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**PAN GENOME SYSTEMS**  
*The Next Generation in Vaccines*

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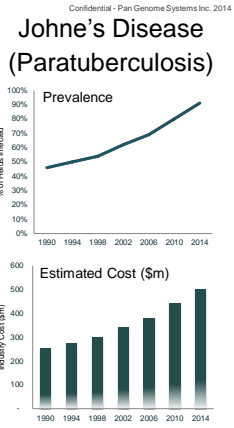
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## An endemic problem affecting 90% of US dairy herds

- Chronic, contagious and fatal
- Causes diarrhea, emaciation & loss of milk yield
- Hard to detect, slow to develop & spreads readily

Cost to US dairy industry  
**\$500m per year\***

\* Estimates from Council for Agricultural Science and Technology

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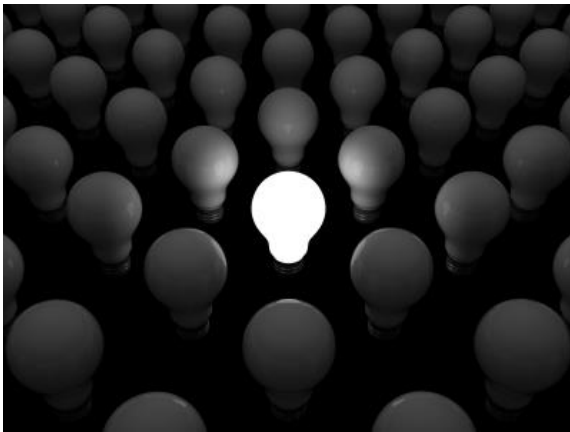
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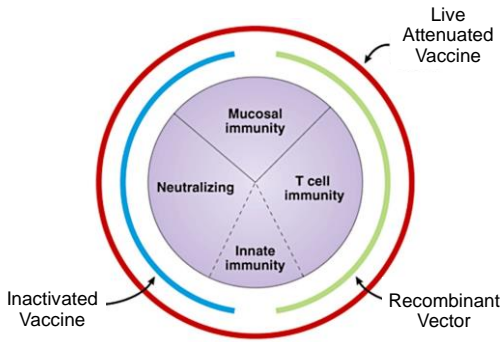
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### Advantages of a Live Attenuated Vaccine




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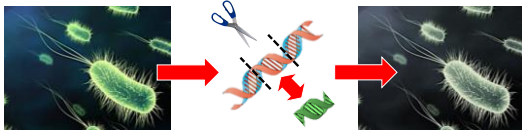
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### Inactivated Vaccine (Current Technology)



### Live Attenuated Vaccine (PGS Technology)




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### Live Attenuated Vaccine is a More Effective Vaccine to Address Johne's Disease

- > **Stronger & longer** immunity
- > **Eliminates shedding** & disease spread
- > **Eliminates side effects** impacting value
- > **Prevents infection**




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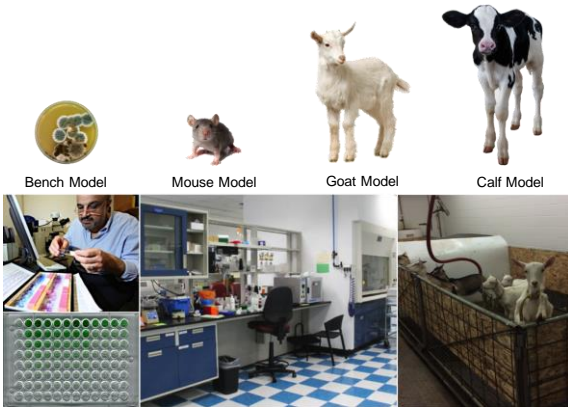
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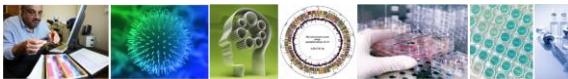
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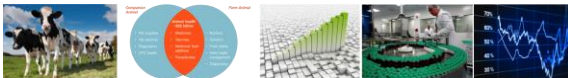
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### Idea & Technology



### Commercial Opportunity




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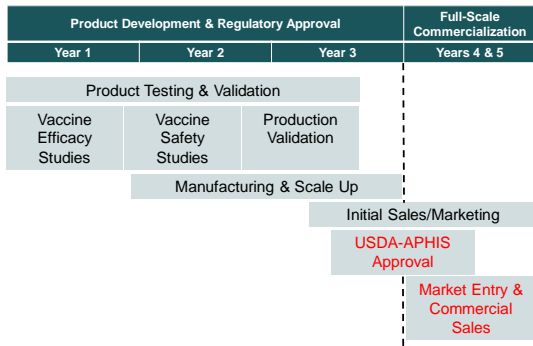
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### Commercialization Process




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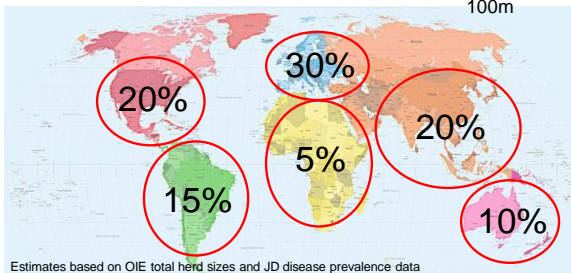
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### Addressable Market

**Dairy cattle**  
**\$280-360m**

### Other ruminant animals

|             |            |
|-------------|------------|
| Beef Cattle | Sheep      |
| \$100-150m  | \$150-200m |
| Goats       | Camels     |
| \$30-50m    | \$50-100m  |




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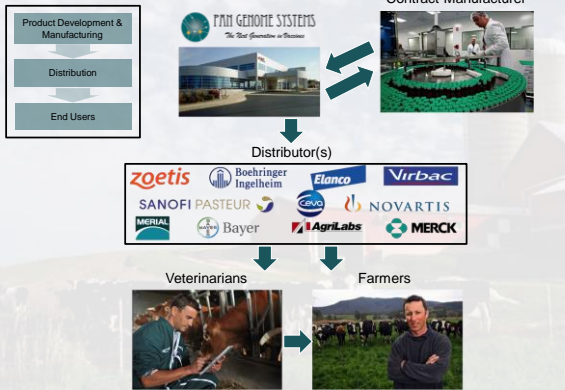
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## Business Model

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## The Farmer's Alternatives

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|                                |             |
|--------------------------------|-------------|
| Test/Cull & On-Farm Management | Vaccination |
| 95%                            | 5%          |

## Current Johne's Disease Vaccine Competitors

|                                | Competitor Vaccine | Pan Genome Systems Vaccine |
|--------------------------------|--------------------|----------------------------|
| Prevents infection             | X *                | ✓                          |
| Eliminates shedding            | X *                | ✓                          |
| No granulomas                  | X                  | ✓                          |
| Doesn't interfere with TB test | X                  | ✓                          |
| Available in U.S.              | Yes **             | Yes                        |

\* Does reduce  
\*\* But restricted or illegal in some states

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## Intellectual Property

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Vaccine candidates against Johne's Disease

*Issued June 2014*

Global gene regulators as vaccine candidates against paratuberculosis

*Pending*

RNA biomarkers for early diagnosis of mycobacterial infections

*Pending*

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