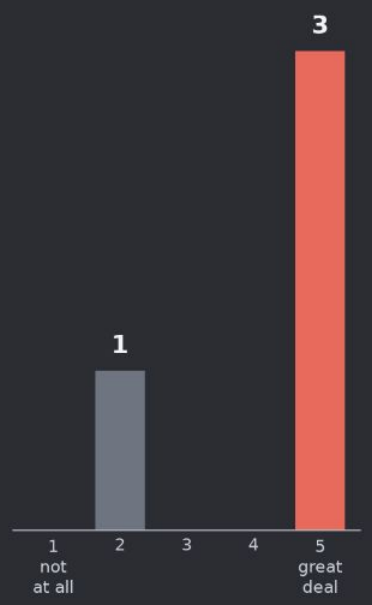
WHERE WE STARTED · CHAPTER 1

Why we are here

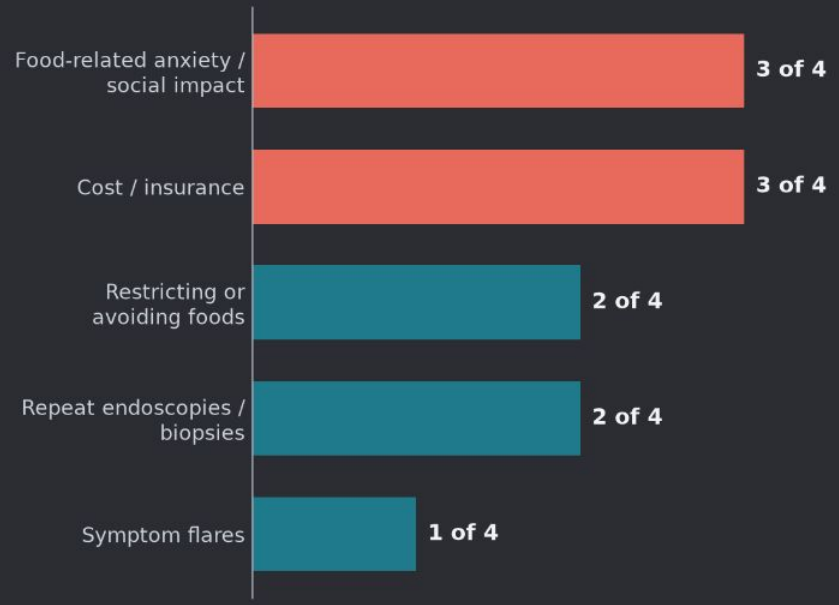
EoE Patient Perspectives survey · pilot, n = 4 respondents

Daily-life interference

mean 4.25 / 5



Most burdensome parts (select up to 3)



WHAT THE LITERATURE REPORTS

larger EoE studies echo the same pattern

- **Disease-related anxiety is the highest-scoring quality-of-life domain in adults.**

  Lucendo et al., United Eur Gastroenterol J 2018 · n=170

- **Dysphagia anxiety and food-centred social activities are the greatest QoL impacts.**

  Real-world EoE programme, Dis Esophagus 2025 · n=161

- **Adults report anxiety above the general population and poorer vitality.**

  Gold et al., Gastro Hep Advances 2024 · n=184

- **EoE care costs ≈ $1 billion / year in the US — endoscopies, biologics, diets.**

  Taft et al., J Asthma Allergy 2019 (review)

Our n = 4 pilot mirrors these larger studies: anxiety and cost lead the burden, not symptoms alone.

3 of 4 rate EoE's interference at the top of the scale — and the heaviest burdens are anxiety, cost, and food restriction.

WHERE WE STARTED · CHAPTER 1

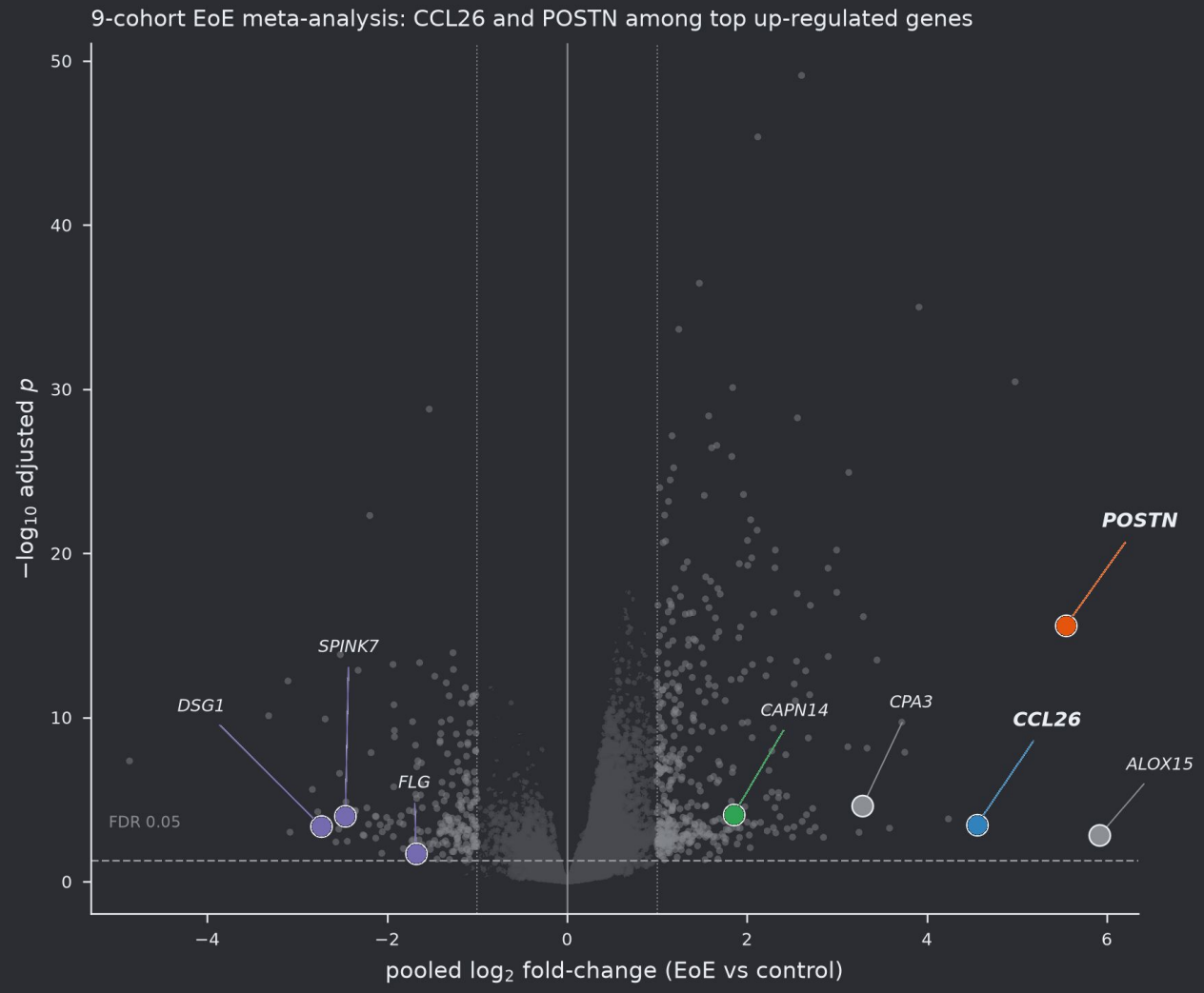
We began with the omics

Public EoE datasets — the 'existing data and tools' the brief asks for:

- Bulk transcriptomes of esophageal biopsy
- Single-cell atlases of inflamed mucosa
- Proteomic & clinical-trial evidence

The question that started it all:

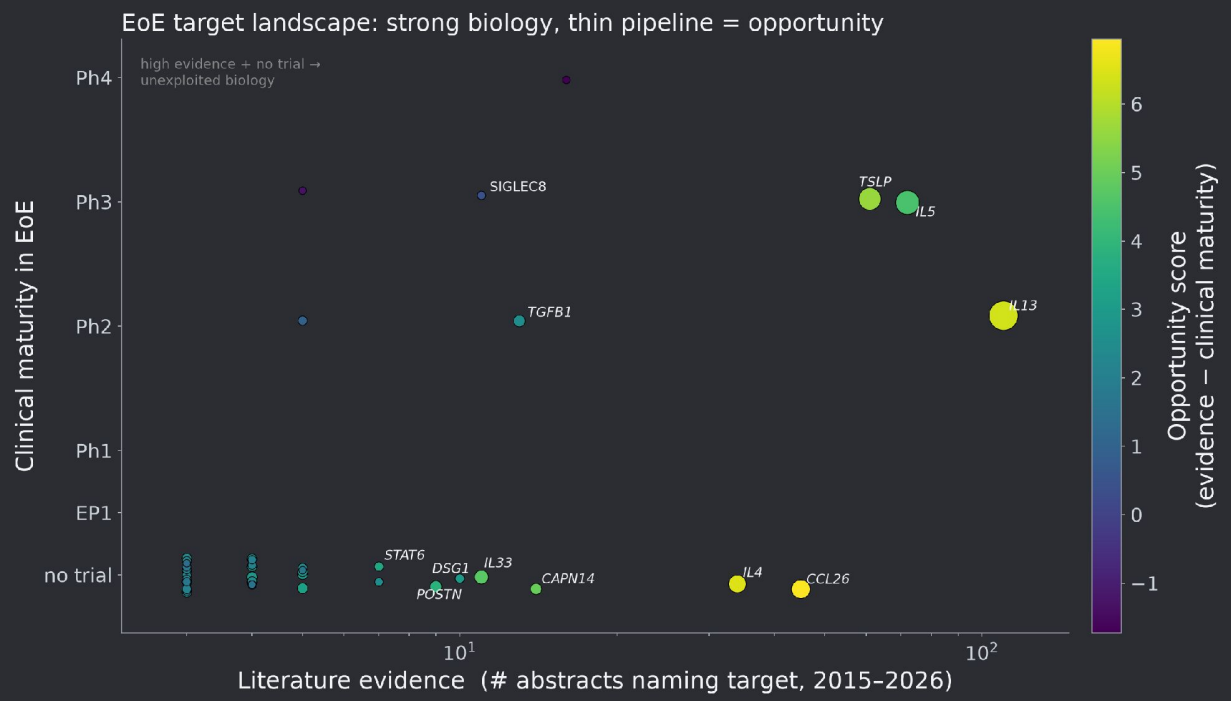
what is truly dysregulated here — and can we act on it?



Meta-analysis volcano · pooled EoE cohorts

CHAPTER 2 · FROM SIGNAL TO TARGET

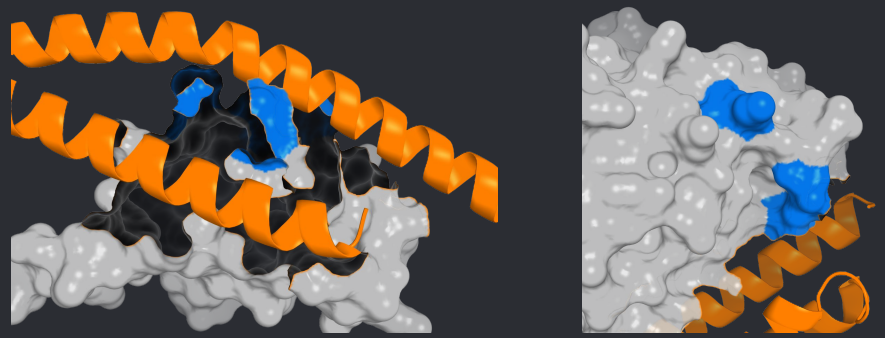
Differential expression → target discovery



Design funnel: 80 backbones → 1,920 sequences → 60 folded complexes → 2 leads

RFdiffusion backbones	SolubleMPNN sequences	Complexity filter	Selected for fold-back	Boltz-2 pass	Leads
80	1,920	1,074	60	59	2
40 / target	8×3T×80	pass	30 / target	ipTM>0.5 & pLDDT>0.7	validated

De novo binders, docked to real EoE targets



CHAPTER 3 · THE PIVOT

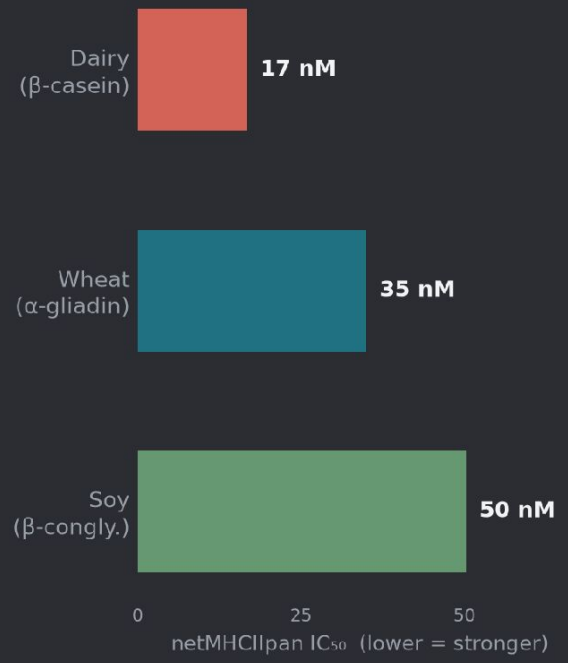
The Tolera Project: Target the cause

CHAPTER 4 · I HAD NEVER USED A PROTEIN MODEL

From target to designed protein

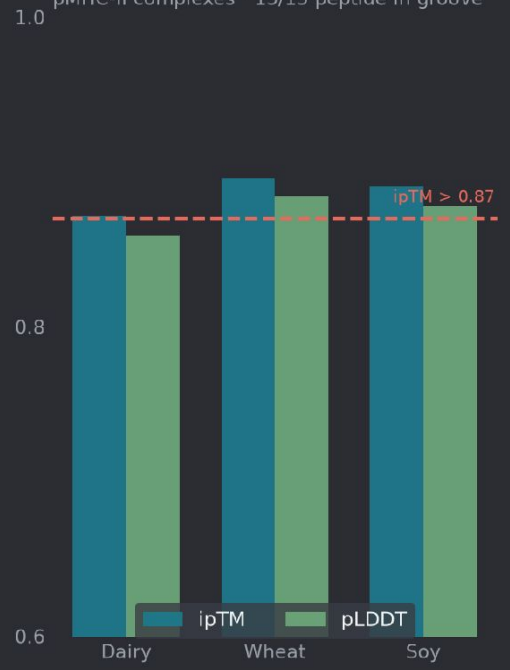
1 · Epitope selection

3 food epitopes · HLA-DRB1*07:01 · all <100 nM



2 · Structural validation

pMHC-II complexes · 15/15 peptide in groove



3 · Therapeutic modality

one epitope → three deployable formats

Single-chain

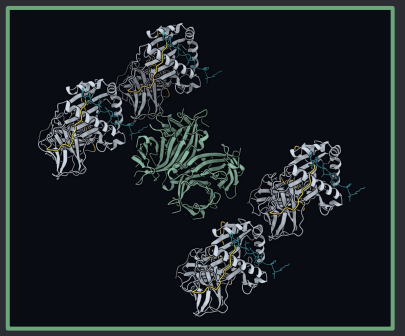
pMHC monomer · 449 aa

Nanoparticle

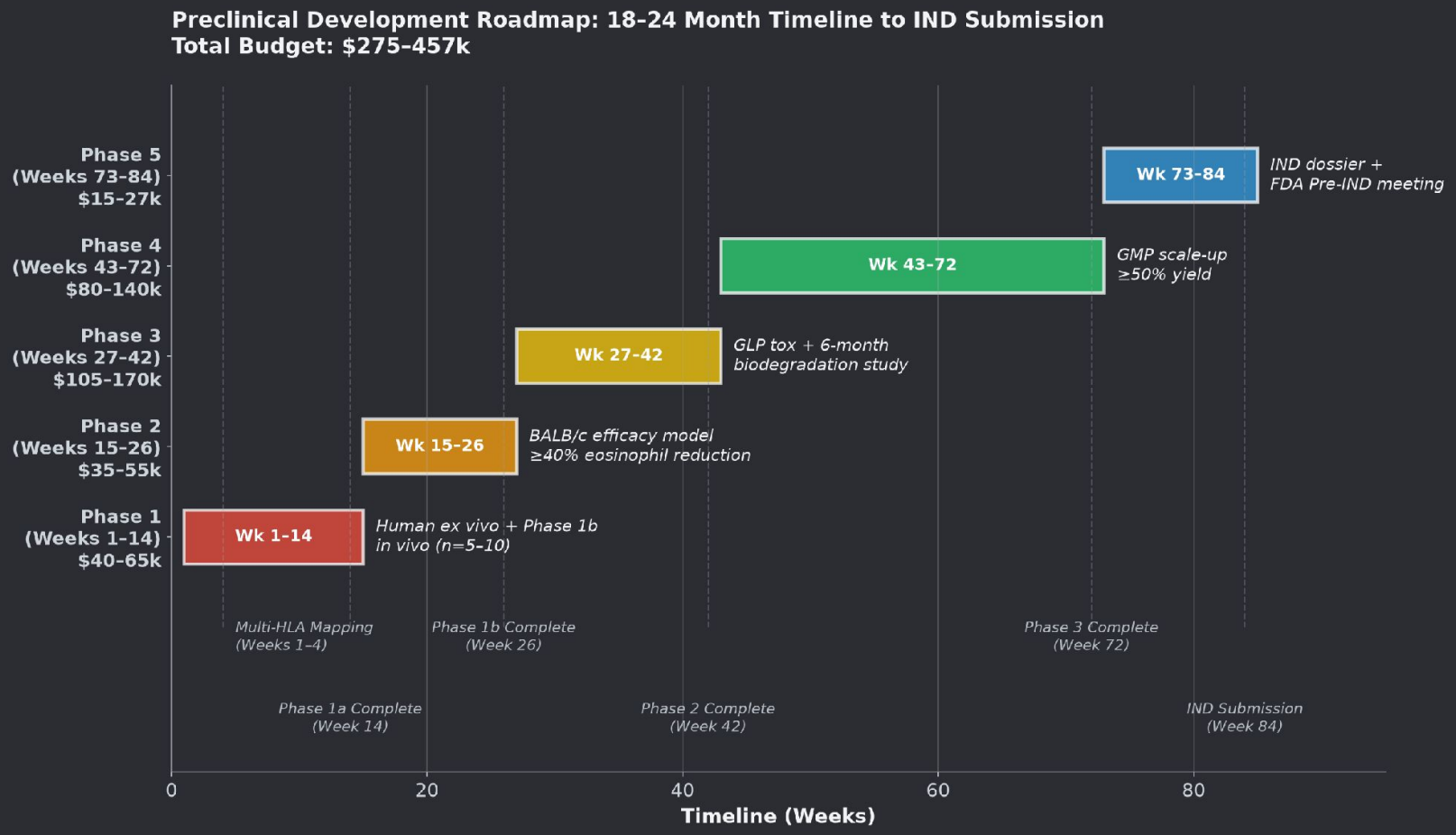
free-thiol handle · multivalent

Tetramer

AviTag→SA · diagnostic



A full AI-to-clinic plan



Out of one week:

- 2 Peer-review–style manuscripts with synthetic reviewer responses
- Preclinical → IND roadmap
- Regulatory & market strategy
- The Project Tolera deck

A credible line from a public dataset to the clinic.

CHAPTER 5 · LEARNING BY BUILDING

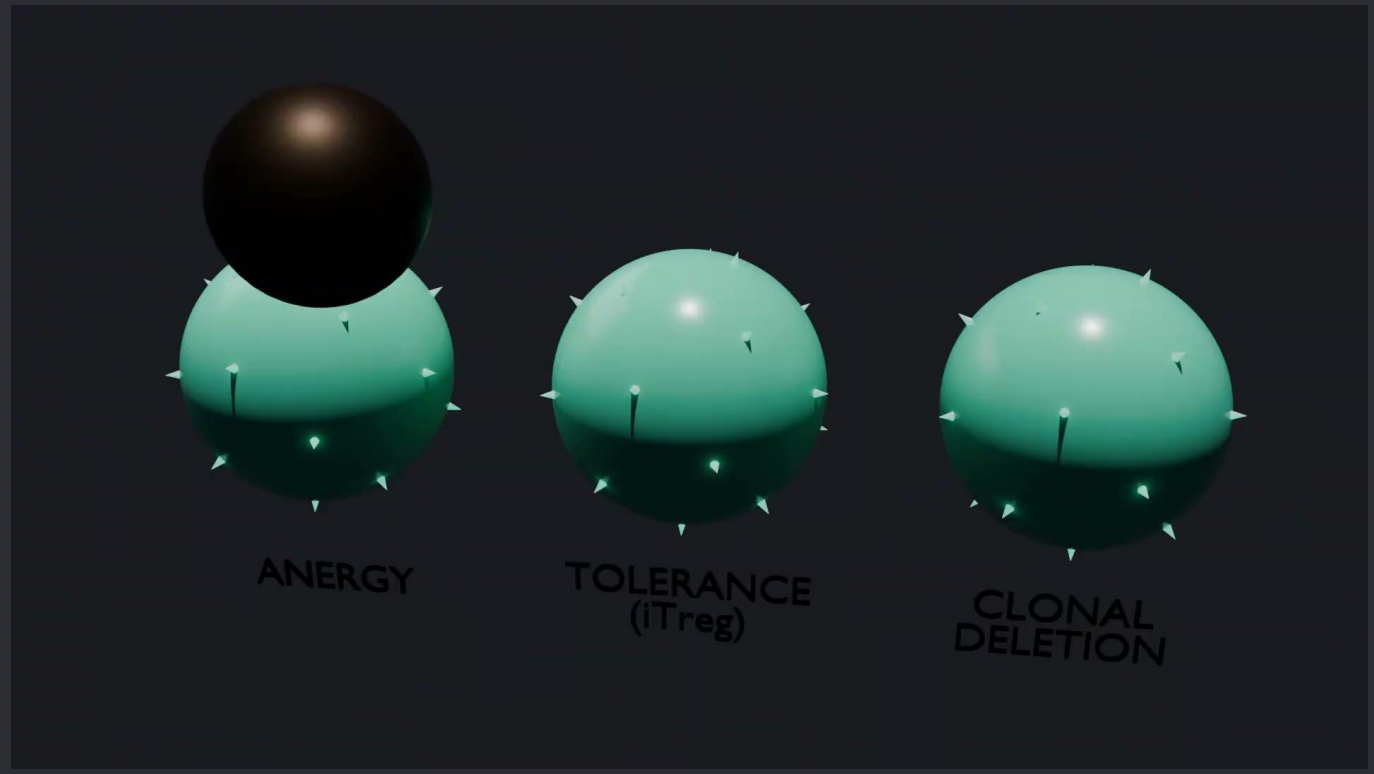
I built skills and pushed them to the world

1 **Created GitHub & Modal accounts**
First time ever — from zero to publishing.

2 **Published my first skills**
Reusable pipelines anyone can run.

3 **Learned ChimeraX & Blender**
Rendered my own molecular videos…

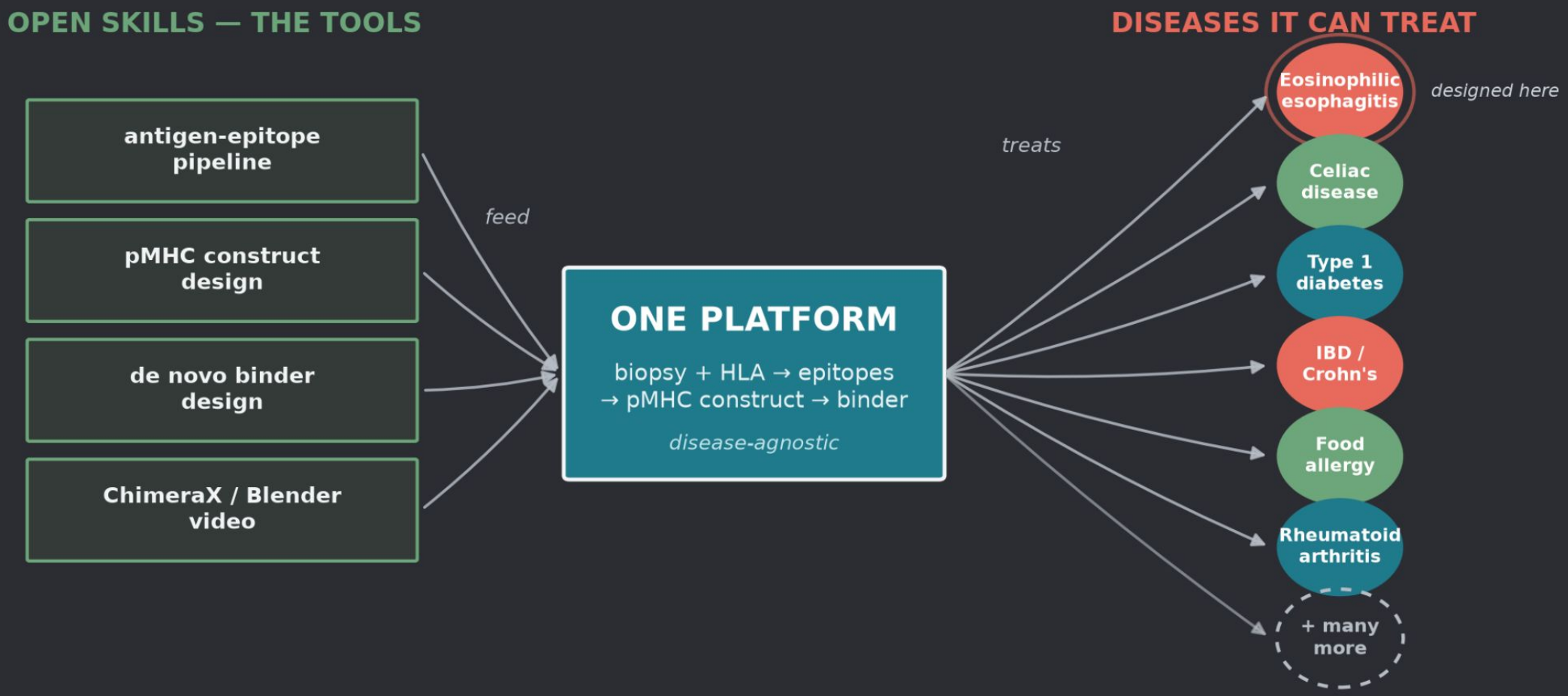
4 **…on Claude Science + Modal GPUs**
Claude ran and rendered them for me.



github.com/ruthannepai-tech · rendered on Modal

CHAPTER 7 · ONE PLATFORM, MANY DISEASES

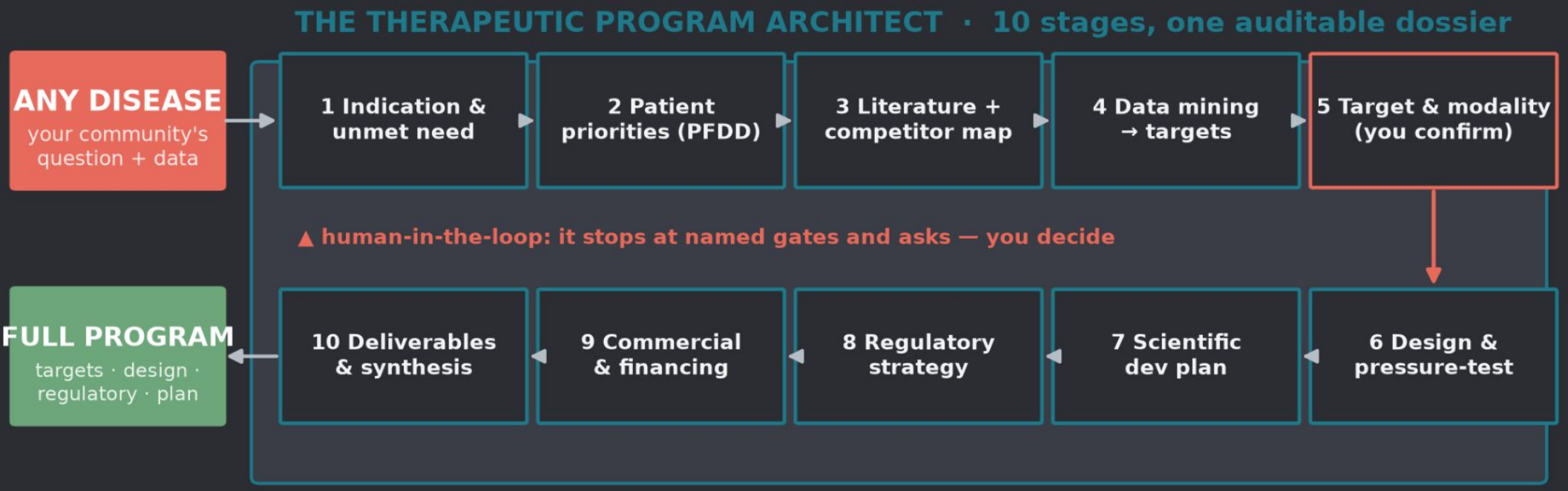
Built to overcome disease — at scale



Any antigen-specific, HLA-restricted disease — every skill open on GitHub for anyone to run

CHAPTER 8 · THE REUSABLE ENGINE

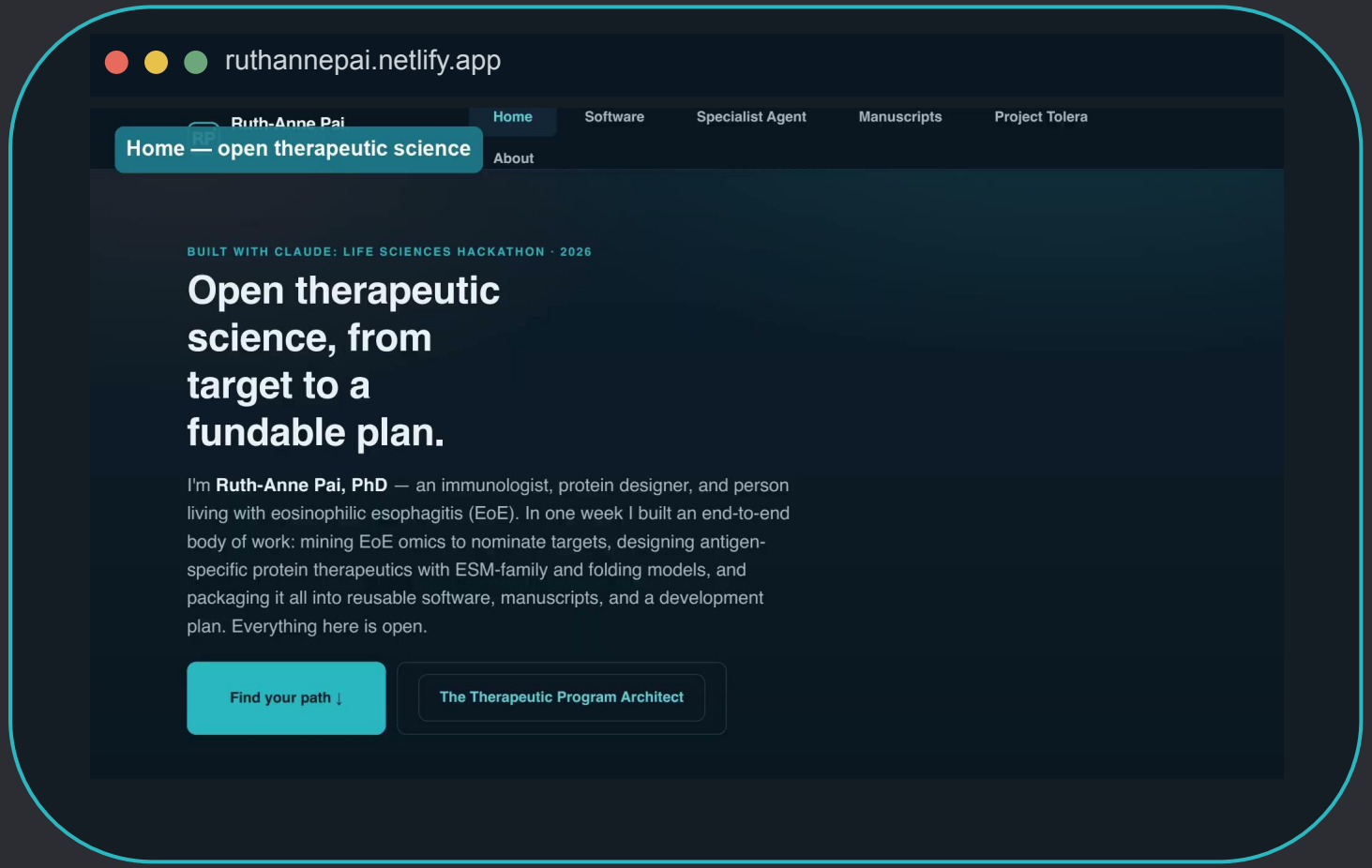
The Specialist Agent: any disease → a full drug program



Demonstrated on EoE. I packaged the whole method as an installable specialist — **now anyone can point it at their disease and run.**

CHAPTER 9 · THE FRONT DOOR

One website — the whole project, open to anyone



Six pages, six audiences:

- Patient orgs & advocates
- Scientists using protein models
- Biotech, investors & partners
- Claude Science developers
- Academics & data scientists

9 constructs **8** repos

2 manuscripts **0.87–0.90** ipTM

Every result, skill, and structure — downloadable, open, reproducible.

ruthannepai.netlify.app · walkthrough video embedded — click to play

WHY THIS MATTERS

Science, democratized.

As an EoE patient, I was empowered to lean into the science and design a therapy for my own disease.

Patient-driven, patient-centered drug development is now genuinely possible.

500 hackers + a growing wave of AI adopters can close the gap — **and change lives.**

Thank you hackathon organizers — Anthropic · Gladstone Institutes · Cerebral Valley **— Ruth-Anne Pai, PhD**