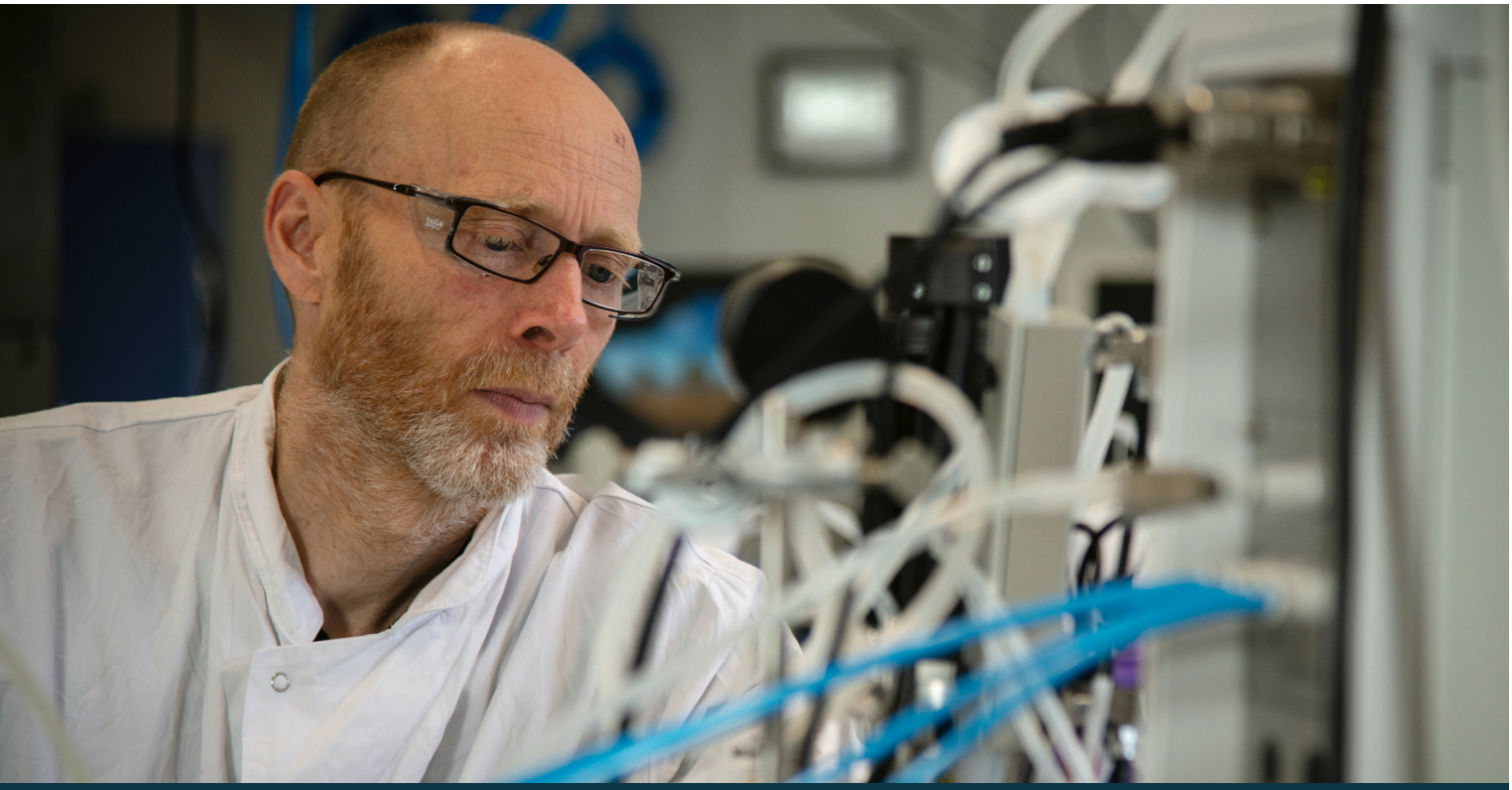
OMV-Vacc: Outer Membrane Vesicles (OMV) vaccine platform.

The versatile and scalable platform underlying a new generation of vaccines for today's public health challenges



At a glance

Technology

A proprietary platform that allows the flexible use of Outer Membrane Vesicles (OMVs) to express antigens of interest or serve as a vaccine adjuvant or carrier.

Advantages

- **Effective:** Elicit potent innate and adaptive immunity
- **Efficient:** Scalable production delivers high yield and purity
- **Versatile:** Flexible strategies to leverage different antigen types
- **Safe:** Produced OMVs undergo LPS detoxification
- **Stable:** Long-term integrity simplifies transport and storage
- **User-friendly:** Offers the option of intranasal administration

Examples

Homologous OMV
- Avacc® 3: Pertussis
- Avacc 11: Gonorrhea
- Avacc 13: Meningitis B

Heterologous OMV
- Avacc 12: Gonorrhea

Mix OMV
- Avacc 10: COVID-19

OMV-Vacc platform

Background: what are OMVs?

Outer Membrane Vesicles, or OMVs, are excellent vaccine candidates. These spherical nanoparticles (20–200 nm) harbor bacterial antigens, which play several roles in bacterial homeostasis. Gram-negative bacteria naturally release OMVs into their environment, and these OMVs can be purified from cultures. Small and with a composition mimicking the pathogen of origin, OMVs activate the immune system. But they are non-replicating, making OMVs a suitable and safe vaccine platform. We leverage these features and fruther arm OMVs with immunogenic peptides and/or proteins to stimulate effective adaptive immunity.

Our platform

Our OMV-Vacc platform is a robust technology for developing new prophylactic and therapeutic vaccines. The platform is scalable and flexibly allows modifying vaccine antigen composition through genetic modification of an OMV-producing bacterial strain, or by mixing or coupling antigens to OMVs.

OMV-Vacc consists of molecular tools to adapt and augment antigenic elements in OMVs. This includes engineering strategies to design bacteria that express desired antigens and methods to conjugate or mix OMVs with antigens that cannot be expressed or require post-translational modification. Our proprietary OMV production process is compatible with GMP requirements and efficiently generates high yields of OMVs. Candidate vaccines can be formulated for intramuscular or intranasal delivery (Figure 1) and are developed with relevant analytical assays required for testing and release of the OMV product.

OMVs used in intranasal vaccines: Avacc 10 induces high levels of IgA and IgG in animal models

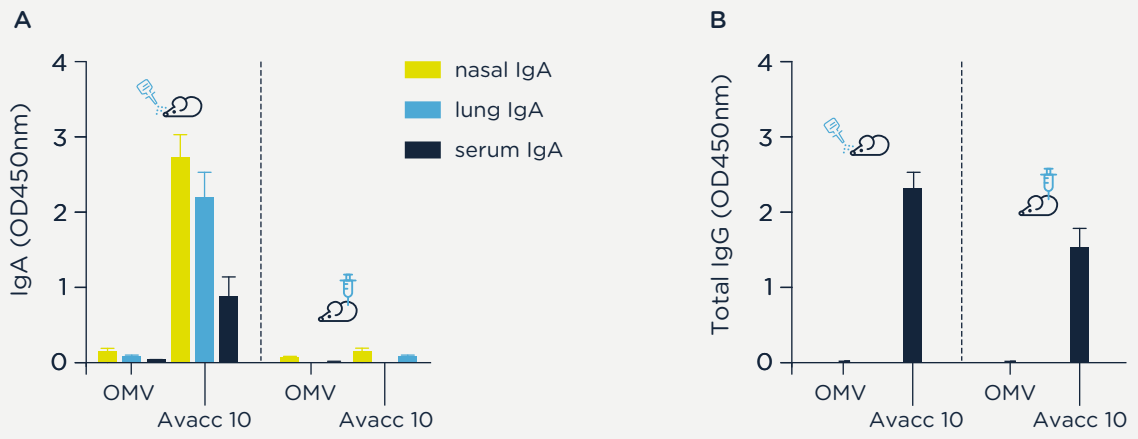


Figure 1. Mice vaccinated intranasally with Avacc 10, a COVID-19 vaccine combining *N. meningiditis* OMV with stabilized spike protein (Mix OMV), developed high levels of IgA against the spike protein in serum, nasal and lung tissue. By comparison, intranasal administration of the OMV alone and intramuscular vaccination with either Avacc 10 or the OMV alone elicited no significant increases in IgA (A). IgG against the spike protein increased with intranasal and intramuscular Avacc 10 vaccination, whereas no change was detected with administration of the OMV alone (B).

The vaccine design strategies of OMV-Vacc can be classified into 3 categories based on how the relevant antigens are produced and associated with the OMVs:

Homologous OMVs	Heterologous OMVs	Click/Mix OMVs
Homologous OMV vaccines are derived directly from the target bacterium. They offer a broad immune protection based on the incorporation and presentation of various natural antigens. In general, homologous OMVs are the best choice when multiple antigens of the pathogen are needed to induce immunity.	Not all bacteria are suited or able to generate OMVs. Our heterologous OMV strategy allows us to express pathogen antigens in our platform OMV-producing bacterium (Figure 2). A notable advantage of heterologous OMVs is that their production and analytical toolkit are similar from one vaccine to the next, facilitating rapid development.	Antigen expression within a bacterium is not always possible. The proteins may be incompatible, too large, or require post-translational modification. We master strategies to conjugate immunogenic peptides to OMVs (Click OMVs) as well as generate optimal mixtures of antigens with OMVs that function as adjuvants (Mix OMVs). These strategies are particularly suitable for pandemic preparedness as the OMVs can be stockpiled.
Antigen expression		
In the OMV-producing bacteria		Externally (e.g., E.co-Vacc)
OMV producer		
In the OMV-producing bacteria	Our platform OMV-producing bacterium (*Neisseria meningiditis*)	
Type of antigen		
Broad protection using natural bacterial antigens.	Strong immune response through engineered expression of bacterial or viral antigens.	High efficacy via conjugation or mixing of bacterial, viral, or tumor antigens with OMVs.

Heterologous OMVs grant flexibility to display specific target antigens in a vaccine

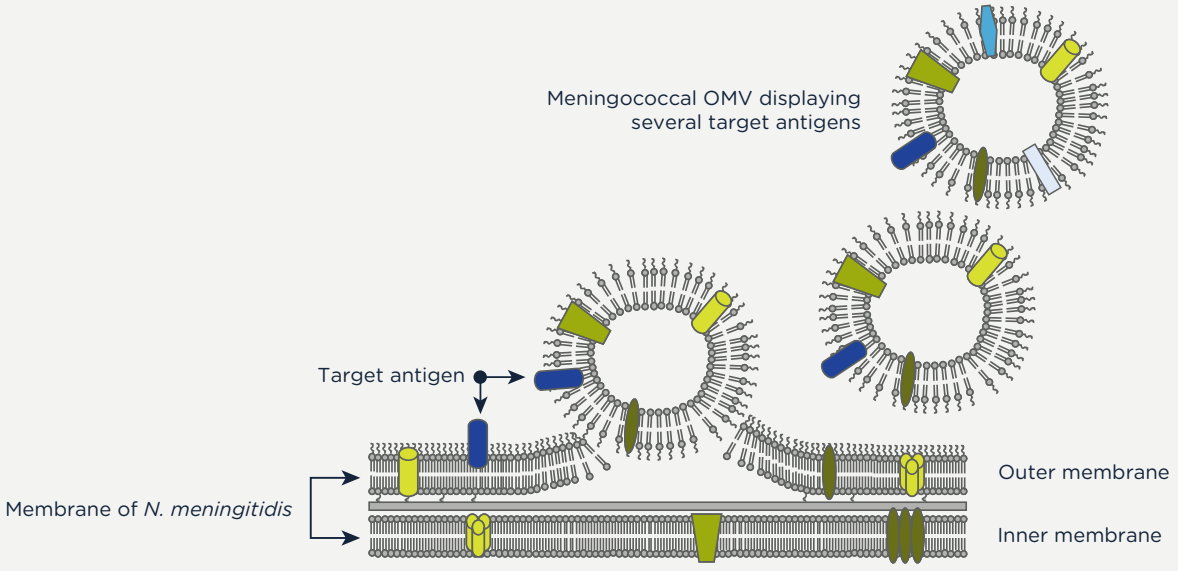


Figure 2. Intravacc uses *Neisseria meningitidis* serogroup B as a platform OMV-producing bacterial strain. For the heterologous OMV strategy, the bacterium is engineered to express the target antigens of a vaccine.

Clear advantages of the OMV-Vacc platform, from design to clinical material production

- **Proven safety:** Non-infectious and with LPS detoxification, OMVs have a strong safety profile
- **Effective:** OMVs intrinsically elicit a potent innate and adaptive immune response
- **Stability:** OMVs maintain integrity, simplifying transport and long-term storage
- **High yield:** Our platform has an optimized production efficiency
- **High purity:** Our platform includes well-established and scalable purification steps
- **Versatility:** Our platform allows combining OMVs with different antigen types
- **Flexible administration:** OMV-based vaccines can be given intramuscularly and intranasally

Working with Intravacc

Use of the OMV-Vacc platform is a vaccine development service that builds on the out-licensing of the platform on a non-exclusive basis. Additionally, many of our OMV-based vaccines have been successfully outlicensed. Further supportive data and structures for partnership or licensing are available and can be presented in a confidential follow-up meeting.

Additional information

 Learn about the history of OMV-Vacc and how it tackles vaccine development hurdles. **Read more**	 Take a closer look at the advantages of intranasal vaccine delivery. **Read more**	 Our OMV-based Avacc vaccine candidates are available to out-license. **Discover them**

Contact us at bd@intravacc.nl

Intravacc. Innovating vaccines

Intravacc B.V. Utrecht Science Park Bilthoven . Antonie van Leeuwenhoeklaan 9 . 3721 MA Bilthoven . The Netherlands
Phone: +31 30 792 03 00 . Mail: bd@intravacc.nl **intravacc.nl**

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