TAKEDA VACCINES

INNOVATION FOR GLOBAL IMPACT

RAJEEV VENKAYYA, MD
President, Global Vaccine Business Unit
OUR MISSION

Develop and deliver innovative vaccines that tackle the toughest problems in public health and improve the lives of people around the world
WE HAVE BUILT A GLOBAL VACCINE BUSINESS UPON A STRONG FOUNDATION IN JAPAN

日本バイオ製薬株式会社は、日本での強力な基礎を築いたグローバルな製薬事業を築きました。

1946年

日本製薬業を設立

2012年

グローバル製薬業を設立

2010年

1st Takeda manufactured vaccine

2014年

multiple vaccine products manufactured internally and marketed in Japan

2016年

Global pivotal Phase 3 clinical trial of dengue vaccine candidate initiated: 20,100 participants in 8 countries in 2 regions

2018年

Phase 3 clinical trial results of dengue vaccine candidate is expected in H2 FY18

ACQUISITIONS

- Invirager
- Ligocyte

PARTNERSHIPS

- Bill & Melinda Gates Foundation
- U.S. Government- BARDA
- Polio vaccine candidate
- Zika vaccine candidate
- Norovirus vaccine candidate
- Dengue vaccine candidate

1947年

1st Takeda manufactured vaccine
THE VACCINE MARKET IS AN ATTRACTIVE PLACE FOR INVESTMENT

Vaccine sales growth projected at 7.1% between 2017 and 2024, reaching $44.6 billions in 2024¹

Durability in sales with limited impact of patent expiry

Blockbuster potential in newly launched vaccines

Threat of emerging and existing infectious diseases with epidemic potential

¹ Evaluate Pharma report 2018
OUR STRATEGY

Develop vaccines with global relevance and business potential

BUILD A GLOBAL PIPELINE

TACKLE UNMET NEED

LEVERAGE PARTNERSHIPS

Target the greatest opportunity in infectious diseases

Partner to de-risk and drive vaccine development
**OUR PIPELINE**

<table>
<thead>
<tr>
<th>Discovery/preclinical</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Japan Marketed Vaccines</th>
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<tbody>
<tr>
<td></td>
<td>NOROВURS VACCINE (TAK-214)</td>
<td>DENGUE VACCINE (TAK-003)</td>
<td>MEASLES RUBELLA (BIKEN)</td>
<td>VARICELLA (BIKEN)</td>
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<tr>
<td>BARDA</td>
<td>SABIN INACTIVATED POLIOVIRUS VACCINE (TAK-195)</td>
<td>HSN1 FLU (BLB-750)</td>
<td>EGG-BASED SEASONAL FLU DENKA &amp; KM BIOLOGICS</td>
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<td>ZIKIA VACCINE (TAK-426)</td>
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<td>ENTEROVIRUS 71 VACCINE (TAK-021)</td>
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<td>JAPANESE ENCEPHALITIS BIKEN</td>
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<tr>
<td>CHIKUNGUNYA VACCINE (TAK-507)</td>
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<td>DIPHTHERIA TETANUS TOXOID</td>
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Pipeline as of September 23, 2018

- **External collaboration**

+ Takeda has a measles-rubella combined vaccine, a measles vaccine and a rubella vaccine on the Japanese market.
‡ Takeda has a diphtheria-tetanus combined toxoid vaccine and a tetanus-toxoid vaccine on the Japanese market.
^ Takeda’s varicella vaccine has been approved for an additional indication preventing herpes-zoster.
DENGUE THREATENS HALF OF THE WORLD’S POPULATION

Endemic in more than 120 countries¹

Causes an estimated 390M infections¹

Causes more than 20K deaths each year²

In 2015, >85M US, Canada, and Japan travelers to endemic countries³

Without safe and effective dengue vaccine

>3.9 BILLION people around the globe are at risk of dengue¹

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A SAFE AND EFFECTIVE DENGUE VACCINE SHOULD BE DESIGNED TO
PROTECT AGAINST ALL FOUR STRAINS OF THE VIRUS

- Dengue is a mosquito-borne disease that can be caused by each of the four strains of the dengue virus (DENV) 1-4
- In people previously exposed to dengue, a subsequent infection with a different strain could lead to more severe disease
- A dengue vaccine must provide broad protection against all four strains of dengue, particularly in persons who have never been exposed to the virus (“naïve”)
TAK-003 IS MODELED ON THE COMPLETE DENGUE VIRUS AND ACTIVATES MULTIPLE ARMS OF THE IMMUNE SYSTEM

- Live attenuated dengue vaccine based on the complete DENV-2 genome
- Vaccine virus stimulates robust immune response without causing illness
- Components of immune response that are activated include:
  - Neutralizing antibodies
  - Cell-mediated immunity
  - Antibodies to the NS1 protein (NS1 is implicated in severe disease)
**TAK-003 TRIGGERS BOTH ANTIBODY AND CELL-MEDIATED IMMUNE RESPONSES**

**Antibody-mediated immune response in dengue naïve population**

- High and sustained antibody response to multiple serotypes after 2 doses (0, 3 month), in participants without prior exposure to dengue

**DENV-2 cell-mediated immune response**

- >90% of TAK-003 vaccinated participants demonstrate a Dengue-specific T-cell response
- Comparable response between seronegative and seropositive participants at baseline
- Demonstrated cross-reactivity to DENV-1, -3, and -4

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1 Lancet Infect Dis 2018; 18: 162–70 Published Online November 6, 2017 http://dx.doi.org/10.1016/S1473-3099(17)30632-1; results from DEN-204, a Phase 2 study in children living in 3 dengue endemic countries

2 6th Pan-American Dengue Research Network Meeting; results from DEN-205, a Phase 2 study
TAK-003 TRIGGERS NS1 ANTIBODIES THAT PREVENT VASCULAR LEAKAGE IN THE LABORATORY¹

- Severe dengue is characterized by vascular leakage in the lungs and abdomen
- This vascular leakage is thought to be mediated by the dengue virus non-structural protein 1 (NS1)
- TAK-003-induced NS1 antibodies block NS1-induced vascular leakage in human pulmonary tissue models

¹ 6th Pan-American Dengue Research Network Meeting; results from DEN-203, a Phase 2 study
HPMEC = Human Pulmonary Microvascular Endothelial Cells
TAK-003 WAS GENERALLY SAFE AND REDUCED THE INCIDENCE OF DENGUE IN CHILDREN IN A RECENT PHASE 2 STUDY

STUDY FEATURES

• 1,800 participants received either TAK-003 (1 dose; 2 doses at 0, 3 months; or 2 doses at 0, 12 months) or placebo
• Mean age 7.3 years, range 2 – 17 years
• Approximately 45% of participants were dengue naïve

INCIDENCE OF SYMPTOMATIC DENGUE WAS SIGNIFICANTLY LOWER IN VACCINE RECIPIENTS OVER 18 MONTHS¹

<table>
<thead>
<tr>
<th>Dengue Incidence</th>
<th>Relative risk of dengue in vaccines (95% CI)</th>
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<tbody>
<tr>
<td>TAK-003 (%)</td>
<td>Placebo (%)</td>
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<tr>
<td>1.3</td>
<td>4.5</td>
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</table>

¹ Lancet Infect Dis 2018; 18: 162–70 Published Online November 6, 2017 http://dx.doi.org/10.1016/S1473-3099(17)30632-1; results from DEN-204, a Phase 2 study in children living in 3 dengue endemic countries

THESE PROOF-OF-CONCEPT FINDINGS REQUIRE CONFIRMATION IN OUR ONGOING PHASE 3 EFFICACY STUDY
OUR PHASE 3 PIVOTAL TRIAL IS DESIGNED TO ANSWER THE MOST IMPORTANT QUESTIONS ABOUT SAFETY AND EFFICACY OF OUR DENGUE VACCINE CANDIDATE

STUDY DESIGN

• 20,100 participants, aged 4 – 16 years old
  – Age range ensures a mix of dengue exposed and naïve participants
• Blood sample in all participants at baseline
  – Enables identification of seronegative subjects
• 8 countries in 2 regions
  – Brazil, Colombia, Dominican Republic, Nicaragua, Panama, Philippines, Sri Lanka, Thailand
  + Assesses the safety and efficacy of TAK-003 in diverse populations and epidemiological scenarios

PRIMARY ENDPOINT RESULTS EXPECTED IN H2 FY18 FOLLOWED BY REGULATORY FILING IN FY19
Takeda has the most advanced norovirus vaccine candidate (TAK-214) and recently completed Phase 2b study.

**Challenge**
- Leading cause of acute gastroenteritis
  - 600M infections per year
- No vaccine available

**Our Path**
- Most advanced vaccine in development
- Completed Phase 2b study
- Phase 3 preparations underway

**Our Goal**
- Potential for first and best vaccine
- Impact in all markets
TAKEDA HAS PARTNERED WITH THE U.S. GOVERNMENT TO DEVELOP THE FIRST ZIKA VACCINE (TAK-426)

**CHALLENGE**
- Devastating impact on newborns
- Potential for recurrent outbreaks
- No vaccine available

**OUR PATH**
- Largest Zika investment by U.S. government
- Proven platform
- Fast track designation

**OUR GOAL**
- Deliver the first Zika vaccine to market
1 STRONG FOUNDATION AND TOP TALENT
- Over 70 years of vaccine manufacturing experience
- Top talent in vaccine development
- Built a high impact global pipeline

2 BEST-IN-CLASS AND FIRST-IN-CLASS POTENTIAL
- Dengue vaccine (TAK-003) in Phase 3
- Norovirus vaccine (TAK-214) in Phase 2b
- Zika vaccine (TAK-426) in Phase 1

3 A PARTNER OF CHOICE FOR VACCINES
- U.S. Government
- Japan Government
- Bill & Melinda Gates Foundation
- Industry Partners
“If you want to save and improve lives around the world, vaccines are a fantastic investment.”

- Bill Gates