Pioneering Development in the Treatment of Gastrointestinal Diseases

(NASDAQ: RTTR)
This presentation contains forward-looking statements. All statements pertaining to future expectations, beliefs, goals, plans or prospects included in this presentation, constitute “forward-looking statements.” By their nature, forward-looking statements involve risks and uncertainties that may cause actual results, performance or achievements to differ materially from any future results, performance or achievements expressed or implied by the forward-looking statements. The forward-looking statements in this presentation are only predictions and are subject to a number of risks, uncertainties and assumptions, including, without limitation, risks inherent in the development of potential products, uncertainty in the results of clinical trials or regulatory approvals, need and ability to obtain future capital, and maintenance of intellectual property rights and other risks discussed in our reports filed with the Securities and Exchange Commission, which are available for review at www.sec.gov.

We have based these forward-looking statements largely on our current expectations about future events and financial trends that we believe may affect our business, financial condition and results of operations. Any forward-looking statements that we make in this presentation speak only as of the date of this presentation, and the Company undertakes no obligation to update or revise such statements to reflect events or circumstances after the date of this presentation, except as may be required by law.

This presentation may contain references to our trademark and to trademarks belonging to other entities. Solely for convenience, trademarks and trade names referred to in this presentation, including logos, artwork and other visual displays, may appear without the * or TM symbols, but such references are not intended to indicate, in any way, that we will not assert, to the fullest extent under applicable law, our rights or the rights of the applicable licensor to these trademarks and trade names. We do not intend our use or display of other companies’ trade names or trademarks to imply a relationship with, or endorsement or sponsorship of us by, any other company.
## Key Metrics: RTTR

<table>
<thead>
<tr>
<th>Stock</th>
<th>Cash/Capitalization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stock</strong></td>
<td><strong>Cash</strong></td>
</tr>
<tr>
<td>Exchange</td>
<td>NASDAQ</td>
</tr>
<tr>
<td>Symbol</td>
<td>RTTR</td>
</tr>
<tr>
<td>Recent Price</td>
<td>$2.10</td>
</tr>
<tr>
<td>52 Week Range</td>
<td>$0.18 - $4.00</td>
</tr>
<tr>
<td>Market Cap</td>
<td>$12.0 Million (at recent price)</td>
</tr>
<tr>
<td>50 Day Avg. Daily Vol.</td>
<td>108K Shares</td>
</tr>
<tr>
<td></td>
<td><strong>Cash</strong></td>
</tr>
<tr>
<td></td>
<td><strong>$18.1M(^1)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Common shares</strong></td>
</tr>
<tr>
<td></td>
<td><strong>5.7M</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Preferred shares</strong></td>
</tr>
<tr>
<td></td>
<td><strong>6.8M(^2)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Preferred rights</strong></td>
</tr>
<tr>
<td></td>
<td>Pari passu to common</td>
</tr>
<tr>
<td></td>
<td><strong>Warrants o/s &amp; Strike Price</strong></td>
</tr>
<tr>
<td></td>
<td>8.4M @ $1.30</td>
</tr>
<tr>
<td></td>
<td><strong>Fully Diluted Market Cap</strong></td>
</tr>
<tr>
<td></td>
<td>$43.9 Million (at recent price)</td>
</tr>
</tbody>
</table>

1. Proforma, based on 9/30/18 reported balances plus net proceeds from 11/18 offering
2. Assuming all preferred share series were converted to common at their respective conversion rates
• Developing novel therapeutics to treat gastrointestinal diseases – Lactose Intolerance, IBD, C. Diff - by modulating the gut microbiome

• RP-G28, potentially the first FDA-approved drug for lactose intolerance (LI)
  – Phase 3 pivotal study underway – Data expected 2nd half 2019

• Robust intellectual property portfolio and NCE status

• Experienced executive leadership team and world-renowned scientific advisors

• Large unmet need - shortage of late-stage, GI drug candidates
  • Excellent partnering/monetizing environment
## Investment Highlights

| Late Stage Asset - Excellent Partnering Environment | RP-G28 currently in Phase 3, potentially the first FDA-approved drug for lactose intolerance (LI)  
• With few GI drug candidates, attractive profile to partners |
|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Large, Growing & Unsatisfied Market                  | $2.5B over-the-counter (OTC) U.S. market  
• 40M U.S. sufferers with a target market of 9M moderate/severe individuals & millions more suffering globally |
| Near Term Data                                        | Pivotal Phase 3 trial of RP-G28 initiated in Q2 2018  
• Halfway enrollment milestone achieved in Q4 2018 |
| Additional Value Drivers                              | Multiple additional product/indication opportunities  
• Data readout expect in 2H 2019  
• Commercialization strategy and reimbursement analysis underway |
| Seasoned Executive Team                               | Seasoned late-stage clinical development and capital markets focus |
| Compelling Valuation                                  | Phase 3 asset with proof of efficacy/safety in large underserved market. Attract profile to partners |
Lactose Intolerance Market Summary

Significant Market Opportunity

No prescription drug currently available for LI despite patient desire and need for a prescription treatment

- **40 million** U.S. lactose intolerant population
  - 9 million are moderate/severe patients

- **>1 billion** global lactose intolerant population
  - 65 million in Europe
  - 90 million in Japan

• 60% of patients seek a better solution

• Unsatisfactory treatment options:
  – Challenging to avoid all dairy and “hidden” lactose can cause unexpected symptoms
  – Lactase supplements are unreliable and modestly effective
  – $400/person current annual spend on LI management

3. Internal Formula – Lactaid Purchase 3x Month x 12 Months.
Symptoms Driving Strong Consumer Demand

- Physicians likely to recommend RP-G28 to **44%** of their patients as a first management option
- **82%** of patients experience symptoms weekly or more frequently
  - >50% report symptoms moderately or severely impacts their daily activities
  - Long-term health concerns (such as osteoporosis, hypertension)
- **78%** are interested in consuming dairy products without discomfort
  - >70% are “extremely interested” or “interested” in an FDA-approved treatment
  - GI physicians report seeing 29 LI patients/month

---

**RP-G28**
**Novel Lactose Intolerance Treatment**

- **Novel, non-digestible oligosaccharide**
  - Modulates the gut microbiome
  - Designed to stimulate growth of lactose-metabolizing colonic bacteria

- **Single course of treatment with 30-day duration**
  - Early results suggest 1 course of treatment may provide long-lasting, durable relief
  - Patients likely can be safely re-treated (study planned)

- **Provided in single dose packets as a powder to be mixed with water**

**Target claim:**
For the treatment of lactose intolerance
**Mechanism of Action**

**Microbiome Modulation**

- **Lactose Intolerance:**
  - Inadequate lactase activity in small intestine results in undigested lactose
  - LI symptoms from undigested lactose are the result of:
    - Bacteria in gut ferments lactose that produces: **abdominal pain, flatulence and cramping**
    - Osmotically active lactose causes water retention in the gut: **bloating and diarrhea**

- **RP-G28 Promotes Colonic Adaptation:**
  - Preferentially **stimulates growth of lactose-metabolizing** bacteria in the GI tract
    - Lactose-metabolizing bacteria compensate for the lack of endogenous lactase activity
    - Decrease proportion of gas-producing bacteria
  - Lactose is broken down, reducing gas production and water retention, thus reducing gastric symptoms
Microbiome Data Supports Mechanism

- Phase 2a and Phase 2b trials report consistent outcomes supporting RP-G28’s mode of action
  - A clear and significant increase in the relative abundance of lactose metabolizing bacteria was seen post-treatment
- 82% of subjects on treatment showed significant alterations in their microbiome
- 90% of treated patients had a bifidogenic response
- 78% of treatment patients compared to 52% of placebo patients increased Bifidobacteria (p=<.001)

Principal Component Analysis of Microbiome Shifts
Amplicon Sequencing of 16S rRNA Gene (Day 0 v. Day 66)

n=35 (treatment group only)
Red: Day 0, Blue: Day 36, Gold: Day 66

1 Phase 2a Microbiome Data. Andrea Azcarate-Peril, et al. DDW Conference; 2013 May 18-21; Orlando, FL.
2 Phase 2b Microbiome Data
RP-G28 Development

- RP-G28 is one of the most advanced therapeutics in microbiome research & development
- Clinical development program in Phase 3
- Strong safety profile demonstrated

**PHASE TRIAL 1**
- N=14
- Evaluated the pharmacokinetic (PK) profile of RP-G28

**PHASE TRIAL 2a**
- N=62
- Established mode of action (colonic adaptation), identified appropriate endpoints and clarified dosing regimen
- Safety and tolerability supported continued development
- No SAEs reported, AEs similar between placebo and treatment

Publications
- Nutrition Journal 2016
- PNAS 2017
- DDW 2016, 2017

**PHASE TRIAL 2b**
- N=377
- Established efficacy and selected optimal dose
- Validated well-defined patient-reported outcomes tools providing meaningful treatment benefit assessment
- Established safety profile: SAEs and AEs similar between placebo and treatment
- Completed End of Phase 2 Meeting with the FDA

Publications
- Publication pending submission
- DDW 2018

**PHASE PROGRAM 3**
- Two confirmatory clinical trials expected for NDA filing
- First Phase 3 trial (“Liberatus”) underway, N=525

Clinically Meaningful Benefit

- Significant reduction of lactose intolerance symptoms after a 30-day course of treatment
- Primary endpoint met statistical significance in efficacy subset analysis²
  - A statistically significant difference from placebo was reported with both doses²: low dose: p=0.0434; high dose: p=0.0294
- 14-percentage point difference between RP-G28 & placebo, comparable with recently FDA-approved GI drugs that averaged 11-percentage point difference³

Phase 2b: Primary Endpoint Analysis
Lactose Intolerance Symptom Composite

Proportion of Patients Reporting Meaningful Improvement in Lactose Intolerance Symptoms¹,²

<table>
<thead>
<tr>
<th></th>
<th>Placebo</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>mITT Population</td>
<td>31%</td>
<td>40%</td>
</tr>
<tr>
<td>Efficacy Subset mITT</td>
<td>26%</td>
<td>40%</td>
</tr>
</tbody>
</table>

P-value 0.0159 0.0618

¹ Primary endpoint defined as patients reporting a 4-point change in LI Symptom Composite Score post-treatment compared to baseline or a zero LI Symptom Composite Score post-treatment.
² Efficacy Subset modified intent to treat (mITT) population excludes from analysis inconsistent data from one study center (mITT population represents full data set).
³ Comparable endpoint delta analysis includes Amitiza, Entyvio, Viberzi, Linzess.
Significant percent of treated patients reported elimination of symptoms

Lactose Intolerance Symptoms

Treatment patients consumed nearly 2x more milk

Milk Consumption

Patients consistently report symptom relief

Global Assessments

Phase 2b: Secondary Endpoints
Compelling Treatment Outcomes

Efficacy Subset PP, observed inconsistent data from one study center was excluded from analysis.

Percent of Patients Responding

Abdominal Pain
Cramping
Bloating
Gas Movement
Symptom Composite

Placebo
Treatment

P-value
0.0005
0.0144
0.0004
0.0020
0.0150

( vs. baseline)

Cups of Milk Consumed Per Day

Placebo
Treatment

P-value
0.0144
0.0020
0.0150

( vs. baseline)

Percent of Patients Responding

No or Mild Symptoms
Very or Extremely Satisfied
“Yes” Adequate Relief
Very Much or Much Improvement

Placebo
Treatment

P-value
0.0343
0.0013
0.0302
0.042

( vs. baseline)

W. 2022.12.14
Phase 3: Clinical Trial Protocol

- Double-blind, placebo-controlled, multi-center (approx. 28 sites): N=525
- Designed with input from an End of Phase 2 Meeting with the FDA*
- Primary endpoint: Mean change in LI symptom composite score 30-days post-treatment (agreed upon with FDA)
- 50% enrolled as of December 2018

*Two confirmatory clinical trials expected for NDA filing
Pioneering Development in the Gut Microbiome for the Treatment of Lactose Intolerance

Excellence Partnering/Monetization Environment

- Gastrointestinal drug market increasing to USD 59.3 Billion by 2023¹
- 35-40% of world’s total population is suffering from acute or chronic GI complications. Increasing rates of GI diseases and disorders, due to change in dietary pattern are the major factor for increasing the global GI drug market²
- Currently, there are only 23 GI-related NCEs in Phase 3 development

---

¹ Source - Market Research Future report “Gastrointestinal Drugs Market” - 10/4/2018
² Source – World Health Organization
Strong Intellectual Property:
+30 Issued Patent Worldwide

- **Formulation**: 11 issued patents - US, AU, DE, ES, FR, GB, IT & NL
- **Methods of Use**: 13 issued patents - US, AU, DE, ES, FR, GB, IT, NL & ZA
- **Manufacturing Processes**: 11 issued patents - US, CH, CN, JP, KR, DE, FR, GB, IE, IT & NL
- **NCE Market Exclusivity**
  - From date of approval, 5 years in the United States and 10 years in Europe
- **Additional Information**
  - Most patents expiring in 2030, with a potential Patent Term Extension in the United States to 2035 and 2028 in Europe (SPC in Europe)
## Leadership and Management

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Experience/Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew J. Ritter</td>
<td>Co-founder and Chief Executive Officer</td>
<td>15+ years of research in gastrointestinal diseases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Founder of Ritter Pharmaceuticals. Former President of Ritter Natural Sciences, developed and marketed digestive healthcare products. Wharton MBA</td>
</tr>
<tr>
<td>John W. Beck</td>
<td>Chief Financial Officer</td>
<td>25+ years of experience in finance, fundraising, and accounting in the pharmaceutical industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Former CFO of Ardea Biosciences (acquired by AstraZeneca in 2012); former CFO of Metabasis Therapeutics.</td>
</tr>
<tr>
<td>Sharron Gargosky, PhD</td>
<td>Vice President of Clinical Operations</td>
<td>25+ years of global clinical development and operational experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Experience in the field of pharmaceutical and biologic development having managed international programs from early research phase through the U.S. Food &amp; Drug Administration approval process.</td>
</tr>
<tr>
<td>Jennifer Timmerman</td>
<td>Senior Director, Regulatory Affairs</td>
<td>13+ years of US and International regulatory strategy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Most recent experience at Medpace, Kedrion Biopharma, Reckitt Benckiser</td>
</tr>
<tr>
<td>Ira E. Ritter</td>
<td>Chairman, Co-Founder, Chief Strategic Officer</td>
<td>40+ years serving on Executive Boards; Rockwood, Oak Media, RG Publishing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• President and Chairman of Rockwood, produced over 200 private label HBA products for major national retailers including GNC and K-Mart</td>
</tr>
</tbody>
</table>

## Board of Directors

- **Ira E. Ritter**  
  Chairman  

- **Matthew W. Foehr**  
  President & COO, Ligand Pharmaceuticals  

- **Paul V. Maier**  
  Former CFO, Sequenom, Inc.  

- **Michael D. Step**  
  Former Sr. VP Corporate Development, Santarus, Inc.  

- **Andrew J. Ritter**  
  Co-founder and Chief Executive Officer  

- **Noah J. Doyle**  
  Managing Director, Javelin Ventures  

- **William M. Merino, Ph.D.**  
  Former Sr. VP Worldwide Regulatory Affairs at Warner Lambert Pharmaceuticals
Pioneering Development in the Gut Microbiome for the Treatment of Lactose Intolerance

Dennis Savaiano, Ph.D.
Virginia C. Meredith Professor, Department of Nutrition Science, Purdue University
Considered one of the foremost experts on lactose intolerance in the world

William J. Sandborn, M.D.
Chief, Division of Gastroenterology and Director, University of California San Diego Inflammatory Bowel Disease Center

William Chey, M.D.
Director of the GI Physiology Laboratory, Michigan Co-Director of the Michigan Bowel Control Program, Michigan Medicine

W. Allan Walker, M.D.
Director Nutrition at Harvard Medical School

Todd Klaenhammer, Ph.D.
Professor of Food Science, Microbiology & Genetics at North Carolina State University National Academy of Science Member

Byron L. Cryer, M.D.
Professor of Digestive & Liver Diseases Associate Dean at the University of Texas Southwestern Medical Center at Dallas
Thank You

www.RitterPharma.com

Follow us on Twitter: @RitterPharma

Follow us on LinkedIn: www.linkedin.com/company/ritter-pharmaceuticals-inc-
**Phase 2b: Clinical Trial Protocol Design**

- Double-blind, placebo-controlled, multi-center, dose ranging study conducted at 15 U.S. clinical sites, n=377
- **Inclusion/Exclusion**
  - Minimum severity of LI assessed by blinded lactose challenge and lactase deficiency confirmed by standard hydrogen breath test
- **Endpoints**
  - Employed a patient-reported outcomes tool validated by outcomes experts
  - Primary endpoint: Proportion of subjects who report a clinically meaningful reduction in lactose intolerance symptoms, comprised of a composite score of reported GI symptoms (abdominal pain, cramping, bloating and gas)
  - Endpoints incorporated FDA’s recommendations prior to un-blinding the data

---

**Diagram:**

- **Study Subjects**
  - Screening Phase
  - 30-Day Treatment Phase
    - Group A: RP-G28 Low Dose
    - Group B: RP-G28 High Dose
    - Group C: Placebo
  - 30-Day Post-Treatment Phase
    - Real-world Assessment

- Solution Z Assessment (Baseline)
  - Solution Z Assessment (Primary Endpoint)
  - Solution Z Assessment
Phase 2a: Microbiome Data

Mechanism of Action

- **82%** of subjects on treatment showed significant alterations in their microbiome\(^1\)
  - Composition shifts correlated with clinical outcomes of improved lactose tolerance
- **90%** of treated patients had a bifidogenic response
- Lactose metabolizing bacteria increased:
  - *Faecalibacterium, Lactobacilli and Bifidobacterium*
- Change in the fecal microbiome of treated subjects **maintained** for **30-days** post-treatment

![Changes in Operational Taxonomic Units (OTUs) by Terminal Restriction Fragment Length Polymorphism (TRFLP) Analysis](image)

Data published in *Proceedings of the National Academy of Sciences*, 2017

---

\(^1\) M. Andrea Azcarate-Peril, et al. DDW Conference; 2013 May 18-21; Orlando, FL.
Phase 2a: Composition & Abundance Changes

- Fecal microbiome at Day 66 changed significantly
  - Two distinct clusters #2 and #7
- Highly bifidogenic
- Lactose metabolizing bacteria increased:
  - Lactose fermenting genera Faecalibacterium¹
  - Roseburia (butyrate producer, increases metabolizing activity)
  - Lactobacilli and streptococci
- Gas producing bacteria reduced:
  - Prevotella (promoted by rich carbohydrate diets²)

Principal Component Analysis of Microbiome Shifts
Amplicon Sequencing of 16S rRNA Gene (Day 0 v. Day 66)

n=35 (treatment group only)
Red: Day 0, Blue: Day 36, Gold: Day 66

¹ Anti-Inflammatory, butyrate producer
² Wu et al., Science 2011
• Post-treatment (Day 31), a clear and significant increase in the relative abundance of:
  – Phylum Actinobacteria
  – Family Bifidobacteriaceae
  – Genus Bifidobacterium
• 78% of treatment patients compared to 52% of placebo patients increased Bifidobacteria (p=<.001)
  – Sequencing data showed that 5 Bifidobacterium taxa were clearly increased by both low and high dose treatments of RP-G28
• Phase 2b findings are consistent with the Phase 2a microbiome clinical data