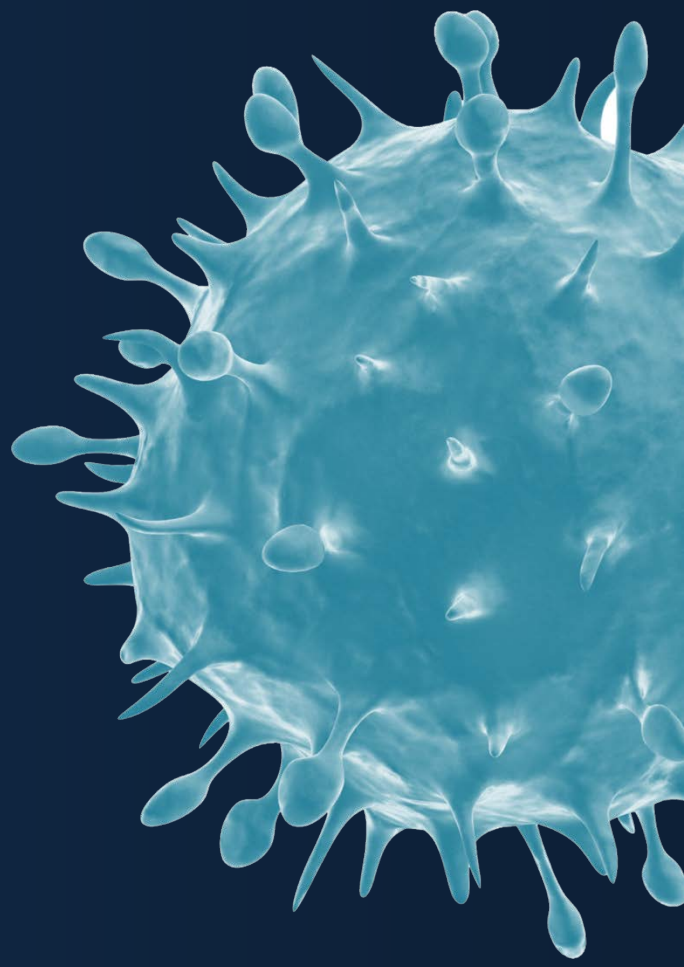
Leadership in Neoantigen Cancer Vaccines

November 2017



genocea BIOSCIENCES

Disclaimer

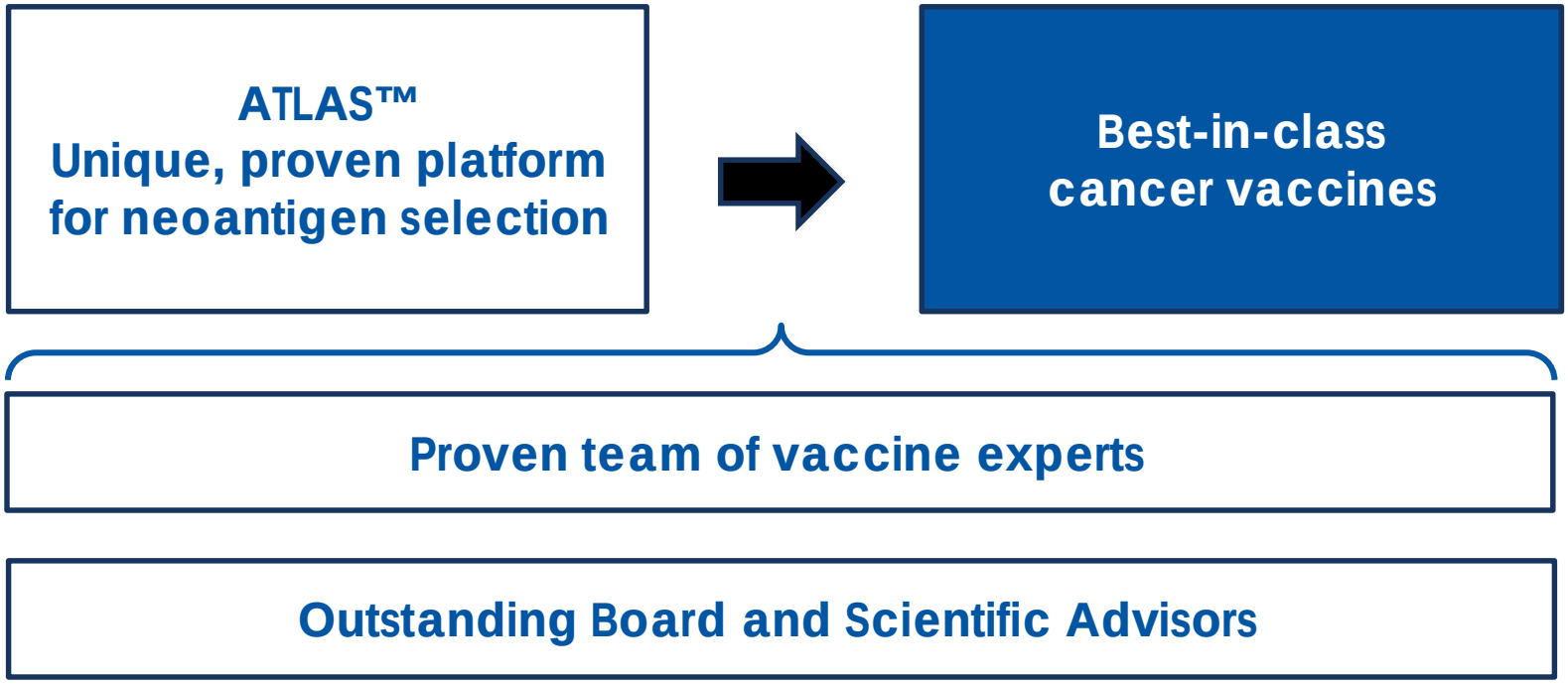
This presentation contains “forward-looking” statements that are within the meaning of federal securities laws and are based on our management’s beliefs and assumptions and on information currently available to management. Forward-looking statements include information concerning our possible or assumed future results of operations, business strategies, clinical trials and pre-clinical studies, regulatory approval of our product candidates, liquidity position and capital needs, financing plans, industry environment, potential growth opportunities, potential market opportunities and the effects of competition.

Forward-looking statements include all statements that are not historical facts and can be identified by terms such as “anticipates,” “believes,” “could,” “seeks,” “estimates,” “intends,” “may,” “plans,” “potential,” “predicts,” “projects,” “should,” “will,” “would” or similar expressions and the negatives of those terms. Forward-looking statements represent our management’s beliefs and assumptions only as of the date of this presentation. Our operations involve risks and uncertainties, many of which are outside our control, and any one of which, or combination of which, could materially affect our results of operations and whether the forward-looking statements ultimately prove to be correct. Factors that may materially affect our results of operations include, among other things, the timing of results of our ongoing and planned our ability to progress any product candidates in clinical and clinical trials, the ability of ATLAS to identify promising oncology vaccine and immunotherapy product candidates, the scope, rate and progress of our preclinical and clinical trials and other research and development activities, anticipated timing of new clinical trails, our estimates regarding the amount of funds we require to complete conduct our clinical trials for GEN-003, our plans to commercialize GEN-003, the timing of, and ability to, obtain and maintain necessary regulatory approvals for our product candidates, GEN-003 and those listed in our Quarterly Report on Form 10-Q for the fiscal quarter ended September 30, 2017 and other filings with the Securities and Exchange Commission (“SEC”). Except as required by law, we assume no obligation to update these forward-looking statements publicly, or to update the reasons actual results could differ materially from those anticipated in the forward-looking statements, even if new information becomes available in the future.

You may get copies of our Annual Report on Form 10-K, Quarterly Report on Form 10-Q and our other SEC filings for free by visiting EDGAR on the SEC website at http://www.sec.gov.

Our vision: Curing cancer with next-generation cancer vaccines

- Our mission: to create breakthrough vaccines based on the right antigens



Neoantigens are an exciting new target class in immuno-oncology

Yadav et al., Gubin et al, 2014

- Personalized tumor mutations (neoantigens) are “foreign” to immune system

Schumacher, Schreiber, 2015

- Response to neoantigens drives checkpoint inhibitor (CPI) efficacy

Ott et al., Sahin et al., 2017

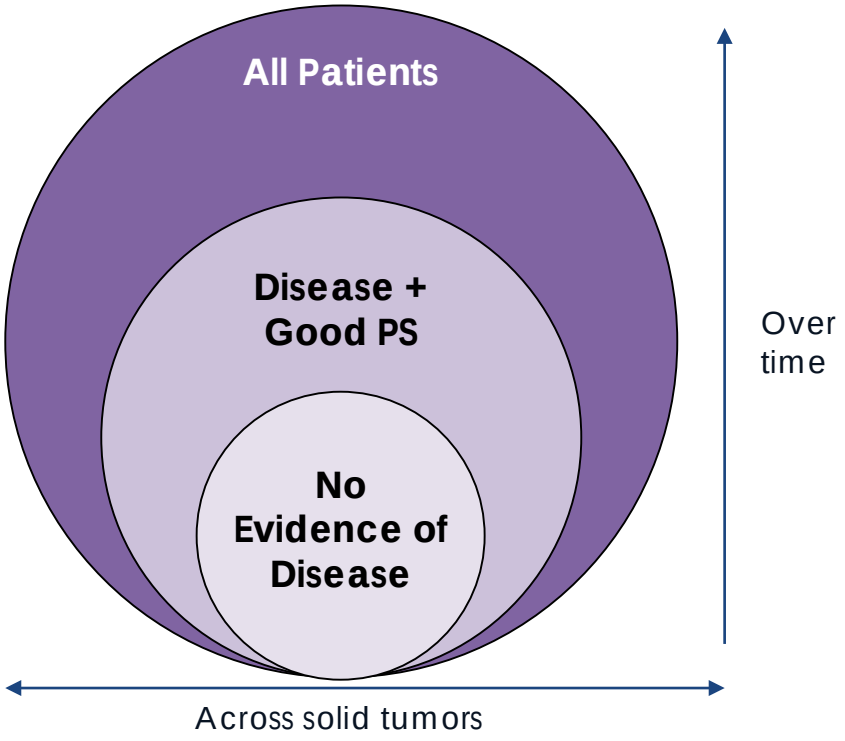
- Possible to vaccinate against neoantigens

After CAR-T therapy, neoantigen vaccines are exciting next wave of personalized cancer immunotherapy

Potential synergy with CPI

- Complementary MoA: "steering wheel" once brakes are off
- Well tolerated[1,2]
- Applicable to most cancer types

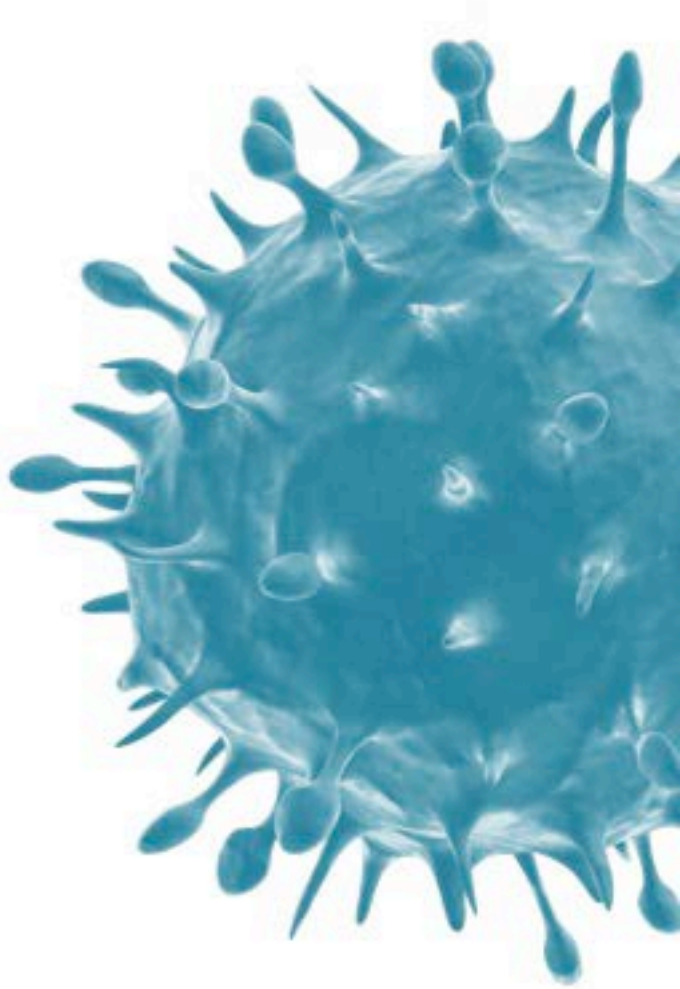
Opportunity to benefit millions



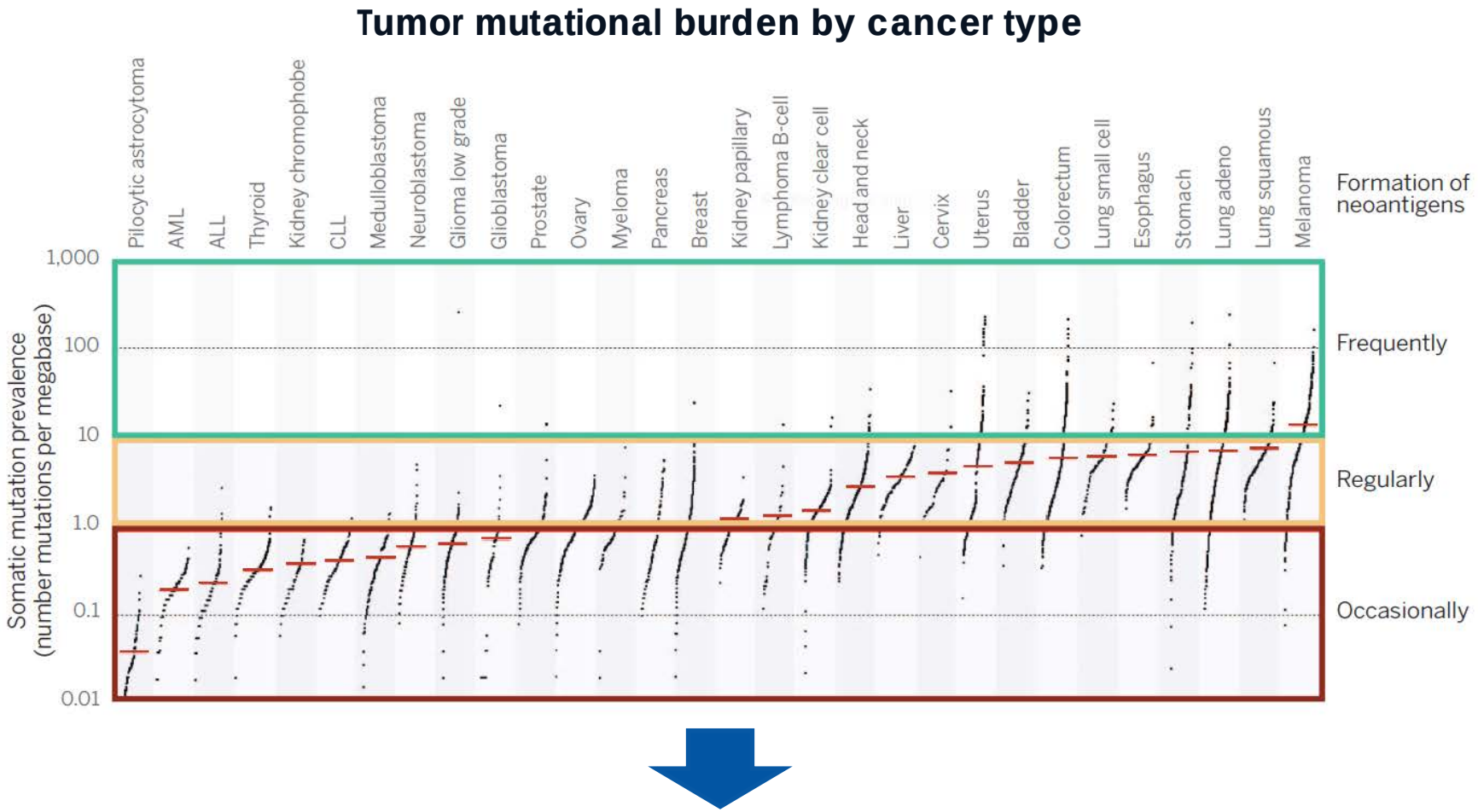
ILLUSTRATIVE

[1]Ott *et al.*, 2017 *Nature*
[2]Sahin *et al.*, 2017 *Nature*

Neoantigen Selection Crucial to Vaccine Success



Cancer biology creates significant antigen selection challenges



Up to thousands of candidate antigens per patient

Schumacher and Schreiber, Science, 2015

Conventional *in silico* approaches have limited ability to predict neoantigens

	Positive predictive value in conventional algorithms
CD4+ T cells	~5%**
CD8+ T cells	~20%*

Skewed toward better predictive power in Western Caucasians

The truth is…that current neoepitope **prediction algorithms** return a vast number of candidates, of which only a tiny handful are ever found to trigger bona fide antitumor responses in patients

"The Problem with Neoantigen Prediction"
Nature Biotechnology, 2017

Algorithms…not robust enough to allow accurate identification of … epitopes bound to infrequently expressed … MHC class I … or to … MHC class II molecules, which limits the … identification of cancer antigens

Steven Rosenberg, M.D., National Cancer Institute
Nature Immunol, 2017

..the sensitivity of the **peptide purification and mass spectrometry** is not sufficient to detect certain antigens. Moreover, reliance on mass spectrometry is probably too impractical for clinical use…

Liz Jaffee, M.D., Johns Hopkins
Nature Reviews Cancer, 2017

You can **algorithm** till the cows come home and you're not really going to know if you're improving things

Drew Pardoll, M.D., Ph.D., Johns Hopkins
Nature, 2016

genocea BIOSCIENCES

*Abelin *et al.*, 2017 *Immunity* 46, 315-326.
** Wang, *et al.*, PLoS Computational Biology, 2008

Clinical trials confirm these approaches do not find the right neoantigens, regardless of treatment modality

Immunogenicity from FIH Neoantigen Vaccine Trials

	Patients	% Response to Neoantigens*			
		Conventional immune monitoring (*ex vivo* ELISPOT)		Multiple rounds of restimulation (*in vitro*, 10-21 days)	
		CD4+	CD8+	CD4+	CD8+
Neon[1] Peptide + adjuvant	Melanoma (stage IIIB/C & IVM1a/b)	20%	0%	40%	16%
BioNTech[2] RNA	Melanoma (stage III & IV)	12% **		57%	17%

*Cohort level; number of SLP with responses in all patients/total SLP immunized across all patients

**Presumed CD4 (total PBMC). Text states majority of responses were CD4 but not disclosed in figure.

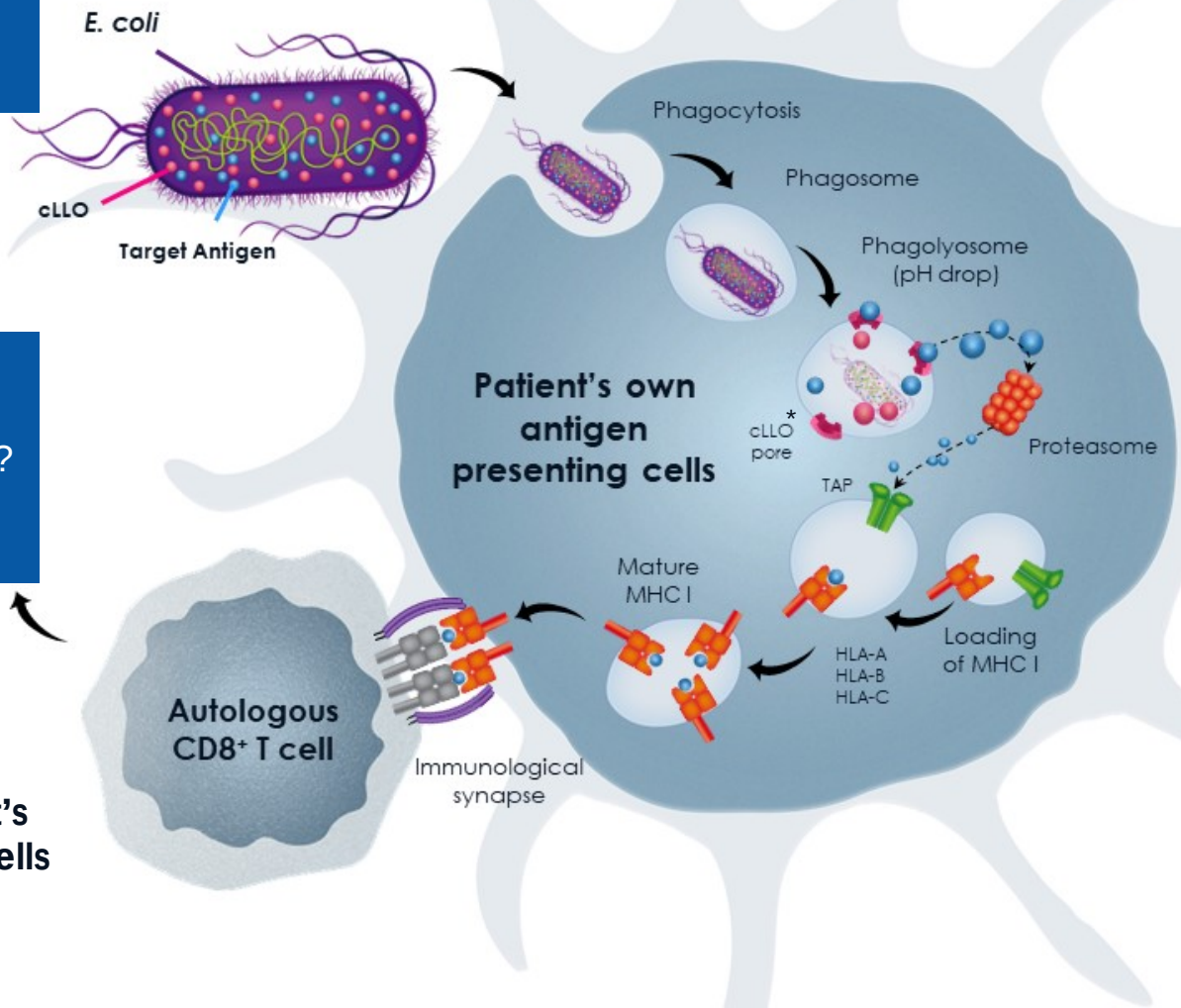
genocea BIOSCIENCES

[1]Ott *et al.*, 2017 *Nature*
[2]Sahin *et al.*, 2017 *Nature*

ATLAS platform uses patients' own T cells to identify true neoantigens

Input:
Every candidate neoantigen

ATLAS cytokine readout:
- Antigen or not?
- Stimulatory or inhibitory?



Patient's own T cells

Patient-specific

HLA agnostic

CD4+ & CD8+ antigens

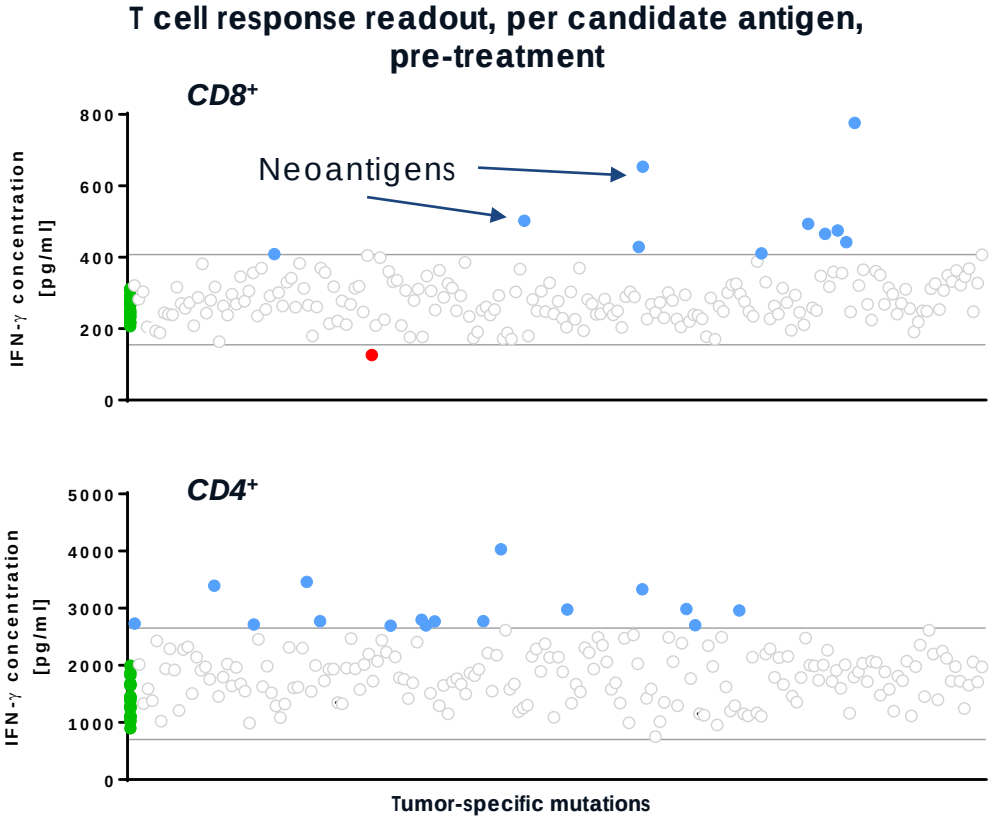
Hot and cold tumors

genocea BIOSCIENCES

*For CD4+ T cell screening the cLLO is not co-expressed, resulting in conventional endosomal processing and presentation by MHC cII

Neoantigens of pre-existing T cell responses increase probability of effective vaccination

ATLAS identifies neoantigens of pre-existing responses



Neoantigens of pre-existing response clinically compelling

- Easier to "boost" existing responses
- Pre-existing immunity associated with effective vaccination:
  - Malignant glioma[1]
  - Her-2/neu in prostate cancer[2]
  - Sarcoma NY-ESO-1 vaccine[3]

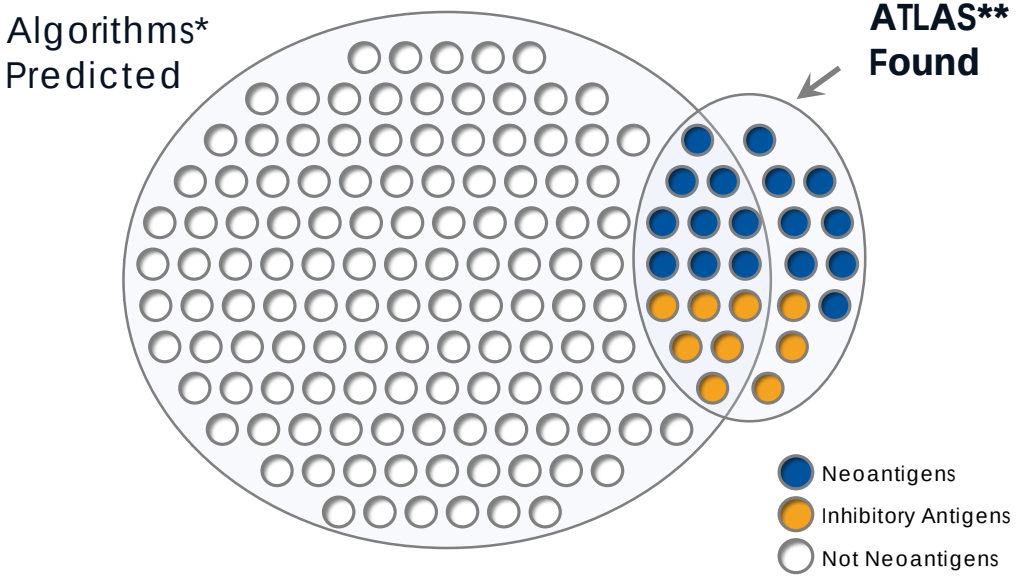
Pre-treatment sample from NSCLC patient with long-term response to CPI; collaboration with Tim Chan, Jedd Wolchok, MSKCC

[1]Yajima *et al.*, 2005 *Clin Cancer Res*
[2]Voutsas *et al.*, 2016 *JITC*
[3] Pollack *et al.*, 2017 ASCO poster

ATLAS data supports superiority in neoantigen identification

ATLAS identifies true neoantigens

Of 202 identified tumor-specific mutations



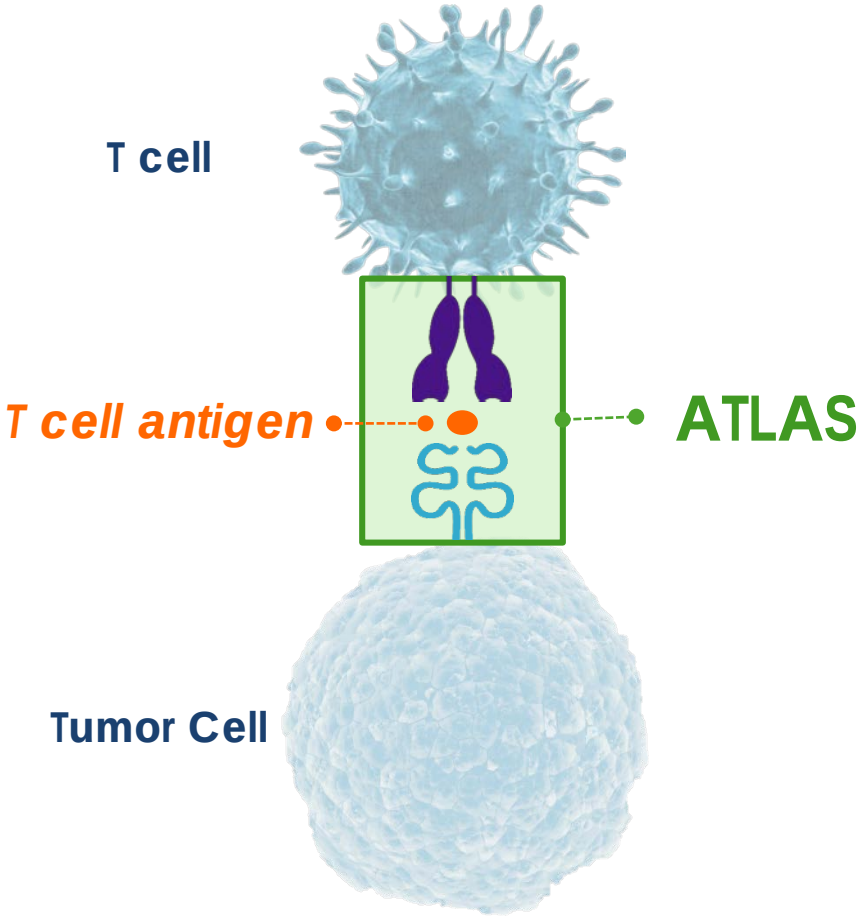
* CD8⁺ predictions (NetMHC, NetCTLpan, IEDB)

Biology too complex for algorithms

- CD4⁺ and CD8⁺ antigens are not the same
- Not all neoantigens are "good"
- No association with key algorithm inputs:
  - Binding affinity
  - RNA expression
  - Allele frequency
  - Frame shifts

**ATLAS also identified CD4⁺ antigens; algorithms do not model CD4⁺ epitopes well

ATLAS: Don't Guess. Know.

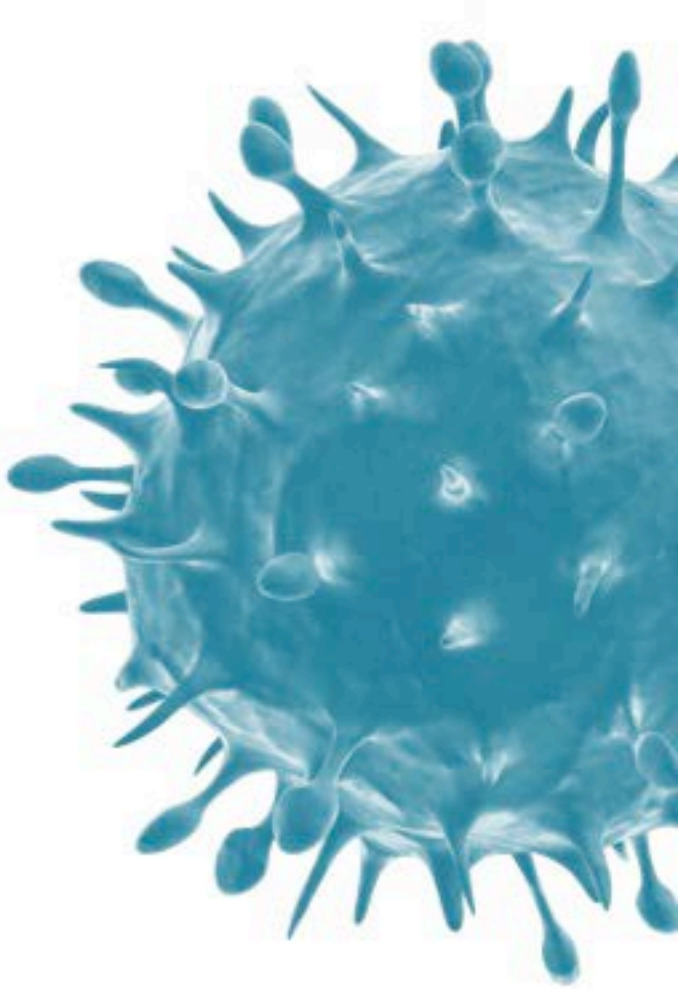


- T cells showing, not predicting, neoantigens:
  - For any patient
  - Of pre-existing responses for easier vaccination
  - For $CD8^+$ and $CD4^+$ T cells for broader immune response

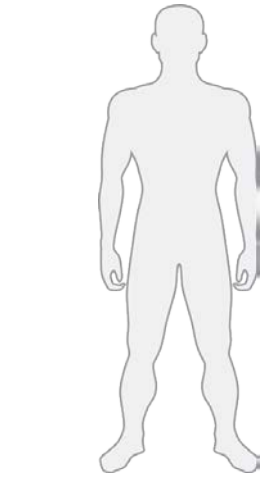
- The right neoantigens for better vaccines

GEN-009

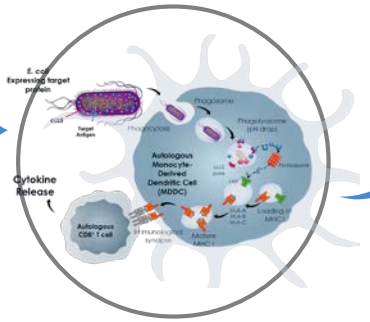
Neoantigen vaccine program



ATLAS neoantigen selection drives potential best-in-class personalized cancer vaccine program

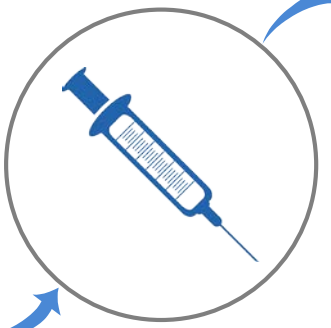


Collect tumor and blood samples, sequence exome



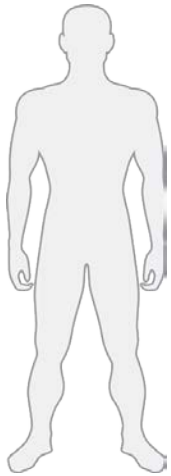
ATLAS to identify true neoantigens of CD4+ and CD8+ T cell responses

Synthesize vaccine with ATLAS-identified T cell antigens



Composition: Synthetic long peptides + adjuvant

Ship personalized product to clinical site



GEN-009 clinical program designed to demonstrate superiority of ATLAS antigen selection in patients

- First-in-man study overview:
  - Monotherapy then combination with CPI therapy
  - **Objectives:** safety & immunogenicity
  - **Multiple tumor types**
  - **Patient cohort:** No evidence of disease, high risk of relapse
  - Expands to test dose regimens

Planned milestones

- IND: early 2018
- Initial monotherapy immunogenicity: H1 2019

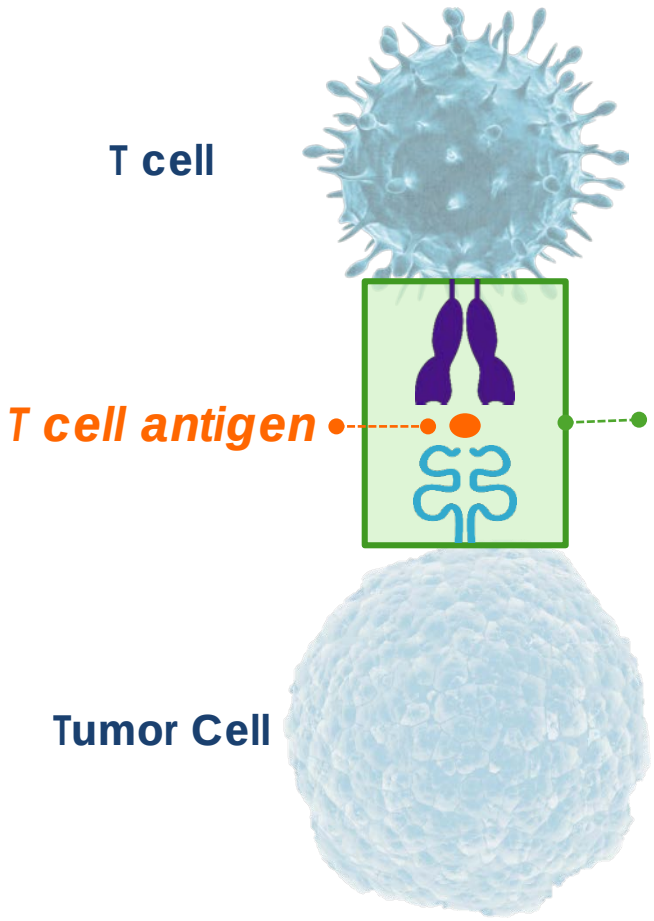
Neoantigen selection separates Genocea from peers

Company	Modality/Delivery System	Neoantigen Selection Strategy
Aduro	Bacterial vector	**Prediction-based** • Poor predictive power ($CD8^+$) • $CD4^+$ predictions more challenging • HLA-limited
Agenus	Peptides + adjuvant	
BioNTech	RNA	
CureVac	RNA	
Gritstone	Viral vectors	
Moderna	RNA	
Neon	Peptides + adjuvant	
Nouscom	Viral vectors	
Advaxis	Bacterial vector	**No down-selection** • Antigenic competition
Geneos/Inovio	DNA	

→ Limited immunogenicity, efficacy to date

→ No clinical data available

Targets matter: ATLAS is centerpiece for sustained leadership in cancer immunotherapy



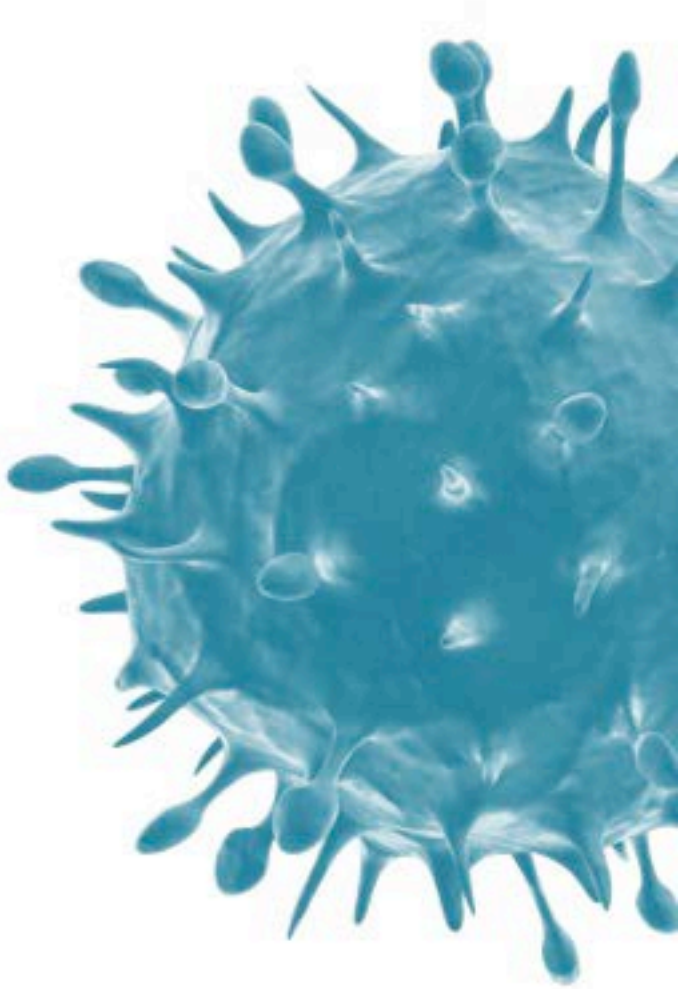
ATLAS

Immunotherapy

- **Neoantigen vaccine** — Genocea-owned
- **Tumor-Associated Antigen** (TAA) vaccine
- **Virus-associated antigen** (VAA) vaccines
- **TCR**

To partner: the right targets for better products

Investment Opportunity



Exploring strategic alternatives for GEN-003

- Positive 12-month Phase 2b data did not lead to a pathway for Genocea to independently advance GEN-003 given time and cost of Phase 3 trials
- Strategic process underway to seek to maximize value for GEN-003 through sale, partnership etc.
- Continue to believe that GEN-003 address unmet medical needs in genital herpes patients

Neoantigen cancer vaccine pipeline drives multiple potential milestones in next 18 months

	DISCOVERY	PRE-CLINICAL	PHASE 1	PHASE 2	STATUS & EXPECTED MILESTONES
GEN-009 ***1st Generation Neoantigen Cancer Vaccine***					• Peptide + adjuvant vaccine • IND filing in early 2018 • Immunogenicity data in H1 2019
GEN-010 ***2nd Generation Neoantigen Cancer Vaccine***					• Innovative delivery modality • IND filing in H2 2018 • Immunogenicity data in H2 2019

- Opportunities to leverage proof-of-concept data to partner ATLAS
  - Shared antigen cancer vaccines (Dana Farber, Checkmate collaborations)
  - Vaccines against cancers of viral origin (Epstein-Barr virus antigen selection)

Strong science

- SAB
  - **Elizabeth Jaffee, MD**, Johns Hopkins, Deputy Director Sidney Kimmel Comprehensive Cancer Center
    - President, AACR; Chair, NCI Moonshot
  - **Chuck Drake, MD, PhD,** Columbia, Director of Genitourinary Oncology and Associate Director for Clinical Research
  - **Luis Diaz, MD**, MSKCC, Head of Division of Solid Tumor Oncology
  - **Kwok Wong, MD**, NYU, Chef of Hematology and Medical Oncology
  - **George Siber, MD, PhD**, Former CSO Wyeth Vaccines

- Scientific founders:
  - **Darren Higgins, PhD**, Harvard
  - **David Sinclair, PhD**, Harvard

We are creating the leading next-generation cancer vaccine company

- Compelling role for effective neoantigen vaccines in the I-O revolution
- Genocea brings differentiated vaccine technology to bear to create best-in-class vaccines
- Important milestones delivered over next 2 years, with longer-term opportunity for sustained leadership
- Strong science, proven team

Financial summary

- Cash at Q3 2017 – $22.0m
- $49m ATM facility capacity
- Debt facility – $14.4m principal outstanding
- Funded into middle of 2018
- Shares outstanding (11/1/17)
  - Basic – 28.7m
  - Fully diluted – 33.2m

Genocea Biosciences, Inc.

NASDAQ: GNCA
Cambridge Discovery Park
100 Acorn Park Drive
5th floor
Cambridge, MA 02140
USA
Phone: +1 617.876.8191

www.genocea.com