REALIZING THE POWER OF RED™
A NEW ERA IN CELLULAR MEDICINE

OCTOBER 2020
Forward-Looking Statements

This presentation may contain forward-looking statements. Forward-looking statements are neither historical facts nor assurances of future performance. Instead, they are based on our current beliefs, expectations and assumptions regarding the future of our business, future plans and strategies, our development plans, our clinical results and other future conditions. All statements other than statements of historical facts contained in this presentation, including statements regarding our future financial or business performance, conditions, plans, prospects, trends or strategies and other financial and business matters; our current and prospective product candidates, planned clinical trials and preclinical activities, including timing related to such trials and expected results, research and development costs, current and prospective collaborations; the estimated size of the market for our product candidates, the timing and success of our development and commercialization of our anticipated product candidates; and the availability of alternative therapies for our target market. New risks and uncertainties may emerge from time to time, and it is not possible to predict all risks and uncertainties. Except as required by applicable law, we do not plan to publicly update or revise any forward-looking statements contained herein, whether as a result of any new information, future events, changed circumstances or otherwise. Although we believe the expectations reflected in such forward-looking statements are reasonable, we can give no assurance that such expectations will prove to be correct. Accordingly, readers are cautioned not to place undue reliance on these forward-looking statements. No representations or warranties (expressed or implied) are made about the accuracy of any such forward-looking statements. Certain information contained in this presentation relates to or is based on studies, publications, surveys and other data obtained from third-party sources and our own internal estimates and research. While we believe these third-party sources to be reliable as of the date of this presentation, we have not independently verified, and make no representation as to the adequacy, fairness, accuracy or completeness of, any information obtained from third-party sources. In addition, all of the market data included in this presentation involves a number of assumptions and limitations, and there can be no guarantee as to the accuracy or reliability of such assumptions. Finally, while we believe our own internal research is reliable, such research has not been verified by any independent source.

Rubius recommends that investors independently evaluate specific investments and strategies. For further information regarding these risks, uncertainties and other factors, you should read the “Risk Factors” section of our Quarterly Reports on Form 10-Q filed for the period ended June 30, 2020, and Annual Report on Form 10-K filed for the period ended December 31, 2019, and subsequent filings with the Securities and Exchange Commission.

This presentation may contain tradenames, trademarks or servicemarks of other companies. Rubius does not intend the use or display of other parties’ tradenames, trademarks or servicemarks to imply a relationship with, or endorsement or sponsorship of, these other parties.
Red Cell Therapeutics™: The Future of Cellular Therapy

LEVERAGE HISTORY OF ADMINISTERING RED BLOOD CELLS

MODULAR PLATFORM THAT MIMICS IMMUNE BIOLOGY

BROAD PIPELINE

ADVANTAGEOUS TOLERABILITY

SCALABLE OFF-THE-SHELF

POTENTIALLY TRANSFORMATIVE CELLULAR THERAPIES
<table>
<thead>
<tr>
<th>PRODUCT CATEGORY</th>
<th>PROGRAM</th>
<th>PRECLINICAL</th>
<th>IND ENABLING</th>
<th>PHASE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CANCER</strong></td>
<td>RTX-240</td>
<td>R/R Solid Tumors</td>
<td>Enrolling*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTX-240</td>
<td>R/R Acute Myeloid Leukemia</td>
<td>IND Cleared; Recruiting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTX-321 aAPC (HPV 16+)</td>
<td>R/R HPV-16+ Solid Tumors</td>
<td>IND Filing Expected by Year-End</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTX-224</td>
<td>R/R Solid Tumors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTX-aAPC</td>
<td>Cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AUTOIMMUNE DISEASES</strong></td>
<td>RTX-T1D</td>
<td>Type 1 Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTX-TBD</td>
<td>Other Programs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*First patient dosed* announced via press release on May 7, 2020, updates provided on June 30 and August 10, 2020.
The Promise of Red Cell Therapeutics™: Highly Potent, Allogeneic and Off-the-Shelf

RED PLATFORM®

- EARLY PROGENITOR CELLS
- GENETIC ENGINEERING
- EXPANSION & DIFFERENTIATION
- ENUCLEATION & MATURATION
- RED CELL THERAPEUTIC

SINGLE HEALTHY O- DONOR

100-1000’s OF DOSES
Rubius Therapeutics’ Differentiated Oncology Approaches

**BROAD IMMUNE SYSTEM STIMULATION**

Stimulate adaptive and innate immunity through **immune cell agonists**
- Presentation of synergistic co-stimulatory ligands and cytokines
- Biodistribution may reduce toxicities
- Potential broad therapeutic window

**ANTIGEN-SPECIFIC IMMUNE STIMULATION**

Drive unique, *in vivo antigen-specific* immune responses
- Direct MHC I antigen presentation
- Co-stimulatory ligand induces significant quantity of CD8+ T cells
- Cytokine potently stimulates desired quality of killer T cells

Natural ligand presentation drives potent cell-cell interactions in preclinical models
RTX-240: Enrolling Phase 1/2 Clinical Trial in Advanced Solid Tumors; Recruiting for Relapsed/Refractory Acute Myeloid Leukemia

BROAD IMMUNE SYSTEM STIMULATION

**POTENTIAL BENEFITS:**
- Activates existing agonist pathways leading to enhanced potency
- Improved anti-tumor activity
- Overcomes resistance to immunotherapy
- Reduced toxicity given biodistribution

**STIMULATE ADAPTIVE AND INNATE IMMUNE CELL AGONIST PATHWAYS**

*Rubius Therapeutics Terminology: RTX – Red Cell Therapeutic product candidate; mRBC – mouse surrogate model; RCT – experimental construct
Rubius’ First Engineered aAPC will Target HPV+ Tumors – IND Expected by End of 2020

RTX-321 (aAPC) | HPV 16+ Tumors

Replicating immune system function to activate and expand antigen-specific T cells for a potent anti-tumor effect
MANUFACTURING
- Highly experienced cell therapy technical operations team with scalable process
- Providing cGMP clinical supply for RTX-240 trial
- Expected to provide supply for RTX-321 trial
- Potential to expand manufacturing capabilities based on future needs
KEY MILESTONES
Financial Position Supports Anticipated 2020 Milestones

AN INTEGRATED DEVELOPMENT COMPANY

- Continue to enroll patients in RTX-240 solid tumors; commence dosing in AML clinical trial
- Produce cGMP material for RTX-240 and RTX-321 trials from Rubius site
- File RTX-321 IND by year-end
- Advance the autoimmune pipeline

STRONG FINANCIAL POSITION

- $236.5 million in cash, cash equivalents and investments as of June 30, 2020
- Cash runway into 2022
REALIZING THE POWER OF RED™
A NEW ERA IN CELLULAR MEDICINE