



## GSK Vaccines

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# Partnering with GSK to accelerate vaccine R&D

Fast-tracking future health solutions.

Combining the science of the immune system and human genetics with advanced technologies is the cornerstone of R&D at GSK, underpinning a pipeline of 57 medicines and vaccines centred on infectious disease, immune-mediated disorders and oncology. In vaccines, GSK works to protect people from infectious disease by active life-cycle management of existing vaccines, and by fast-tracking the delivery of a pipeline of new vaccines. After more than a year defined by COVID-19, the need for innovative technologies to accelerate vaccine discovery, development and production has become increasingly evident, as has the value of synergistically developing such technologies in partnerships.

In 2020, GSK's consolidated R&D investment was £5,098 million. Amongst others, this investment enabled around 2,000 vaccine scientists organized in 4 global centres to advance 17 new vaccines in development. For example, an enduring R&D focus was instrumental in the progress in an RSV programme that took three candidate vaccines tailored to populations most at risk—infants and older adults—into phase 2 or 3 trials.

GSK is committed to accelerating and increasing access to vaccines with a global impact, driving partnerships focused on leveraging the R&D and production expertise that make it a science-driven leader. This long-term commitment has manifested in a pipeline consisting almost entirely of candidates developed through partnerships, and in 150 ongoing vaccine-focused collaborations worldwide. The latter includes 49 academic collaborations with PhDs or postdocs in 2020.

GSK partners with drug and vaccine developers of various sizes, consortia, charities, academics as well as businesses beyond biopharma, focusing on projects spanning discovery to late-phase development. Through these collaborations, the company strives to improve disease prevention and vaccine supply, while driving the adoption of new digital technologies. Areas of focus include amongst others reverse vaccinology for antigen discovery and personalized vaccination approaches, supported by systems biology, to advance priority vaccines and novel technology platforms.

Whatever the focus, the company adopts an open, collaborative and resolutely science-led approach that supported the publication of 300 vaccine-focused scientific papers in 2020. To assess whether a collaboration would be a good fit for both GSK and its potential partner, the vaccine experts managing these collaborations examine the scientific evidence, potential impact of a project, and the partner's requirements.

The collaborative approach has resulted in a large pipeline of candidates against diseases affecting the developing world. The strength of the pipeline

### Areas of interest for potential partnerships with GSK Vaccines R&D

The infographic is divided into two main columns. The left column lists target populations: infants, children, adolescents, adults immunocompromised patients, pregnant women, and older adults. The right column lists five key areas of interest:

- Immunology and vaccinology**
  - Characterization of host-pathogen interactions or immune responses
  - Research on novel associations between viral/bacterial agents and chronic diseases
  - Immunotherapy of chronic diseases
  - Epigenetic research on modification of innate immune cells (trained immunity)
- Artificial intelligence and digital data analytics**
  - Novel applications of systems biology, data modelling/analysis and artificial intelligence
- New vaccine targets and antigen design**
  - New tools to refine or accelerate future vaccine target identification (infectious and chronic diseases)
  - Structural vaccinology research
  - Nanoparticles, virus-like particles, ...
- Vaccine delivery**
  - Delivery methods/devices related to alternative routes of administration (oral, mucosal, intradermal, ...)
- New technology platforms**
  - New immunomodulation technologies and adjuvants
  - Vaccine stability technologies
  - mRNA vaccine technologies
  - Vector technologies (viral, bacterial, ...)
  - Induction of more efficient and rapid immune responses (1 dose vaccine)
  - Microbiome functions/interventions research
  - Discovery, identification, engineering of human monoclonal antibodies
- New technologies to accelerate R&D**
  - Assays on a chip for clinical read-outs or quality control and assurance
  - Novel clinical trial designs (incl. human challenge models)
  - Biomarkers research and application of systems biology to new readouts
  - Development of in vitro models such as organoids or organ-on-chip systems
- New production process technologies**
  - New technologies to characterize or improve biologicals manufacturing (PAT, biosensors, microfluidics, continuous manufacturing, ...)

is reflected in the Access to Medicine Index, which in 2021 ranked GSK as the top pharmaceutical company for the seventh consecutive year.

### Countering pandemic health threats

A long-standing commitment to infectious disease R&D made GSK a sought-after partner on COVID-19 projects. The company leveraged its broad capabilities across a multi-pronged approach, firstly by collaborating with other vaccine developers, including Sanofi and Medicago, enabling the development of vaccine candidates using GSK's pandemic adjuvant technology. The adjuvant is used to enhance immune responses, which enables getting more doses out of facilities at a time, especially when supply is a bottleneck. GSK is also working with SK Bioscience on a phase 1/2 study for a vaccine based on self-assembling nanoparticle technology developed by the University of Washington, with funding from CEPI and the Bill and Melinda Gates Foundation. Furthermore, GSK is supporting production of up to 100 million doses of CureVac's first-generation COVID-19 vaccine.

GSK is looking ahead to the next phase of the pandemic, by working with CureVac to develop second-generation multivalent mRNA vaccines aiming to protect against viral variants. Finally, GSK is working with Vir Biotechnology to accelerate development of anti-SARS-CoV-2 monoclonal antibodies.

These partnerships put the company in a position to contribute to addressing the pandemic and to support the continued control of emerging SARS-CoV-2 variants. However, COVID-19 is unlikely to be the last global infectious disease crisis. In the future, societies will need better ways to manage pathogenic threats; the emergence of multidrug resistant bacteria is a striking case in point.

### Partnerships to counter health threats beyond COVID-19

Antimicrobial resistance to existing antibiotics creates an urgent need for new remedies. GSK supports the push to address this health threat by developing novel vaccines, in order to stimulate the immune system to quickly eliminate pathogens, drive immunity against multiple targets, reduce the need for antibiotics and, in doing so, reduce the risk of resistance.

CARB-X, a global non-profit aiming to tackle the threat of drug-resistant bacteria, recognized GSK's expertise in the area, and agreed to fund the development of vaccines against infections caused by Group A *Streptococcus* and *Salmonella enterica*. Other initiatives include a partnership with microbiome specialist Viome, to investigate the infectious origin of certain chronic disorders, and work with Eligo Bioscience to develop bacteriophages that kill specific bacteria, leveraging CRISPR-Cas technology. Through Europe's Innovative Medicines Initiative, GSK also supports vaccine-enabled healthy aging and, aligned with its strategic objectives, promotion of innovations to speed up vaccine development and manufacture (through the consortia VITAL and INNO4VAC, respectively).

GSK continues to scan the landscape for technologies, knowledge and partnerships that can accelerate the development of vaccines to improve global health.

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