# INTEGRAID

## RETHINKING ADOPTIVE CELL THERAPY WITH NOVEL BIOPROCESSING SOLUTIONS

Yale Innovation Summit

May 8, 2019

# Start-up Team Experience

**Prof. Tarek Fahmy, PhD**
***Scientific Founder***

- Prof. of Biomedical Engineering and Immunobiology, Yale University
- Pioneer in the field of 'Immuno-Engineering'; established authority in the use of biomaterials for immune modulation
- Recognised as a top faculty bio entrepreneur by *Nature Biotechnology;* granted over 20 patents

**Gerard Lopez**
***Seed Investor/Chairman***

- Gerard Lopez is a co-founder in Mangrove Capital Partners, a venture capital fund with a focus on providing early financing for technology companies (Skype & Wix)
- A sector-agnostic Family Office investor who takes a hands-on approach by working with founders in establishing a vision to support financing and growth

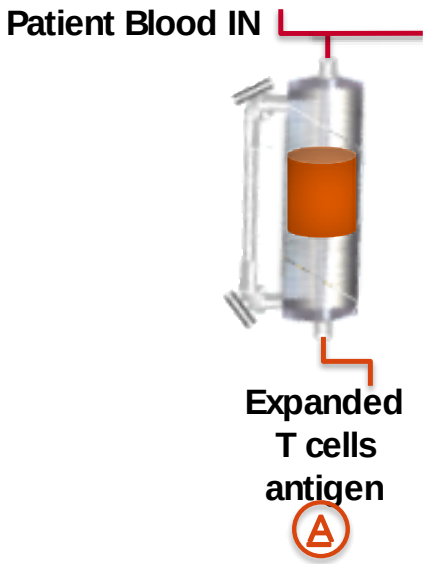
**Kumar Perampaladas**
***Principal, Family Office***

- Kumar Perampaladas is a Principal in the Family Office of Gerard Lopez & Co., and leads early-stage life science investments
- He has worked in strategy and operations for an early-stage biotech and supported evidence generation, commercial planning and payer strategies as a consultant to biopharma companies

## Technology

1. First device to recapitulate key T cell signals in an *ex vivo* lymph node structure for T cell activation
2. Paracrine delivery of IL-2 avoids the issue of T cell exhaustion
3. Single-use technology devices reduce Capex/Opex over entire product lifecycle, reduce risk for cross-contamination and labor costs

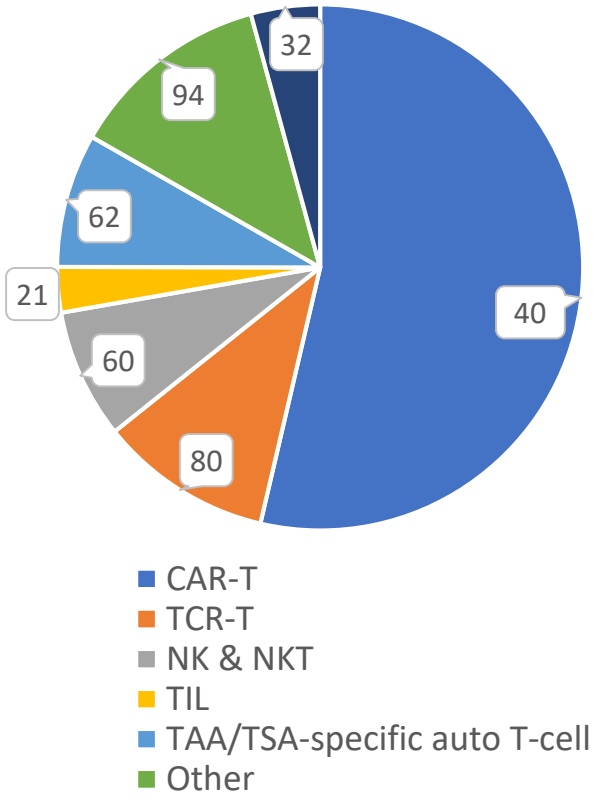
# InteGraid's platform is designed to overcome the key cell therapy limitations




- Single-use disposable bioreactor device tailored to target antigen-specific immune and regulatory signals
  - Multi-target approach for efficacy in solid tumors
- Controlled delivery of IL-2 from bioreactor impacts the phenotype, magnitude and kinetics of T cell activation
  - Leads to reduction in labor intensity and cell processing steps
- Our technology will introduce a paradigm shift in adoptive cell therapy:
  - Deliver adoptive cell therapies in an outpatient setting without the need for pre-infusion conditioning; potential for repeat dosing

# Market – Global Landscape for Cancer Cell Therapy

Numbers of different types of cell therapies in development (Preclinical to Phase 3)




- Market fundamentals remain attractive
- Favourable R&D pipeline; strong emphasis on cancer cell therapy which represents >50% share of biopharma R&D pipeline
- Emphasis on combination therapies with PD-1/PD-L1, where peak sales are expected to be $21B in 2019 and exceed $44B in 2024
    - Expect to see more cell therapy combinations with PD-1/PD-L1 therapies

Adapted from Tang, J et al. The global landscape of cancer cell therapy. *Nature Reviews Drug Discovery* **17,** 465-466 (2018)
Cowen & Co. Investors' Guide to Immuno-Oncology. September 2018.

# Market – Bioprocess Solutions Tools For Cell Therapy

## Life Science Tools by Category

Tumor Biology | Reagents | Cell Culture Media | Liquid Biopsy | Cell Therapy

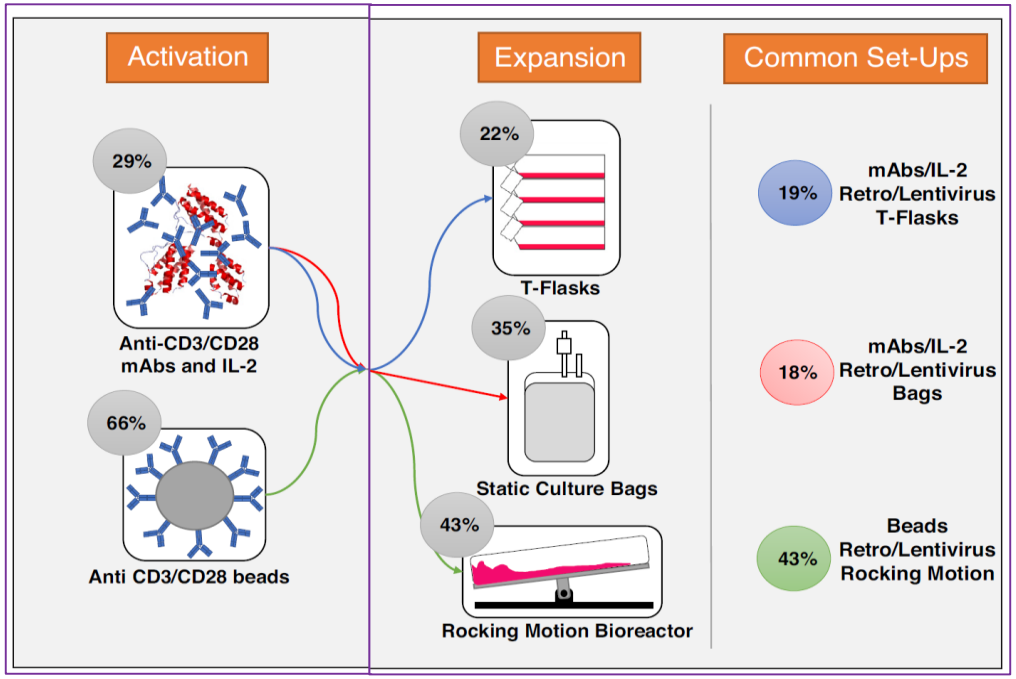
Bioprocess Solutions

Production upstream & downstream

## Life Science Tool Providers Outlook for M&A

- Tool providers such as Sartorius and Thermo Fisher have identified bioprocess solutions as a market for growth
- Identify technologies tailored for cancer cell therapies
- Increase importance of product costs and time to market
- Strong emphasis on technologies that can reduce Capex/Opex entire product lifecycle; provide meaningful efficiencies in the manufacturing and delivery of cell therapies

# Competition




**Review of ~950 CAR T products from clinical trials:**

- 66% use anti-CD3/CD28 antibody coated magnetic beads (Dynabeads™, Thermo Fisher)
- 43% used a rocking motion bioreactor (GE Wave ™ bioreactor)
- Highly variable processing protocols and technology mix used across evaluable products; lead to variation in subset composition in final T cell product and CAR T cell doses

- Our technology offers:
  - ✓ Addresses the need for small-scale technologies tailored for cell therapy
  - ✓ Single-use disposable cartridge
  - ✓ Streamlines and incorporates several cell manipulation steps in a all-in-one device
  - ✓ Reduce operator and open-handling of material via the use of a sterile bag
  - ✓ Aims to reduce labor intensity and run-to-run variability



Adapted from Vormittag, P. et al. A guide to manufacturing CAR T cell therapies. *Current Opinion in Biotechnology* 2018, **53:** 164-181

# Our Technology is Tailored For Adoptive Cell Therapy

***Signal 1:*** T cell recognition *(ex. Polyclonal: anti-CD3)*

- ✓ Signal selects for phenotype or specificity of cells of interest

***Signal 2:*** Co-stimulatory molecule (anti-CD28)

- ✓ Signal amplifies the recognition signal and initiates T-cell activation process

***Signal 3:*** T cell growth factor (e.g. Interleukin-2)

- ✓ Signal responsible for robustness of T cell expansion similar to the natural human response via '*T-cell zone*' orientation

***Signal 4:*** Laminar flow

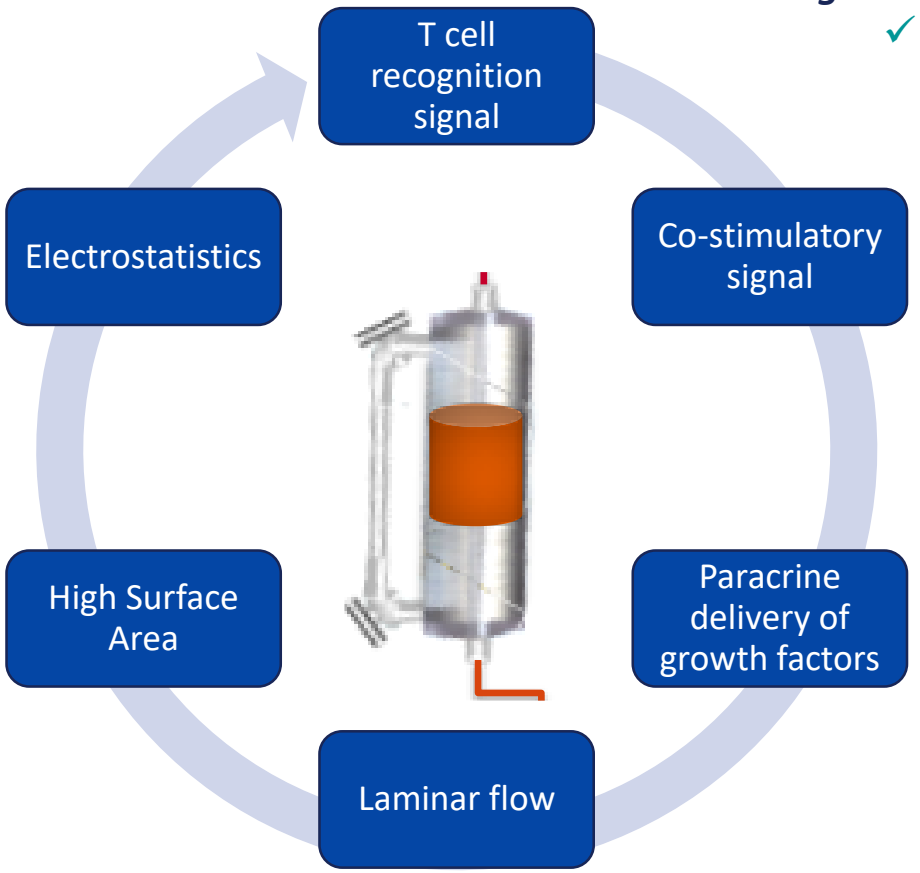
- ✓ Laminar flow is required to enhance the quality of expanded T cells and expression of markers that are important for cell potency against tumors

***Signal 5:*** High surface area

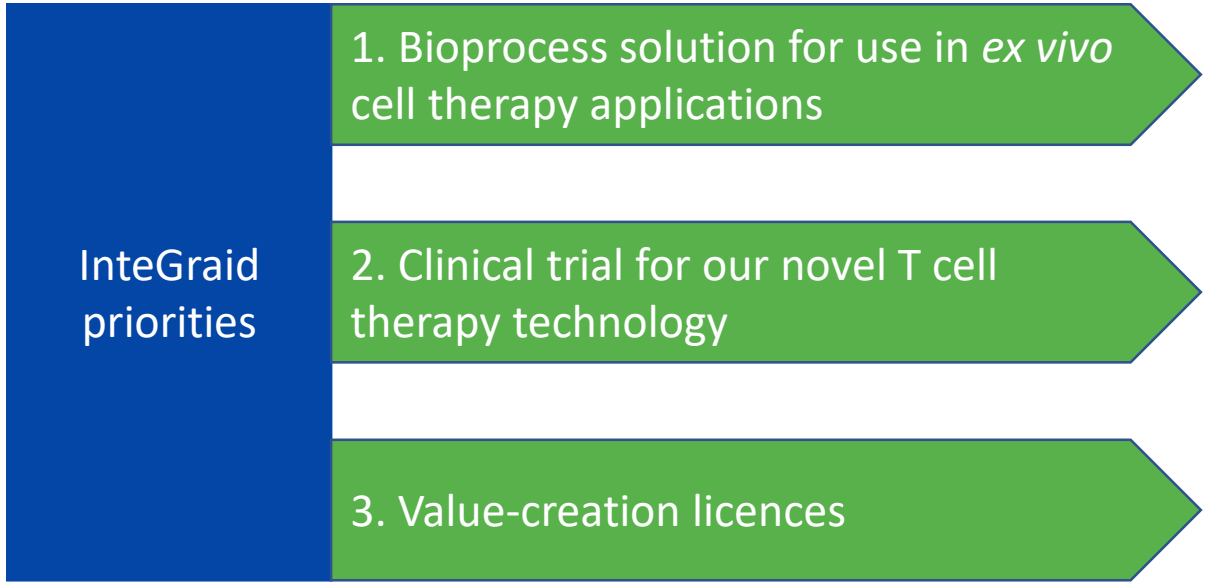
- ✓ The device is viewed as a 'safe' lymph node used outside the body for T cell activation

***Signal 6:*** Electrostatics

- ✓ T cell expansion is best performed under specific charge potential incorporated in the advanced materials assembly process



# Business Model




Develop a FDA cleared device to be used in R&D of cancer cell therapies

Invest in a clinical trial programme to demonstrate the clinical value of our technology as a **non-engineered approach** to adoptive cell therapy

Explore collaborations and device iterations with partners to maximise R&D and clinical potential

# Funding and Milestones

Funds to support FDA roadmap for device clearance
and early clinical studies;
establish a full management team.