HMOs
(2'-Fucosyllactose)
Cell
Factory
For
Human
## 1. Vision

"Cell factory for human"

- Redesign of microorganisms
- High cell density culture
- High efficiency purification
- Commercialization technology

### Human milk oligosaccharides
- Process development
- Recombinant Proteins

## 2. History

- **Foundation (Seoul National University):** 2001
- **Process development service for customer proteins:** 2003
- **rProtein production for research (hGH, IFN, GCSF...):** 2005
- **Bioconversion process (detoxification of chemical):** 2007
- **Manufacturing proteins for bioPharmaceutical process (ProteinA, Growth factors):** 2011
- **Technology development research (Metabolic engineering):** 2013
- **HMOs development:** 2016
- **Construction of HMOs plant: Capacity: approx. 100ton/year:** 2020

## 3. Products and services

- **HMOs (Human Milk Oligosaccharides):** 2'-Fucosyllactose (2'-FL), 3-Fucosyllactose (3-FL)
- **Proteins:** ProteinA/G/L, Collagenase H/G, EGF, IGF
- **Process development for recombinant protein (Customized):**
4. Human Milk Oligosaccharides (HMOs)

- Benefits of breastfeeding

<table>
<thead>
<tr>
<th>Human Milk</th>
<th>Component (g/L)</th>
<th>Bovine Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Protein</td>
<td>32</td>
</tr>
<tr>
<td>41</td>
<td>Fat</td>
<td>37</td>
</tr>
<tr>
<td>70</td>
<td>Lactose</td>
<td>48</td>
</tr>
<tr>
<td>10</td>
<td>Oligosaccharides</td>
<td>0.05</td>
</tr>
<tr>
<td>(5~8)</td>
<td>2'-FL</td>
<td>(0.001)</td>
</tr>
</tbody>
</table>

WHO strongly recomends breastfeeding for more than 6 months

- Promotes brain cell protection, brain development
- Visual acuity is higher in babies fed human milk
- Prevention of external infection via ear and respiratory system
- Breastfed children have lower cholesterol
- Decrease on child’s obesity and the likelihood of occurrence of diabetes
- Decreased risk of childhood cancer and helps to mature immune system

- 2'-Fucosyllactose (2'-FL) is major component of HMOs

- Develop beneficial gut microbiom
- Lower inflammatory cytokines
- Lower virus infection (animal tests)
- Alleviate food allergy (animal tests)
- Increase learning capabilities (animal tests)
1. Strength of our 2'-FL project

- **GRAS strain**
  - (consumer friendly)

- **Strong Scientific Advisory Committee**
  - (8 groups: domestic & international)

- **Strong Global IP Plan**
  - (8 patents & 5 trademarks)

- **Scientific Advisory Committee**

- **Experience & Know-how**
  - (fermentation & downstream processing)

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (est.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>100 ton / year</td>
</tr>
<tr>
<td>2020</td>
<td>1,000 ton / year</td>
</tr>
</tbody>
</table>
Core Technology

1. Technology for Production of Oligosaccharide

Selection of target materials

Strain development

Process development

HMOs (2'FL, 3'-FL...)

Metabolic engineering

Fermentation & purification

2. Technology for Process Development of rProtein (AD-Pure System™)

Comparison for Technology

<table>
<thead>
<tr>
<th></th>
<th>Existing technology</th>
<th>Our technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of steps</td>
<td>Complicated process (over 10 steps)</td>
<td>Simplified process (5 steps)</td>
</tr>
<tr>
<td>Yield (hGH)</td>
<td>&lt; 200mg/l broth</td>
<td>&gt; 1.5g/l broth</td>
</tr>
</tbody>
</table>

AD-Pure system™ with high yield and purity

ADzyme™ exactly cut off the fusion partner from the target protein
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HMOs Plant
- 2’-FL, 3-FL plan to construct in Chungnam Province in 2020
- Capacity : approx. 1,000 ton/year (estimates)

Bioconversion Plant
- Production of material for bioconversion by microorganism
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Bongdam-eup, Hwaseong-si, Gyeonggi Province, Republic of Korea