Infant Formula from Algae - Identifying and Targeting Key Market Needs as a Driver for Product Development

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Triton Algae Innovations, Co.

- Triton, founded in 2013, is built on over 30 years of research and technology development from Scripps and UC San Diego.

- Triton has developed an IP protected technology platform to produce human and bovine milk proteins from low cost and scalable algae production and purification systems to revolutionize infant formula and adult nutritional supplements.

- Triton has a large milk protein pipeline. Its lead protein, bovine Osteopontin (OPN), is now in production process development, and Triton is engaging with infant formula companies on product development.

- Triton is using its proprietary production process to manufacture Triton’s signature native algae strain, Comfortin™, and will launch this product in 2017, a product supported by sound science and tailored to a large and attractive market segment.
Triton process

Identify milk proteins

Enable algae to produce native milk proteins

Grow algae low cost and scalable

Premium products

Protein purification

Harvest algae
Algae holds a unique solution

Example:  Bovine OPN is available as research reagent at $7 million USD a gram.

Triton has the ability to produce recombinant proteins that are identical to those found in human milk, and to produce them cost effectively at scale.

<table>
<thead>
<tr>
<th>Host</th>
<th>Low cost production</th>
<th>Host protein edible</th>
<th>Complex proteins</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Yeast</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>CHO</td>
<td>x</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Insect</td>
<td>x</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Algae</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Triton’s production process

- **Process development** (0.5 L)
- **Process validation** (20 L)
- **Contract manufacturing** (up to 500KL)

Established in-house to develop own production process IP

Outsource to reduce capital spending

cGMP CMOs
The global infant formula market has double digit growth

- The global infant formula market is expected to be US$ 24.5 billion in 2016
- The global infant formula market is expected to expand at a CAGR of 10.1% through 2026 and surpass US$ 64 billion in revenues
- China has become the largest market for infant formula in the world, with estimated 41.4% revenue share of the global market in 2016
- Increasing participation of women in the workforce will continue to positively influence the market
- Leading companies are focusing on expanding their production capacity and launching new product offerings

Formula-fed babies experience poorer health

- **IQ TEST:** Breast-fed infants score 5.2 points higher on IQ tests (*American Journal of Clinical Nutrition*)

- **DIABETES:** Breast-fed infants are 40% less likely to develop diabetes before 40 years of age in some communities (*The Lancet*)

- **IMMUNE BOOSTING FLORA:** Breast-fed infants have a more immune-boosting microflora in their digestive systems (*Genome Biology*)

- **ASTHMA:** Breast-fed infants are 50% less likely to suffer from asthma symptoms (*European Respiratory Journal*)

- **FEVER:** Formula-fed infants have more fever than breast-fed infants, but experience a significant reduction in fever when fed formula supplemented with OPN (*J Pediatr Gastroenterol Nutr*)
Key functional milk proteins are missing in today’s formula

<table>
<thead>
<tr>
<th>Protein</th>
<th>Breast milk (mg/L)</th>
<th>Infant formula (units/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteopontin</td>
<td>138</td>
<td>9</td>
</tr>
<tr>
<td>Lactadherin</td>
<td>75</td>
<td>0</td>
</tr>
<tr>
<td>sCD14</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Lysozyme</td>
<td></td>
<td>290</td>
</tr>
<tr>
<td>Lactoperoxidase</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Superoxide dismutase</td>
<td>21</td>
<td>0</td>
</tr>
</tbody>
</table>
Clinical trial: infant formula supplemented with OPN (320 infants from 1 month to 6 months):

- **CYTOKINE PROFILE:** Supplementation of infant formula with bovine OPN modified the serum cytokine profile of infants fed this formula and made their serum profiles more similar to that of breast-fed infants.

- **FEVER:** Infants fed the OPN-supplemented formula had less fever (pyrexia) than infants fed regular formula.

- **REDUCED ILLNESS:** OPN-supplemented formula modifies regulators of immune function (cytokines) and reduces illness, making infants fed such formula more similar to breast-fed infants.

Triton has developed a scalable production process for OPN

- All media constituents are certified food grade
- Rapid improving peak productivity and peak density
- Currently having pilot runs with a cGMP certified CMO
Triton has developed a scalable purification method for OPN

(1) Lyse Cells  (2) Remove Debris  (3) Precipitate  (4) Wash and Elute

OPN with over 85% purity ready for many applications
Triton’s OPN has been validated as biologically active

The activity of Triton’s OPN was validated in Prof. Bo Lonnerdal’s laboratory at UC Davis.

Increased proliferation of human intestinal epithelial cells (HIEC) by OPN promotes digestive and absorptive capacity and thus enhances infant development in early life.

* statistically different from the control, p < 0.05
In 2017, Triton will start to commercialize its *Chlamydomonas reinhardtii* strain.

**What are we selling?**

Comfortin™ is an adult nutraceutical in the form of a powdered drink mix to support normal gastrointestinal health and function.

**Who are we selling it to?**

Comfortin’s target market are people with symptoms associated with Irritable Bowel Syndrome (IBS).
Three independent animal trials have demonstrated that Comfortin™ supports normal gastrointestinal health and function

**Animal trials**

1. Mouse Trial - DSS challenge (14 days)
   a. Number of mice: 22 mice
   b. Dependent variables: Weight
   c. Collaborator: UC San Diego

2. Piglet Trial - *E.coli* challenge (21 days)
   a. Number of piglets: 24 piglets
   b. Dependent variables: Diarrhea incidence
   c. Collaborator: U of Illinois

3. Piglet Trial - Exposure to natural disease (14 days)
   a. Number of piglets: >100 piglets
   b. Dependent variables: Diarrhea incidence
   c. Collaborator remains confidential

**Results**

- Reduces severity (41%)
- Supports recovery of colitis in mice (44%)
- Diarrhea incidence dropped from 35% to 24%, a reduction in the incidence of diarrhea by 31%
- Algae performed as well as Zinc and Aureomycin
- Algae reduced the incidence of diarrhea over a control diet by a statistically significant 63%
Our customer demographic is one of the most desirable consumers

• Irritable Bowel Syndrome (IBS) is a medically recognized constellation of symptoms without clear GI pathology, often chronic and sometimes debilitating.

• 42 million people (13% of the population) in the USA suffer from IBS, with similar levels world-wide.

• According to the American Gastroenterology Association, approximately 65% of IBS sufferers report that their most recent episode which failed treatment occurred within the last 3 months.
What is Unique about Comfortin™?

1. This is the first time that the nutritious green algae *Chlamydomonas reinhardtii* has been made available for commercial consumption.

2. This algae has an abundance of nutritionally impactful and heart healthy components:
   - High levels of Protein
   - Excellent source of Omega oils
   - Rich in Vitamin A and Iron
   - High levels of Fiber

3. Comfortin™ has substantial scientific evidence supporting its benefits.

4. Comfortin™ is manufactured in cGMP facilities to the highest standards of purity and safety.
THANKS