ANTIVACCINATION AND VACCINE HESITANCY

A PROFESSIONAL GUIDE TO FOSTER TRUST AND TACKLE MISINFORMATION

THOMAS AECHTNER

ROUTLEDGE

Antivaccination and Vaccine Hesitancy

This important book provides a comprehensive guide to understanding vaccine hesitancy, as well as the nuances of antivaccination claims. It is designed to give clinicians and other professionals targeted information to help them address vaccine hesitancy and antivaccination claims, as well as ways of responding to immunisation concerns.

Alongside the scientific facts around vaccinations, it considers the historical foundations of modern vaccine scepticism, while offering key insights into the psychology behind vaccine hesitancy and the factors which influence an individual's decision-making. Separating fact from fiction, the book explores the most well-known antivaccine myths, many of which proliferate online, uncovering ways that counter-vaccine narratives can influence audiences. Importantly, it also outlines the most effective strategies to address both doubts and misinformation, detailing five general principles to improve communications, with tips and guidance to debunk false claims or provide assurance in the face of immunisation doubts.

This is essential reading for anyone wishing to really understand the phenomenon of vaccine hesitancy, whether professional, student or general reader, and the methods that can be used to challenge misinformation.

Thomas Aechtner is an Associate Professor in the Faculty of Humanities and Social Sciences at the University of Queensland. As a Westpac Research Fellow alumnus, and a recipient of UQ's Foundation Research Excellence Award, his research examines vaccine hesitancy, antievolutionism, religion-science conflict, media persuasion, and public perceptions of science. He holds a doctorate from the University of Oxford, an MA from the University of Calgary, and a BSc in Biological Sciences from the University of Alberta.

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A Professional Guide to Foster Trust and Tackle Misinformation

Thomas Aechtner

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To Ben and Xander

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Abbreviations

DCD	Distrust, Confidence, and Danger
DTP	Diphtheria, tetanus, pertussis
ELM	Elaboration Likelihood Model
Hib	Haemophilus Influenzae Type B
HPV	Human Papillomavirus
ITP	Idiopathic thrombocytopenic purpura
MI	Motivational Interviewing
MMR	Measles, mumps, rubella
OARS	Open-ended questions, Affirmation, Reflecting, and Summary
OPV	Oral polio vaccine

1 Understanding vaccination and antivaccination

In 2021, when COVID-19 vaccine rollouts were launching across the world, several people began to confide in me about their vaccination fears. Colleagues, friends, and strangers related stories about dangers they had heard about. Some expressed how it seemed as though the new vaccines were improperly tested and rushed into production. I received texts from acquaintances, explaining that they had been told getting vaccinated with the "experimental" COVID-19 vaccines would lead to infertility. A fellow researcher at my university whispered unease to me about the risks of vaccine-related blood clots. In coming months, another colleague stormed out of a meeting, enraged that newly introduced work mandates would require her to be vaccinated. Necessitating vaccines, she insisted, was undemocratic. When I went to get my haircut, the hairdresser asked whether I had heard the latest news about mRNA vaccines? They were incredibly unsafe, she confided, because they could alter our DNA. I also received several emails from members of the public, which accused the Government, as well as myself, of colluding with BigPharma for malicious ends. As the pandemic continued a relative of mine announced that every person under the age of 50 who had received a COVID-19 vaccine would drop dead within the next five years.

Each of these encounters related to vaccines in the SARS-CoV-2 pandemic. However, they were also representative of a wider range of arguments and anxieties about vaccines that have been voiced long before the age of COVID-19. In fact, worries about possible vaccine risks, as well as vocal opposition to mandatory vaccination policies, have existed for almost as long as vaccines have. Additionally, early apprehensions about vaccines, and past grievances against compulsory vaccination acts, frequently parallel the types of assertions made about vaccines and immunisation policies in the present day. The claims and fears that people have aired about vaccines throughout history are surprisingly similar to modern vaccination worries. These commonalities are important, because they embody core disputes and doubts about vaccines that continue to have real world consequences, including outbreaks of preventable diseases. This is why in 2019 the World Health Organization listed vaccine hesitancy as one of the top ten global

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health threats.[1] During this same year, before COVID-19 made vaccines a daily frontpage news topic, I also proposed that my employer, the University of Queensland, should host a free online course dedicated to addressing antivaccination and vaccine hesitancy.[2] My research involves examining science scepticism, including antivaccination persuasion, vaccine hesitancy, antievolutionism, public perceptions of science, and mass media. In studying these topics, a persistent theme emerged: though academics have continued to identify what seems to lie behind science scepticism, there can be lack of easily accessible, comprehensive training on science scepticism, antivaccination and vaccine hesitancy.[3] With the help of my university's Institute for Teaching and Learning Innovation, I set out to help tackle that deficit. This book is one of the products of that reckless venture. Its goal is to untangle vaccine hesitancy and antivaccination claims, while also mapping out optimal ways of responding to immunisation concerns.

This volume features central insights into the psychological tendencies that lie behind why people have vaccine worries. It also reveals what sociocultural factors influence vaccine decision-making, while covering the science and safety of vaccines. This includes exploring many of the most widespread antivaccine myths and persuasion strategies. In doing so, this book not only provides genuine vaccination facts, but it also uncovers the striking ways that counter-vaccine narratives continue to influence audiences around the world. Importantly, upcoming chapters outline the most effective strategies identified for addressing vaccine doubts expressed by hesitant patients, friends, or relatives. This includes five general principles for improving pro-vaccine communications, and tips for more effectively debunking misinformation. Altogether, it offers a suite of practical advice about vaccine refusal, and research-based methods that can be implemented to improve vaccine advocacy. Before diving into these topics, however, it is necessary to examine what the terms antivaccination and vaccine hesitancy actually refer to. This reveals that they are not necessarily one and the same thing.

What is vaccine hesitancy?

For countless people vaccinations are simply part of the mundane routines of life. Vast numbers of individuals were vaccinated during childhood, and if they went on to have their own kids, they got them vaccinated as recommended by their family physicians. For many, flu shots are an annual custom, and when traveling abroad people ensure that they are up to date with the vaccines needed to keep themselves protected from disease. This commonplace nature of vaccines may cause the general public to overlook the colossal impacts of vaccination on global health. Despite seeming to be a banal part of our lives, vaccines represent one of the most effective medical breakthroughs in human history, and save millions of lives every year.[4] Nevertheless, despite the clear health outcomes of vaccines, opposition to

vaccination has existed for over a century. The first references to "anti-vaccinators" appear at the very start of the 19th century, and the percentage of books which contain the words "anti-vaccination" or "antivaccination" spiked in the decades following the introduction of the first state-sponsored vaccination campaigns.[5] By the end of the 20th century, however, references to antivaccination had dropped dramatically, before they once again started rising sharply from the 1990s to the present-day. That rise has continued, and there remained a growing interest and concern over antivaccination from the end of the 20th century, into the 21st.

The terms *antivaccination* and *antivaccinationist* usually refer to vocal, ardent vaccine denial, and a refusal to be vaccinated, designating the active rejection of scientific consensus on vaccines. What is important about these categories is that while they may apply to a particular segment of any given society, the percentage of people who might be classified as antivaccinationist tend to represent relatively smaller shares of the public in most countries.[6] Apart from that, avid vaccine denial and refusal does not suitably describe a broad spectrum of people who might simply have questions or worries about vaccines. Maintaining concerns about what ingredients are in vaccines, or reservations about how many vaccines a child should receive at any one time, does not necessarily make someone an antivaccinationist. The term, antivaccination can also be quite polarising, and an oversimplification that may involve characterising people as either antivaccinationist on one hand, or fully supportive of vaccines on the other. As it turns out, there is a lot of middle ground between those two polar options.[7]

This middle ground includes people who have received all their recommended vaccinations, who have had their family members vaccinated, yet who still express some doubts about the safety and effectiveness of vaccines. It can also be made up of individuals who might accept some but not all vaccines, as well as people who choose to delay certain vaccines for their children. Consequently, a continuum of views exists between those members of the population who accept vaccines without uncertainties, and those who totally refuse all vaccines (Figure 1.1). This spectrum is comprised of individuals who choose to get vaccinated but still have misgivings, as well as others who may refuse some but not all vaccines, or those who delay

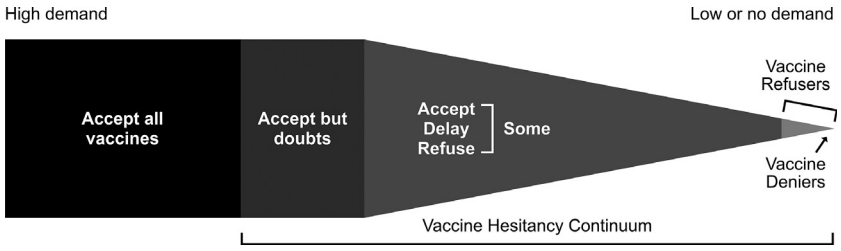

Figure 1.1 The Vaccine Hesitancy Continuum[9]

vaccination and fail to keep their children up to date with all of the recommended immunisations. In recognising that populations reveal such complexities that extend beyond unswerving antivaccination and resolute vaccine acceptance, researchers have developed the term *vaccine hesitancy* to depolarize matters.[8]

Vaccine hesitancy refers to assorted reasons why someone might question, delay, or refuse vaccinations in the context of a decision-making process around vaccination.[10] The term includes varying degrees of concern about vaccines, their safety, and doubts about their necessity, as well as a range of behaviours taken in response to such concerns. The scope of vaccine hesitancy, therefore, includes everyone who is not classified as a wholehearted vaccine acceptor; from those who accept vaccines but still have doubts, to ardent vaccine deniers. This means that vaccine hesitancy is broader and more complex than the term antivaccination. Plus, the number of people who express vaccine hesitancy includes a far larger percentage of the population than only those who might be classified as committed vaccine rejectors.

The extensive scope of vaccine hesitancy makes it challenging to draw a general picture of individuals who express it. This is because people who have anxieties and questions about vaccination can come from a variety of backgrounds, and they can convey distinct hesitations for different vaccines. For instance, some might feel thoroughly comfortable with the Hepatitis B vaccine, but have qualms about the measles, mumps, and rubella shot, or be particularly uncomfortable with newer vaccines, such as those developed to prevent COVID-19. As things stand, vaccine hesitancy has proven to be particularly complicated, and people's vaccination worries can be shaped by a wide variety of factors. These include whether people trust in the safety of vaccines, or if individuals have confidence in the medical system and healthcare professionals. Vaccine hesitancy can be sparked by a lack of trust in pharmaceutical companies and governments, or whether people have had positive experiences discussing vaccines with their local family physician in the past. Social ties and cultural beliefs, shared with an individual's family, friends and community networks, can also predispose some to resist vaccines. Added to all these factors may also be political and media influences, which can impact people's vaccination decisions. As a result, there is often no single source of vaccine hesitancy. Plus, because vaccine hesitancy is featured across a spectrum of attitudes and behaviours, people with vaccination uncertainties cannot simply be pigeonholed into one clear-cut group or characterisation.

This complexity is both the key, and the challenge, of vaccine hesitancy. While only a comparatively small fraction of the population may be genuinely antivaccinationist, a much larger proportion of people convey vaccine hesitancy. Such individuals represent different backgrounds, beliefs, and life experiences that can fuel doubts about the necessity and safety of vaccines. This may include you, if you have ever had some misgivings about certain

vaccines, or your friends and family, who might have shared rumours about potential vaccination risks similar to those that I was told about COVID-19 vaccines. Crucially, the sheer breadth and intricacy of vaccine hesitancy is also why it is necessary to look beyond the very narrow term antivaccination. This is because when it comes to public confidence in immunisation, and the importance of maintaining sufficient vaccination rates to avoid preventable disease outbreaks, we need to consider the potentially much greater numbers of people who are not necessarily antivaccine, but who may *still* harbour vaccine hesitancy. With that in mind, it is also essential to consider further questions connected to the dilemma of vaccine hesitancy, including: Why do people have such uncertainties in the first place, and what can be done to better address these doubts in order to keep vaccination coverage high? Before trying to grapple with these questions, it is useful first to review the history of vaccination, to understand how it has revolutionised modern medicine and the implications of vaccine hesitancy.

Smallpox, vaccination, and the rise of counter-vaccine movements

The history of vaccination is often traced back to the British scientist Edward Jenner, who in 1796 inoculated an eight-year-old boy, James Phipps, with cowpox pus from a lesion on the hand of Sarah Nelmes, who worked as a milkmaid. Jenner did this because it had been observed that milkmaids, women such as Nelmes who milked cows, seemed to rarely contract smallpox. Though few of us are concerned with smallpox today, it was one of the deadliest infectious diseases in human history. Described as the "Greatest Killer," smallpox was an incredibly painful sickness, resulting in the death of between 20–30% of all people who contracted it, and causing significant scarring and even blindness in survivors.[11] With this scourge in mind, Jenner postulated that milkmaids were shielded from smallpox because they had first been exposed to cowpox; a disease that resulted in similar but relatively benign symptoms. After taking fluid from cowpox pustules on a young milkmaid, Jenner inserted it into incisions that he had made on the boy's hands. The boy developed mild symptoms but then recovered, after which Jenner completed the same procedure using smallpox matter. Incredibly, no smallpox symptoms developed in the boy. Jenner's technique derived the name "vaccination" from the Latin word for cow, *vacca*.[12]

Although Edward Jenner is credited with ushering in our modern understanding of vaccination, the factual accuracy of his legendary medical story involving a milkmaid has since been questioned by historians.[13] It has also been recognised that Jenner was not the first person to use cowpox materials to combat smallpox. An English farmer named Benjamin Jesty, for instance, had already recorded performing a similar procedure 22 years before Jenner conducted his famous milkmaid experiment.[14] Additionally,

many fundamentals of inoculation that underpinned Jenner's procedure had been previously recognised by others. For example, it had already been observed that many survivors of infectious diseases were immune to reinfection from the same ailments. *Variolation*, the practice of administering materials taken from smallpox blisters on infected individuals to non-infected patients to generate immunity, had also been established throughout different regions of the world. There were reports of such procedures being practised in Africa, China, India, and Turkey well before Jenner's 18th century test.[15]

Nevertheless, Jenner led the way in establishing vaccination's official scientific standing, and he also became the procedure's top populariser. As a result, it was knowledge of Jenner's cowpox trials that would eventually spread throughout the world, and the Harvard professor Benjamin Waterhouse later became the first to test it in the USA by employing the technique on his own children. In the 19th century, Louis Pasteur then revolutionized medicine by applying vaccination principles to produce lab-made vaccines to prevent bacterial and viral infections, including developing a vaccine for rabies. The 20th century then witnessed the creation of large-scale vaccine production techniques, and by the end of the 1900s researchers had developed individual vaccines for over 20 infectious diseases. These included vaccines for diphtheria, tetanus, anthrax, cholera, typhoid, tuberculosis, polio, measles, mumps, and rubella. Following on from such advancements, 183 years after Edward Jenner's vaccination experiment, the World Health Assembly, which is the decision-making body of the World Health Organization (WHO), officially declared that smallpox had finally been eradicated in 1979.[16] This milestone was described as the "world's most triumphant achievement in public health."[17]

Even so, the story of smallpox and vaccinations is not only a narrative about combating devastating, life-threatening illnesses. It is also a tale that involves a parallel rise of vocal opposition to vaccines, which erupted not long after widespread, government-initiated vaccination drives began in the early 1800s.[18] After Jenner demonstrated the usefulness of the cowpox-smallpox vaccination technique, the United Kingdom's government introduced the Vaccination Act of 1840. The Act delivered free vaccinations to the public, while it also made the comparatively riskier procedure of smallpox variolation illegal. Following on from this, the Vaccination Act of 1853 rendered vaccination mandatory for children up to three-months-old, wherein failure to comply resulted in a fine or even imprisonment. A series of additional Vaccination Acts were successively introduced in ensuing decades, which further consolidated and updated UK laws around compulsory vaccination and the types of penalties given to citizens for non-compliance.[19] Protests were launched in response to the 1853 Act, and the Anti-Vaccination League was founded in London. In 1867, the Anti-Compulsory Vaccination League was then established, and its members contended that mandatory vaccination policies violated people's personal freedoms.

Throughout the 1870s and 1880s numerous antivaccination publications were drafted and distributed across Great Britain, while new antivaccination organisations were also initiated across Europe.

On the other side of the Atlantic, in the USA, protesters against vaccination mandates were forming their own opposition groups. The Anti-Vaccination Society of America was formed in 1879, followed by the establishment of the New England Anti-Compulsory Vaccination League in 1882, as well as the Anti-Vaccination League of New York City in 1885. Such American organisations distributed antivaccination publications critical of compulsory vaccination policies, and they were successful in having mandatory vaccination laws repealed in several states throughout the country by challenging them in US courts. Along with complaints that obligatory vaccination policies infringed upon civil liberties and personal health choices, 19th century counter-vaccine claims in the US involved religious objections to the animal origins of vaccination materials, overt distrust in medicine, and scepticism about the effectiveness of the procedure itself.[20] Conspicuously, many of these very same grievances remain at the heart of modern antivaccination arguments, and they continue to be identified as sources of present-day vaccine hesitancy. What also unites historical and contemporary arguments against vaccination is that they have commonly been based on misunderstandings and misinformation about vaccines. This includes recurrent misconceptions about how vaccination works and the nature of vaccine ingredients, as well as miscalculations about the safety and necessity of vaccines. For this reason, it is essential to outline the basic science of vaccines, including their safety and effectiveness.

How do vaccines work?

In basic terms, vaccines harness your natural immune system by training your body how to recognise and then combat pathogens. Pathogens are disease-causing agents, including viruses, bacteria, fungi and parasites, that can lead to illness, injury, or death.[21] Every day, we come into contact with a legion of pathogens, and our immune systems are persistently defending our bodies against these invaders to stop us from becoming ill. The first line of defence against pathogens is described as the *innate immune system*. This includes chemical barriers that prevent infection, as well as our skin, the linings of our lungs and the digestive tract, which function as physical barriers to keep pathogens from invading the body. This innate immune system is also composed of certain white blood cells that guard the body from pathogenic assault.[22] Cumulatively, the innate immune system negates many potential pathogens, and it is nonspecific in nature, serving as a general defence barricade against entry into the body.

The most common variety of innate immune system white blood cells are *neutrophils*, which circulate in the bloodstream and only survive for a few days. When these cells identify a pathogen, they surround and ingest it. The

innate immune system also includes *macrophages*, pathogen-engulfing white blood cells that live much longer than neutrophils. Macrophages are particularly important because they activate inflammation within the body, and they secrete signals to recruit other immune cells to the area. The innate immune system is also comprised of *natural killer cells*, which attach themselves to cells infected with viruses, as well as tumour cells, and then release chemicals to destroy the tissue. *Dendritic cells* of the innate immune system have threadlike tentacles to capture pathogens, which they then break apart and present to other immune cells to stimulate increased immune responses. These cells are vital because they activate another level of protection termed the *adaptive immune system*.

The adaptive system operates beyond the innate immune system's non-specific defences, for more precise, aimed action against specific pathogens. It works in concert with the innate immune system, and can detect unique molecular parts of pathogens, or molecules in the toxins that a pathogen can produce. These specific molecular parts of pathogens, or pathogenic toxins, are called *antigens*.[23] Every pathogen is composed of a unique set of building blocks, such as proteins and sugars, or nucleic acids like DNA. These individual building blocks, which can be recognised by the immune system to stimulate an immune response, are antigens. When the innate immune system's white blood cells, especially the dendritic cells, identify an antigen, they muster into action the adaptive immune system's own set of white blood cells.[24] The adaptive immune system's two primary types of cells include *T-cells* and *B-cells*. The T-cells essentially control and direct the adaptive immune system's more targeted responses, and they can also kill cells infected by pathogens. B-cells, which are activated by T-cells, are crucial because they manufacture *antibodies*. Antibodies are complex proteins, which serve as molecular weaponry that can lock onto specific antigens to neutralise them. Antibodies can also attach to pathogens and mark them for destruction by other white blood cells.

When the combined activities of the immune system fight off a pathogen, numerous activated white blood cells expire during, or shortly after the pathogenic invader has been destroyed. Yet, what is remarkably important about the adaptive immune system is that a small number of T-cells and B-cells remain in the body long-term. These are named *memory cells*, and they can recognise and target a specific antigen from a previous infection using receptors on their cell surfaces. Such cells can remain on guard for years, or even for the life of an individual, to provide long-lasting defence from reinfection.[25] Consequently, when someone is exposed to a pathogen that their memory cells are already primed to recognise, the memory cells will quickly trigger the immune system for an efficient, heightened, and more sustained defensive response. This can mean that some individuals may not express any symptoms when they are re-exposed to a pathogen that the immune system has previously fought off, or they could experience less severe symptoms over a shorter duration when compared to first-time exposure.

If a person has an immune system with memory cells that can recognise and mount a faster response to specific antigens, that individual sustains immunity to such antigens. The result is that the body can then destroy the related pathogen before it can cause disease, or, fight the infection to the degree of significantly reducing the span and severity of disease symptoms. Critically, this basic understanding of the immune system is fundamental to grasping how vaccines function, and why they are such a momentous medical intervention. This is because while our immune system is an extraordinarily complex and effective defence apparatus, which is constantly operating to keep us safe, some pathogens can overwhelm or evade our immune responses. Depending upon the pathogen, this can result in severe illness, injury or death before our bodies have the time to fight them off and develop memory cells. Vaccination for specific pathogens prevents that from happening. This is because vaccines safely introduce antigens into our bodies, though controlled exposure to a dead or weakened version of the pathogen, or only part of the pathogen, or even deactivated toxins that pathogens can produce. In its weakened state, a pathogen generally cannot replicate and spread throughout the body to cause the symptoms associated with natural exposure. Additionally, only parts of a pathogen, or deactivated pathogenic toxins, are also unlikely to result in adverse reactions. Even so, an introduced controlled antigen in a vaccine can still train the active immune system to fight off a natural infection.

The immune system learns to recognise the antigenic molecules in a vaccine as an invader, resulting in memory cells that are readied to know how to deal with them in the future. A vaccine accomplishes this without requiring that people be exposed to a full-scale infection from an active pathogen. In the end, what is fundamental is that natural infections and vaccines are both stimulating the *same* immune system defence responses. However, with a vaccine the body can acquire an adaptive memory cell outcome without having to endure or risk the potentially debilitating, and sometimes life-threatening, consequences of the disease itself.[26]

Types of vaccines

Though all vaccines train the immune system to fight pathogens by introducing antigens into the body, there are currently six major types of vaccines that have been developed that do this in somewhat different ways.[27] It is helpful to appreciate this diversity of vaccines, in order to understand the ways that each variety coaches our natural immune systems to fight off disease.[28] Basic knowledge about vaccine types is also vital because not everyone may be as aware of the range of vaccines on offer, while common misunderstandings and misinformation about vaccines often skew and overlook how different vaccines function. The assortment of commercially available vaccines includes the following.

Live attenuated vaccines

This class of vaccines contain a debilitated living version of the bacteria or virus that they are designed to produce immunity against. The pathogens are weakened in a laboratory so that they are unlikely to spread and result in symptoms. For instance, though naturally occurring viruses can reproduce thousands of times in the body during an infection, weakened viruses in live attenuated vaccines usually reproduce fewer than 20 instances. Since these types of vaccines introduce a live pathogen, they mimic natural infections and elicit relatively strong immune responses that often result in life-long immunity after only one or two doses. However, because they contain live pathogens, these kinds of vaccines are not given to people with immune deficiencies, including those with AIDs or patients undergoing cancer treatment. Live attenuated vaccines must also be kept refrigerated to prevent the weakened pathogens from dying. Examples of such vaccines include measles, mumps, and rubella vaccines, as well as vaccines for varicella, known as chickenpox.[29]

Killed/inactivated vaccines

These vaccines contain pathogens that have been killed by chemicals, heat, or radiation. The body can acquire immunity from the dead remains, as they still contain key antigens that allow the body to learn how to defend itself against a live infection. Unlike live attenuated vaccines, inactivated vaccines are easier to store and are safer for people with weakened immune systems because they contain no live pathogens. On the other hand, such vaccines frequently require several booster shots to fully instruct the immune system to defend the body against natural infection, since a dead pathogen is less effective at simulating a natural infection than are weakened living pathogens. Examples include Hepatitis A, rabies, and inactivated poliovirus vaccines.[30]

Subunit vaccines

These contain only an antigen component of a pathogen, rather than a whole weakened, or killed pathogen. The antigens can stimulate and train the immune system to combat a live pathogen. An ingredient called adjuvants are often required in these vaccines to help provoke the immune system, because antigens alone frequently do not elicit a sufficient reaction to result in long-term immunity. Adjuvants are vaccine ingredients that amplify the immune system's response to antigens. Since this variety of vaccine incorporates antigens rather than a live pathogen, the risk of side effects is low, and subunit vaccines can be given to people with immune deficiencies. However, identifying exactly which antigens can be used to develop immunity against a whole living invader often proves to be