Agenda

• Bioenergy Profile
• Ribose Overview
• Selected Clinical Studies
• New Research
• Looking Ahead…
Bioenergy Life Science, Inc

- Founded by physicians
- Pioneered in the medical channel
- Expanded to supplement and ingredient markets
- Currently over 100 supplement and 50 food/bev. Customers including…
- Pepsi, Sobe, Vitamin Water, Snapple, & Go Fast
Bioenergy Life Science, Inc

• World experts and best resource of ribose

• Highest quality service and product

• We continue to provide research-based applications
Canadian Supplement Market

Table 7 Forecast Sales of Vitamins and Dietary Supplements: Value 2007-2012

<table>
<thead>
<tr>
<th>C$ million</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamins and dietary supplements</td>
<td>865.4</td>
<td>867.3</td>
<td>870.4</td>
<td>869.9</td>
<td>868.0</td>
<td>865.0</td>
</tr>
<tr>
<td>Vitamins</td>
<td>322.8</td>
<td>320.6</td>
<td>320.0</td>
<td>317.3</td>
<td>314.1</td>
<td>310.6</td>
</tr>
<tr>
<td>- Multivitamins</td>
<td>156.3</td>
<td>154.7</td>
<td>154.2</td>
<td>154.4</td>
<td>154.9</td>
<td>155.6</td>
</tr>
<tr>
<td>- Single vitamins</td>
<td>166.6</td>
<td>165.8</td>
<td>165.7</td>
<td>162.9</td>
<td>159.2</td>
<td>155.0</td>
</tr>
<tr>
<td>-- Vitamin A</td>
<td>10.3</td>
<td>9.8</td>
<td>9.3</td>
<td>8.8</td>
<td>8.3</td>
<td>7.8</td>
</tr>
<tr>
<td>-- Vitamin B</td>
<td>9.8</td>
<td>9.5</td>
<td>9.2</td>
<td>8.9</td>
<td>8.5</td>
<td>8.1</td>
</tr>
<tr>
<td>-- Vitamin C</td>
<td>59.4</td>
<td>57.3</td>
<td>55.2</td>
<td>53.0</td>
<td>50.8</td>
<td>48.6</td>
</tr>
<tr>
<td>-- Vitamin D</td>
<td>8.7</td>
<td>12.3</td>
<td>16.5</td>
<td>18.4</td>
<td>19.7</td>
<td>20.8</td>
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<tr>
<td>-- Vitamin E</td>
<td>78.4</td>
<td>77.0</td>
<td>75.4</td>
<td>73.8</td>
<td>71.8</td>
<td>69.6</td>
</tr>
<tr>
<td>-- Other single vitamins</td>
<td>522.7</td>
<td>527.5</td>
<td>531.8</td>
<td>534.7</td>
<td>536.7</td>
<td>537.9</td>
</tr>
</tbody>
</table>

Table 8 Forecast Sales of Vitamins and Dietary Supplements: % Value Growth 2007-2012

<table>
<thead>
<tr>
<th>% constant value growth</th>
<th>2007-12 CAGR</th>
<th>2007/12 TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamins and dietary supplements</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Vitamins</td>
<td>-0.8</td>
<td>-3.8</td>
</tr>
<tr>
<td>- Multivitamins</td>
<td>-0.1</td>
<td>-0.4</td>
</tr>
<tr>
<td>- Single vitamins</td>
<td>-1.4</td>
<td>-7.0</td>
</tr>
<tr>
<td>-- Vitamin A</td>
<td>-5.3</td>
<td>-23.8</td>
</tr>
<tr>
<td>-- Vitamin B</td>
<td>-3.7</td>
<td>-17.3</td>
</tr>
<tr>
<td>-- Vitamin C</td>
<td>-3.9</td>
<td>-18.1</td>
</tr>
<tr>
<td>-- Vitamin D</td>
<td>19.0</td>
<td>138.5</td>
</tr>
<tr>
<td>-- Vitamin E</td>
<td>-2.3</td>
<td>-11.2</td>
</tr>
<tr>
<td>-- Other single vitamins</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dietary supplements</td>
<td>0.6</td>
<td>2.9</td>
</tr>
</tbody>
</table>

• “…other supplements (i.e. vitamins), including many herbs, will likely see a continuing decline over 2007-2012. In most cases this will be due to the absence of scientific basis behind product claims…”  ~Euromonitor International
Patents

• Bioenergy pursues an aggressive policy of obtaining patent protection covering substantially all uses of ribose.

• Bioenergy holds:
  – 15 United States patents issued
    • 25+ pending or provisional applications. Some of these have extensive foreign counterparts on file.
  – 3 European patents
  – 4 Great Britain patents
  – 2 Chinese patents
Bioenergy Life Science-Canadian Patents

• Energy
  – Broad Applications
  – All Uses of Energy in Mammals

• Fibromyalgia
  – Recommended Ribose and Malate

• Improves Immune Function

• Viability of a Myocardial Segment

• Cramping and Soreness in Muscles (pending)
New & Existing Products with Ribose
Melanie Roach

Accomplishments:
- 2008 Olympian
- U.S. Record Holder
- 7-Time National Champion
- Mother of 3

“My events don’t allow much recovery time and my second lift was always weaker. Ribose allows my second lift to be as strong as the first. My muscles recover much quicker and I have the sustained energy I need for peak performance.”

–Melanie Roach

Eric Butorac

Accomplishments:
- Top 30 Doubles World Ranking
- 3rd in the U.S.
- 3 Career Titles

“I have incorporated D-Ribose into my plan along with a well-balanced diet and it has really improved my performance. My energy levels in both practice and match play are not only higher, but much more consistent.”

–Eric Butorac
Katherine Reutter - Speed Skating

- 11 World Cup Medals
- 6 WC Medals in 2009
- 4 time American Record Holder
- 2009 US National Champion
- 2008 World Championships Overall Rank – 7th
- 2009 World Championships Overall Rank 3rd
Shannon Bahrke - Mogul Skiing

- 2 Time Olympian (‘02 and ‘06)
- 2002 Olympic Silver Medalist
- 2007 World Championships Silver Medalist
- 2003 World Cup Champion
- 22 time World Cup medalist (7 Gold)
- 2009 National Champion
What Is Ribose?

**ATP: Adenosine Tri Phosphate**

Fundamental energy compound

**ATP is made from D-Ribose - a structural sugar, not a fuel**
Normal ATP Turnover

Glucose
(Yield 36 ATP)

+ O₂

Fatty Acid
(Yield 128 ATP)

ATP

ADP
ATP Turnover in Hypoxia

Glucose

Fat Acid

Yield = 4 ATP

ATP

ADP

Yield = 4 ATP
Energy Lost With Hypoxia

Heart or Muscle Cell

ADP → ADP
Myokinase
ATP → AMP

AMP → AMP
AMP Deaminase
NH₃ + IMP

Supplemental Ribose Replenishes Energy in Every Fatigued or Stressed Cell

Ribose → PRPP
PRPP → Adenosine
Adenosine → PRPP

5'-Nucleotidase

Net Loss of Purines

Free Radicals

BIOENERGY RIBOSE
Ischemia Changes Energy Balance and Concentration

- Loss of nucleotides
- Dramatic change in mix
- Reperfusion stabilizes mix – does not replace lost nucleotides

Availability of Ribose Accelerates Recovery

Source: J.R. Schneider, et al, Cirr., Vol. 72, #4, 1192, 1985
Bioenergy ribose studies fall into 3 major groups:

- Studies with heart disease patients
- Studies with athletes
- Studies with healthy normals
Studies with Heart Disease Patients
Cardiovascular Clinical Research

- Hearts require a lot of energy to function properly
- Ribose has been shown to improve heart function thru a wide array of clinical work over the last 30 years

<table>
<thead>
<tr>
<th>STUDY/FINDING</th>
<th>AUTHOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improves Diastolic Function &amp; QOL In CHF patients</td>
<td>H. Orman, 2003</td>
</tr>
<tr>
<td>Effects on Exercise –Induces Ischaemia; Provides metabolic cardioprotection</td>
<td>W. Pliml, 1992</td>
</tr>
<tr>
<td>Delay Ischemic Injury &amp; Improve Function; Affects myocardial metabolism to supply energy</td>
<td>W.J. Wallen, 2003</td>
</tr>
<tr>
<td>Improves Cardiac Indices for “Off” Pump Coronary Arterial Revascularization</td>
<td>D. Perkowski, 2007</td>
</tr>
<tr>
<td>Preserves Function of the Myocardium after Myocardial Infarction</td>
<td>N. Befera, 2007</td>
</tr>
<tr>
<td>Improves Ventilatory Efficiency In CHF Patients</td>
<td>N. Vijay, 2005</td>
</tr>
<tr>
<td>Supplement for Cardiac Energy Metabolism; Clinical utility in diverse cardiovascular conditions</td>
<td>D. Pauly, 2000</td>
</tr>
</tbody>
</table>
Selected Sports Studies
Sports Applications-Clinical Review

- **Improved Endurance**
  - Increased muscle strength and endurance
  - Improved ventilatory efficiency
  - Improved cardiac function

- **Accelerated Recovery**
  - Improved purine nucleotide salvage (ATP recovery)
  - Free radical management

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Results</th>
<th>Dose</th>
<th>Endurance</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hellsten, 2004</td>
<td>Effect of Ribose Supplementation on Resynthesis of Adenine Nucleotides After Intermittent Training in Humans</td>
<td>Ribose aids in adenine resynthesis</td>
<td>200mg/kg</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Seifert, 2002</td>
<td>The effects of Ribose Ingestion on Indices of Free Radical Production During Hypoxic Exercise</td>
<td>Ribose has a Free Radical managing effect with more work at lower heart rate.</td>
<td>7gm</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Van Gammeren, 2002</td>
<td>The Effects of Four Weeks of Ribose Supplementation on Body Composition and Exercise Performance in Healthy, Young, Male Recreational Bodybuilders: A Double-Blind, Placebo-Controlled Trial</td>
<td>Improvement in pretreatment and post treatment total work performance. Increased muscle strength and endurance.</td>
<td>10gm/day</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Brault, 2001</td>
<td>Purine Salvage to Adenine Nucleotides in Different Skeletal Muscle Fiber Types (in rats)</td>
<td>Ribose could improve ATP recovery during repeated days of intense exercise.</td>
<td>-</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Orly Carter, 2005</td>
<td>D-Ribose Supplementation Improves Peak Exercise Capacity and Ventilatory Efficiency in Heart Failure Patients.</td>
<td>D-Ribose maintains exercise capacity while improving ventilation efficiency.</td>
<td>5gm TID (3x/day)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Williamson, 2001</td>
<td>Effects of Ribose Supplementation on Adenine Nucleotide Concentration in Skeletal Muscle Following High-intensity Exercise.</td>
<td>The data suggests that Ribose supplementation may provide an ergogenic benefit over-time with high-intensity cycle exercise training. (larger change in mean power and greater peak power.)</td>
<td>20gm\bulleted (*11 day loading period)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stout</td>
<td>The Effects of Creatine vs. Creatine plus d-Ribose Supplementation on Anaerobic Working Capacity after Two Days of Loading</td>
<td>Ribose had a larger % change than creatine but less than the creatine Ribose combination.</td>
<td>5gm QID (4x day)</td>
<td>X</td>
<td></td>
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<tr>
<td>Wagner, 1991</td>
<td>Effects of Oral Ribose on Muscle Metabolism During Bicycle Ergometer in AMPD-Deficient Patients.</td>
<td>Enhanced de novo synthesis of purine nucleotides, reduced stiffness and soreness.</td>
<td>3-4gm continued dose every 5 min.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Gross, 1991</td>
<td>Ribose Administration during Exercise: Effects on Substrates and Products of Energy Metabolism in Healthy Subjects and a Patient with Myoadenylate Deaminase Deficiency.</td>
<td>needs discussion</td>
<td>2gm every 5min</td>
<td>X</td>
<td>X</td>
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</table>
Ribose Reduces Oxidative Stress & Peak Heart Rate

- 7-healthy, normal volunteers
- Double blind, placebo controlled, crossover design
- Cycle exercise at lactic acid threshold while breathing 16% $O_2$ (induced hypoxia)
- Measurements
  - MDA (urine) and reduced glutathione (GSH; whole blood)
  - Heart rate (at fixed level of exercise)
  - Various metabolic parameters

Free Radical Formation & Glutathione Depletion

Urine MDA Following Hypoxic Exercise

Plasma Reduced Glutathione Levels Following Hypoxic Exercise

*Significant increase/decrease over pre-exercise levels.

Ribose Protects Against Free Radicals

- Lowered urinary MDA
  - Reduced cell wall damage and lipid peroxidation
- Modified plasma glutathione levels
  - Bypasses G-6-Pdh to cycle GSH and GSSG
  - Produces NADPH for GSSG cycling to GSH
  - Controls hepatic and muscle release of GSH to blood
- Reduced heart rate at similar exercise intensities during hypoxic stress
“...ribose supplementation induces greater percentage gains in muscular strength and endurance...train more intensely during the supplementation period...significant increases in muscular strength and endurance.” (Jose Antonio, Ph.D.)
Ribose Parameters - Other Clinical Studies

• Dose Size
  – 3-7gm efficacious dose

• Dose Timing
  – Ribose loading ineffective

• Work Load Performed
  – Anaerobic threshold for ATP depletion

New Research
Fatigue Study- Baby Boomers

Subjective Measures

- Fatigue Assessment Instrument (FAI)
  - 29 questions; linear scale from:
- QOL questionnaire (SF-36v2 acute)
  - Health Survey
    - Physical Composite – 22 questions
    - Mental Composite – 14 questions
    - Vitality – 4 questions

Objective Measures

- Cardiopulmonary exercise testing (CPX):
  - Sub-maximal exercise treadmill protocol
  - CORTEX equipment (Leipzig, Germany)
Trial study parameters

- 10 Subjects; Age: 50-69 y/o
  - Mean: 56.7 years; BMI: 23.2; 8 female

- No previous medical diagnoses of cardiovascular or respiratory disease

- Normal or near normal BP (>120/70 or < 140/90)

- Complaint of fatigue for longer than a month

- Regimen:
  - D-Ribose 3 grams BID for 2 weeks
  - Testing @ baseline, Week 1 and Week 2
Gas Transport Mechanisms Coupling Cellular (Internal) Respiration to Pulmonary (External) Respiration

Muscle Activity

O₂ & CO₂ Delivery

Ventilation ($V_A + V_D = V_E$)

Mito

Muscle

Periph Circ

Pulm Circ

Expired

Inspired

CO₂ prod
Creat + PO₄

Pyr→Lac
O₂ Consum

O₂ flow

CO₂ flow

Heart

Blood

Lung

$\dot{Q}_{CO₂}$

$\dot{Q}_{O₂}$

Physiological Responses to Exercise

$\dot{Q}_{CO₂}$ Dilate

SV

Recruit

$V_T$

$V_f$

Quality of life survey SF-36v2 (acute)

**Strong response on vitality impacted mental outlook**

Compared to percentiles of 1998 US population

<table>
<thead>
<tr>
<th>Component</th>
<th>Baseline</th>
<th>Week 1</th>
<th>Week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phy Funct</td>
<td>54.00</td>
<td>56.00</td>
<td>58.00</td>
</tr>
<tr>
<td>Role Phy</td>
<td>42.00</td>
<td>44.00</td>
<td>46.00</td>
</tr>
<tr>
<td>Bodily Pain</td>
<td>40.00</td>
<td>50.00</td>
<td>52.00</td>
</tr>
<tr>
<td>Gen Health</td>
<td>34.00</td>
<td>34.00</td>
<td>34.00</td>
</tr>
<tr>
<td>Vitality</td>
<td>54.00</td>
<td>56.00</td>
<td>58.00</td>
</tr>
<tr>
<td>Soc Funct</td>
<td>42.00</td>
<td>44.00</td>
<td>46.00</td>
</tr>
<tr>
<td>Role Emo</td>
<td>40.00</td>
<td>50.00</td>
<td>52.00</td>
</tr>
<tr>
<td>Mental Health</td>
<td>34.00</td>
<td>34.00</td>
<td>34.00</td>
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<tr>
<td>Phys Comp</td>
<td>54.00</td>
<td>56.00</td>
<td>58.00</td>
</tr>
<tr>
<td>Mental Comp</td>
<td>42.00</td>
<td>44.00</td>
<td>46.00</td>
</tr>
</tbody>
</table>

Physical Composite p=0.19  •  Mental Composite p=0.05
# CPX Data Parameters

*(compared to baseline)*

<table>
<thead>
<tr>
<th></th>
<th>Visit</th>
<th>Mean Change ± SD</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>V0₂ @ AT</strong></td>
<td>Week 1 - BL</td>
<td>1.53 ± 0.90</td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>Week 2 – BL</td>
<td>2.13 ± 0.78</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Ventilation Efficiency Slope</strong></td>
<td>Week 1 – BL</td>
<td>-2.26 ± 1.69</td>
<td>0.0022</td>
</tr>
<tr>
<td></td>
<td>Week 2 – BL</td>
<td>-2.44 ± 2.24</td>
<td>0.0074</td>
</tr>
<tr>
<td><strong>O₂ Uptake Efficiency Slope</strong></td>
<td>Week 1 – BL</td>
<td>0.17 ± 0.19</td>
<td>0.0215</td>
</tr>
<tr>
<td></td>
<td>Week 2 – BL</td>
<td>0.24 ± 0.15</td>
<td>0.0008</td>
</tr>
<tr>
<td><strong>Heart Rate to METs ratio @ AT</strong></td>
<td>Week 1 – BL</td>
<td>-3.00 ± 2.83</td>
<td>0.0085</td>
</tr>
<tr>
<td></td>
<td>Week 2 – BL</td>
<td>-3.67 ± 3.27</td>
<td>0.0063</td>
</tr>
<tr>
<td><strong>Net Energy Expenditure @ AT</strong></td>
<td>Week 1 – BL</td>
<td>9.32 ± 7.67</td>
<td>0.0040</td>
</tr>
<tr>
<td></td>
<td>Week 2 - BL</td>
<td>16.23 ± 6.13</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
VO₂ @ AT is a measure of aerobic fitness. It determines the amount of oxygen consumed per minute. By increasing the VO₂ @ AT, subjects are able to do more work with less fatigue.
Oxygen Uptake Efficiency Slope

O₂ uptake efficiency reflects the amount of O₂ (ml/min) used per unit ventilation (L/min). It assesses the coupling efficiency between the heart and lungs. It is predominantly used to measure the functional reserve, and correlates closely with peak VO₂ in healthy normals.
Net energy expenditure @ anaerobic threshold

Net energy expenditure @ AT is a measure of work performed, or functional capacity. It determines energy consumption during exercise.

An increase in energy expenditure @ AT indicates a shift in AT to the right, meaning the tissue is more efficient at energy utilization.

32% improvement to Baseline
Data Summary

• Subjectively, ribose supplementation provides a perceived improvement in:
  – vitality and fatigue
  – mental outlook

• Objective (CPX) data demonstrated that ribose increased:
  – exercise tolerance
  – aerobic capacity
  – oxygen uptake and utilization
  – ventilation efficiency
  – cellular metabolism and work capacity
Why Bioenergy Ribose?

- ENERGY - Natural, Sustainable
  - No Crash
- Nothing Else Works Like Ribose for
  - Endurance
  - Recovery
- Works Well With Other Ingredients
Quality Certifications

- Non-GMO
- Natural
- Kosher and Halal certified
- GRAS Affirmed
- Novell foods and Parnus status dossier have been submitted and reviewed without objection
Why Bioenergy Ribose?

- Clinical research results supporting the following claims:
  - **Energy**
    - Speeds energy recovery
    - Increases energy reserves
    - Builds ATP in heart and muscle
    - Maintains healthy energy levels in heart and muscle
  - **Muscle**
    - Relieves post-exertional muscle cramping and soreness
  - **Heart**
    - Quality of life is enhanced
    - Increases tolerance to cardiac stress
    - Improves exercise tolerance and physical function
    - Provides healthy levels of cardiac energy needed to maintain normal heart function
  - **Strength**
    - Improves physical performance
    - Increases athletic performance
  - **Metabolic stress**
    - Decreases free radical formation during exercise
    - Increases the hypoxic threshold of tissue
    - Increases cardiac efficiency and lowers stress during exercise
Looking Ahead...

- Expanded low dose energy study
- 2009 athletic clinical study
  - Recovery
  - Endurance
- Cardiovascular clinical study
- Chronic pain clinical trail
- 2010 Olympics
  - Katherine Reutter
  - Shannon Bahrke
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