Forward-Looking Statements

This presentation contains forward-looking statements for purposes of the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. All statements contained in this presentation other than statements of historical facts may constitute forward-looking statements within the meaning of the federal securities laws. These statements can be identified by words such as "expects," "plans," "projects," "will," "may," "anticipates," "believes," "should," "intends," "estimates," and other words of similar meaning, including, but not limited to, statements regarding: the Company’s plans to initially apply the XCART technology to advance cell-based therapeutics by targeting the unique B-cell receptor on the surface of an individual patient’s malignant tumor cells for the treatment of B-cell lymphomas, expectations to leverage CMC infrastructure through academic collaboration, anticipated potential for Orphan Drug designation of the XCART technology, expectations regarding the potential of PolyXen to partner with additional pharmaceutical companies and the Company's efforts to build a pipeline of partnerships utilizing PolyXen, anticipated potential to expand the Company’s pipeline by in licensing complementary products/ technologies, expectations regarding capital sufficiency funding the Company through mid-2021, the Company’s program highlights and expected milestones, XCART’s potential to transform CAR T therapy and the potential to address various target and tumor types, anticipated efforts to drive the Company’s development strategy through academic collaboration and expected timelines, including the timing of establishing site collaborations and completing IND filings, expectations regarding cash runways expected to fund Company through preclinical advancements towards IND filing, and the Company’s expectations that XCART has the potential to fuel a robust pipeline of therapeutic assets targeting high-value oncology indications. Any forward-looking statements contained herein are based on current expectations, and are subject to a number of risks and uncertainties. Many factors could cause our actual activities or results to differ materially from the activities and results anticipated in forward-looking statements. Important factors that could cause actual results to differ materially from such plans, estimates or expectations include, among others, (1) unexpected costs, charges or expenses resulting from the acquisition of the CAR T technology; (2) uncertainty of the expected financial performance of the Company following completion of the acquisition of the CAR T technology; (3) failure to realize the anticipated potential of the XCART technology; (4) the ability of the Company to implement its business strategy; and (5) other risk factors as detailed from time to time in the Company’s reports filed with the SEC, including its annual report on Form 10-K, periodic quarterly reports on Form 10-Q, periodic current reports on Form 8-K and other documents filed with the SEC. The foregoing list of important factors is not exclusive. In addition, forward-looking statements may also be adversely affected by general market factors, competitive product development, product availability, federal and state regulations and legislation, the regulatory process for new product candidates and indications, manufacturing issues that may arise, patent positions and litigation, among other factors. The forward-looking statements contained in this presentation speak only as of the date the statements were made, and the Company does not undertake any obligation to update forward-looking statements, except as required by law.
Investment Highlights

Advancing cell-based CAR T therapeutics targeting significant unmet need in B-cell non-Hodgkin lymphoma

- Significantly differentiated from current CAR T therapies
- Leveraging CMC infrastructure and development expertise through academic collaborations
- Potential for Orphan Drug designation

Next generation half-life extension platform for biologics

- Receiving royalties under license agreement with Takeda
- Potential to partner with additional pharmaceutical companies

Potential to expand pipeline by in-licensing complementary products/technologies  |  Cash expected to fund through mid-2021
## Program Highlights

<table>
<thead>
<tr>
<th>Program</th>
<th>Indication</th>
<th>Preclinical</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>XCART™ Platform</strong></td>
<td>B-Cell Non-Hodgkin Lymphoma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Academic Collaborators</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Scripps Research</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PHARMSYNTHEZ</td>
</tr>
<tr>
<td><strong>PolyXen®</strong></td>
<td>Next Generation Half-Life Extension Platform for Biologics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Active Partnership with Takeda (receiving royalties under license agreement)</td>
</tr>
<tr>
<td>Name</td>
<td>Title and Contributions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Matthew Frigault</td>
<td>Medical Oncologist in the Hematologic Malignancy Program at the Massachusetts General Hospital Cancer Center, as well as Assistant Director of the Cellular Immunotherapy Program, serves as Instructor at Harvard Medical School.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Alexander Gabibov</td>
<td>Head of the Shemyakin &amp; Ovchinnikov Institute of Bioorganic Chemistry at the Russian Academy of Science. Dr. Gabibov holds several senior positions in the Biochemistry sphere in both Russia and France. In 2008, he was appointed President of the Russian Biochemical and Molecular Biology Society. In 2009, Dr. Gabibov took up the role of Foreign Correspondent at the National Academy of Pharmacy in France.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Guenther Koehne</td>
<td>Internationally recognized cancer specialist and current Chief of Blood &amp; Marrow Transplant and Hematologic Oncology at the Miami Cancer Institute; noteworthy reputation for his work in adoptive immunotherapeutic approaches with antigen-specific, donor-derived T lymphocytes in the treatment of viral complications following allogeneic transplants and has developed new approaches to the treatment of patients with high-risk multiple myeloma.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Greg MacMichael</td>
<td>Over 35 years of experience in the development and manufacture of therapeutic proteins, vaccines and cell and gene therapies. Serves as President and Founder of CMC BioServices, LLC, a well-established consulting firm. Previously served as the Senior VP of Technical Operations at Axovant Gene Therapies; VP of Development, Manufacturing and Quality Control at NantKwest Therapeutics; and Senior VP of Process, Development, Manufacturing and Quality Assurance at Rocket Pharma.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Maksim Mamonkin</td>
<td>Leading research expert in developing new therapeutic tools to treat hematologic malignancies and solid tumors using adoptive cell therapy. Serves as Assistant Professor, Pathology and Immunology and is an independent faculty member at the Center for Cell and Gene Therapy at Baylor College of Medicine.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Jia Xie</td>
<td>One of the original inventors of XCART™. Specializes in new platform development and therapeutic molecule discovery. He and his team have invented a collection of new technologies for antibody drug discovery and cell therapy, which were licensed by biotech companies and led to joint collaboration efforts with large pharmaceutical companies.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Alexey V. Stepanov</td>
<td>Leading research expert in developing personalized therapeutic tools for lymphoproliferative diseases using immunotoxins or adoptive cell therapy. Currently serves as a Senior Staff Scientist in the Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry. Maintains a Senior Staff Scientist position in the Dmitry Rogachev National Medical Research Center of Pediatric Hematology, Oncology and Immunology in Russia. Professional scientific collaborator of Dr. Richard Lerner’s laboratory in The Scripps Research Institute.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
XCART™ Platform
Expanding the Potential of CAR T Cell Therapy
CAR T Cell Therapy is Driving New Breakthroughs in Cancer

Targeted Therapy That Leverages Patient's Own Immune System to Fight Cancer

- Over 80% complete or partial response when treated with Yescarta
- Over 80% remission rate when treated with Kymriah
- 47% survival rate at 39-months when treated with Yescarta

...But There Remains Shortcomings in Treatments

- B-Cell Aplasia
- CRS and ICANS
- CD19 Antigen Escape
- T Cell Exhaustion
- CAR T Relapse

XCART™ Has the Potential to Transform CAR T Therapy

Truly Differentiated Cell-Based CAR T Therapeutics

• XCART™ constructs can target patient-specific tumor neoantigens
• Established proof-of-mechanism in B-cell lymphomas
• Potential to address various target and tumor types

• Proprietary cell-based CAR screening platform
• Proprietary autocrine technology licensed from Scripps (originating in Richard Lerner’s lab)

• Compatible with current up- and down-stream CAR T manufacturing processes
• Applicable to a wide range of CAR T constructs
• Enables rapid identification of functional CARs & TCRs
XCART™: Engineered to Target Patient- and Tumor-Specific Neoantigens

Shown Preclinically to be Effective in B-Cell Lymphoma

B-cell Receptor (BCR) on an Individual Patient’s Lymphoma Cells

BCR Signaling Pathway

- Central regulator of B-cell function
- Promising anticancer drug target in lymphomas

BCR Expressed by Clonal B-Cell Tumor

- Pivotal driver of tumor pathways
- Patient- and tumor-specific neoantigen

Targeting a Tumor-Specific BCR with CAR T Therapy

- Imparts high selectivity
- Can overcome limitations of CD19 CAR T therapies
The BCR is a Neoantigen Unique to Each B-Cell Clone

Each Unique B-Cell Clone Displays a Unique BCR

Normal B-Cell Repertoire

Malignant Transformation of Single Clone

Normal B-Cells (~10^9 Unique Clones)

Malignant B-Cell (Retains Unique BCR as a Neoantigen)

Tumor Development

CD19
Selective Targeting of Unique BCRs is Differentiated from Current Anti-CD19 CAR T Approaches

**XCART™ CAR T Cells Target Patient- and Tumor-Specific Neoantigens**

**Tumor Growth**

- **Clonal Proliferation**
  - Malignant B-Cell Proliferation (Retains Unique BCR)

**Tumor Treatment**

- **XCART™ Therapy**
  - XCART™ Eliminates Only Malignant B-Cells
  - Normal B-Cells Are Spared

- **CAR T Therapy**
  - Current Anti-CD19 CAR T Therapy Eliminates All B-Cells
  - Results in B-Cell Aplasia
Autocrine-based selection of ligands for personalized CAR-T therapy of lymphoma

Alexey V. Stepanov¹, Oleg V. Markov², Ivan V. Chernikov², Daniił V. Gladkikh², Hongkai Zhang³,⁴, Teresa Jones³, Alexandra V. Sen'kova⁵, Elena L. Chernolovskaya⁵, Marina A. Zenkova², Roman S. Kalinin¹, Maria P. Rubtsova⁶, Alexander N. Meleshko⁶, Dmitry D. Genkin⁷, Alexey A. Belogurov Jr.¹, Jia Xie³,⁸, Alexander G. Gabibov¹,⁸, Richard A. Lerner³,⁸

We report the development of a novel platform to enhance the efficacy and safety of follicular lymphoma (FL) treatment. Since lymphoma is a clonal malignancy of a diversity system, every tumor has a different antibody on its cell surface. Combinatorial autocrine-based selection is used to rapidly identify specific ligands for these B cell receptors on the surface of FL tumor cells. The selected ligands are used in a chimeric antigen receptor T cell (CAR-T) format for redirection of human cytotoxic T lymphocytes. Essentially, the format is the inverse of the usual CAR-T protocol. Instead of being a guide molecule, the antibody itself is the target. Thus, these studies raise the possibility of personalized treatment of lymphomas using a private antibody binding ligand that can be obtained in a few weeks.
Human CD8+ T cells were transduced with Lentiviral vectors coding for one of pepFL1-CAR, pepFL2-CAR, pepFL3-CAR or CD19-CAR constructs.
**XCART™ Proof of Mechanism in Model Systems**

**CD8+ CAR T Cells Engineered to Target Model Lymphomas Expressing Patient-Derived BCRs**

- Anti-CD19 CAR T cells target and lyse **any** CD19+ Raji cells
- Anti-BCR#1 CAR T cells target and lyse **only** Raji cells expressing BCR#1
- Anti-BCR#3 CAR T cells target and lyse **only** Raji cells expressing BCR#3

**Anti-BCR#1 and Anti-CD19 CAR T Showed Similar Effect**

- CD8+ T Cell Expressing Anti-CD19 CAR
- CD8+ T Cell Expressing Anti-BCR#1 CAR
- CD8+ T Cell Expressing Anti-BCR#3 CAR

**Graph:**
- Tumor volume (mm³)
- Days after tumor implantation
- CAR T-cells

**Legend:**
- Anti-CD19 CAR T
- Anti-BCR#1 CAR T
- Anti-BCR#3 CAR T
- Myc-CAR T (neg.)

**21 days post infusion**
Market Opportunity – Non-Hodgkin Lymphoma Therapeutics
Estimated 2018 US Incidence of NHL: 75,000

Follicular Lymphoma (FL)
Second most common subtype of NHL in the US
(~20% of all NHL Cases)

~15K/year US Incidence
• Majority of FL cases remain incurable with standard therapies
• Most patients undergo relapses over time, often with increasing frequency and aggressiveness

Diffuse Large B-Cell Lymphoma (DLBCL)
Most common subtype of NHL in the US
(~40% of all NHL cases)

~30K/year US Incidence
• ~30% relapse within 24 months
• ~50% Of Refractory & Relapsed DLBCL have poor prognoses

Global Market for Non-Hodgkin Lymphoma

Trends in NHL Incidence Rates, 1975-2014
Per 100,000, age adjusted to the 2000 US standard population.

Unmet Need in Follicular Lymphoma (FL)

FL Treatment Timeline

First Line
[R-CHOP; R-mono]

POD > 2 yrs

(80%)

POD < 2 yrs

(20%)

Treatment
Decisions Based On:
- Tumor burden
- Other risk factors
  (e.g. FLIPI)

Diagnosis FL

POD > 2 yrs

XCART™ Opportunity
~3,000 patients/yr (US)

POD < 2 yrs

Time to first POD is an important prognostic indicator

Survival Probability (%)

Time from Risk-Defining Event (months)

5-year survival rate: 90%
Median OS from first POD: >12 years

5-year survival rate: 50%
Median OS from first POD: 5 years

Patients with FL have a 28-31% probability of high grade transformation at 10 years

Second Line(s)

R-CHOP
R-mono

R-CHOP
Chemotherapy
Targeted Agents
Radioimmunotherapy

High Dose
Chemo / SCT

CAR T

CAR T Relapse
CD19 / CD19+

Addressable with 6-
month XCART™ process

Unmet Need in Diffuse Large B-Cell Lymphoma (DLBCL)

DLBCL Treatment Timeline

0 Month | 12 Months | 24 Months | 36 Months | 48 Months

- **Diagnosis DLBCL**
- **First Line (R-CHOP)**
- **Relapse**
- **Primary Refractory**
- **2nd Line Ablation/BMT**
  - (50%)
  - (50%)
- **Relapse/Refractory**
  - (50%)
  - (50%)
- **XCART™ Opportunity**
  - ~10,000 patients/yr (US)
- **CAR T**
  - CAR T Relapse CD19+/CD19-
- **NET ~70% (OS 5 yrs)**

**Addressable with 6-month XCART™ process**

---

Driving XCART Development Through Academic Collaborations

Leveraging Development and Manufacturing Expertise for Patient-Specific Therapies

Provides Many Advantages

- Access to Manufacturing Suites
- Establishes CMC and Regulatory Infrastructure for Manufacturing
- Operational/Cost Efficiencies and Risk Mitigation

Announced Collaboration:

- Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry of the Russian Academy of Sciences (IBCh RAS)
- Belarussian Research Center for Pediatric Oncology, Hematology and Immunology
- Institute of Bioorganic Chemistry of the National Academy of Sciences of Belarus
- Vitebsk Regional Clinical Oncological Center

Scripps Research
PolyXen® PSA Technology Platform
Enables Next Generation Biologic Drugs
PolyXen®: Next Generation Half-Life Extension Platform

Polysialylation employs the biological polymer polysialic acid (PSA) to modulate the pharmacokinetic and pharmacodynamic profiles of protein drugs.

Key Features
- Retention of native protein conformation
- Non-immunogenic
- Biodegradable
- Fewer injections
- Improved protease stability
- Improved thermal stability
- Broad patent cover

Broad Utility
- Clinically demonstrated to extend half-life of therapeutic proteins
- Applicable to franchise extensions as well as candidates in development
- Potential utility in other molecule classes such as peptides and small molecules

License Agreement
- Exclusive License Agreement with Takeda in the field of coagulation disorders
- Granted right to Takeda to grant a nonexclusive sublicense to certain patents related to PolyXen®
  - Received $7.5 million upfront payment
  - Single digit royalties based on net sales
    - Receiving royalties under agreement
  - One active development program

Seeking to build a pipeline of partnerships utilizing PolyXen®
Experienced Management Team

**Jeffrey F. Eisenberg**  
Chief Executive Officer & Director  
Life Sciences executive with over 20 years of successful track record in value creation in both private and public companies; former CEO of Noven Pharmaceuticals and responsible for 2 product launches and led Noven’s Novogyne Women’s Health joint venture with Novartis

**Curtis Lockshin, Ph.D.**  
Chief Scientific Officer  
20 years Biotech/Pharma management experience, including discovery, preclinical and clinical development and commercial manufacturing; former CEO of SciVac Therapeutics, CTO of VBI Vaccines and VP of Corporate R&D Initiatives for OPKO Health

**James F. Parslow, MBA, CPA**  
Chief Financial Officer  
Over 30 years of experience providing financial and business leadership to biotech, manufacturing, technology, business-to-business e-commerce and cleantech industries
Financial Snapshot
NASDAQ: XBIO

Cash runway expected to fund Company through preclinical advancements towards IND filing

<table>
<thead>
<tr>
<th>Market Cap&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Shares Outstanding</th>
<th>Cash Balance&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>~$5.5M</td>
<td>~6.3M</td>
<td>~$7.1M</td>
</tr>
</tbody>
</table>

1: As of November 20, 2020; 2: As of September 30, 2020
### Acquisitions

<table>
<thead>
<tr>
<th>Company</th>
<th>Lead Program</th>
<th>Phase</th>
<th>MKT Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xyphos</td>
<td>ALL</td>
<td>Phase 1/2</td>
<td>$597M</td>
</tr>
<tr>
<td>celldesignlabs</td>
<td>UCART19</td>
<td>Phase 1</td>
<td>$744M</td>
</tr>
<tr>
<td>Juno Therapeutics</td>
<td>rGBM &amp; Libtayo®</td>
<td>Phase 2</td>
<td>$529M</td>
</tr>
<tr>
<td>Kite</td>
<td>MB-101 IL13Ra2-specific CAR</td>
<td>Phase 2</td>
<td>$156M</td>
</tr>
</tbody>
</table>

### Licensing Agreements

<table>
<thead>
<tr>
<th>Company</th>
<th>Agreement with</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellicum</td>
<td>AgenSys</td>
<td>$80M upfront &amp; up to $185M per product</td>
</tr>
<tr>
<td>Pfizer</td>
<td>collectis</td>
<td></td>
</tr>
<tr>
<td>abbvie</td>
<td>Calibr</td>
<td>$350M</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>Nanjing Legend</td>
<td>for</td>
</tr>
</tbody>
</table>

1: Lead program in preclinical development at time of acquisition; 2: Lead program in pivotal trial at time of acquisition; 3: Lead program BLA under priority review at time of acquisition; 4: As of November 9, 2020
Advancing diversified program portfolio with focus on driving value from lead CAR T technology platform

**XCART™ Platform**
- Truly differentiated CAR T technology with potential to address various target and tumor types
- Lead program targeting $5 billion initial opportunity in b-cell non-Hodgkin lymphoma

**PolyXen®**
- Next generation delivery platform for biologic drugs
- Active program with Takeda and potential for additional partnerships
  - Receiving royalties under Takeda license agreement
Enhancing lives with transformative therapies

Thank you!
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Background and Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam Logal</td>
<td>Chairman</td>
<td>CFO, OPKO Health; Former Director, VBI Vaccines; Nabi Biopharmaceuticals</td>
</tr>
<tr>
<td>Dmitry Genkin</td>
<td>Director</td>
<td>Former Head of Pharmavit, one of Russia’s largest pharmaceutical companies; Chairman, PJSC Pharmsynthez</td>
</tr>
<tr>
<td>James Eric Callaway, Ph.D.</td>
<td>Director</td>
<td>Seasoned CEO within the venture-backed community and current CEO of Kalgene; Former Head of Development, Elan Pharmaceuticals</td>
</tr>
<tr>
<td>Grigory G. Borisenko, Ph.D.</td>
<td>Director</td>
<td>Investment Director of RUSNANO Management Co LLC and former head of the pharmaceutical sector of the Department of Science and Technology Expertise at the state corp., RUSNANO</td>
</tr>
<tr>
<td>Firdaus Jal Dastoor, FCS</td>
<td>Director</td>
<td>Fellow Member of The Institute of Company Secretaries of India; Group Director of the Poonawalla Group of Companies</td>
</tr>
<tr>
<td>Roger Kornberg, Ph.D.</td>
<td>Director</td>
<td>Winzer Professor of Medicine in the Department of Structural Biology at Stanford University; Nobel Prize in Chemistry - Molecular Basis of Eukaryotic Transcription</td>
</tr>
<tr>
<td>Jeffrey F. Eisenberg</td>
<td>Chief Executive Officer &amp; Director</td>
<td></td>
</tr>
<tr>
<td>Dr. Alexey Vinogradov</td>
<td>Director</td>
<td>Business Development Director and Operations Director at Cantreva LLC; Former General Manager at Togas Middle East LLC in Dubai, UAE</td>
</tr>
</tbody>
</table>