

FOCUS: VACCINES

Introduction

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Vaccines by definition are biological agents that elicit an immune response to a specific antigen derived from an infectious disease-causing pathogen. Edward Jenner developed the first vaccine in 1796 using cowpox to inoculate against smallpox. His groundbreaking work ultimately led to the global eradication of smallpox, officially declared in 1980. Since then, vaccines have helped to suppress the spread of several infectious diseases including polio, which has been eliminated from many countries, including all of those located within North and South America and Europe. With the continued use of vaccines, it is tempting to speculate that other infectious diseases will soon follow suit. Unfortunately, we have taken a large step backward with the vocalization of the anti-vaccine movement and the reduction in vaccine acceptance.

Although arguably one of man's greatest discoveries, vaccines have always been met with some hesitation, even in the late 18th and early 19th centuries. Yet recently, vaccination has rapidly become a highly controversial issue, due in large part to an erroneous link between vaccines and autism. It is important to shed light on the necessity of immunization and the value it offers both personally and publicly. Universal vaccine acceptance is essential to providing herd immunity, such that those who are unable to be directly protected by vaccination are protected by communal immunity. Vaccine education will be critical

in maintaining the forward progress that has been made in reducing or eliminating many infectious diseases.

In this issue of the *Yale Journal of Biology and Medicine*, articles focus on many different aspects of vaccine research and development, ranging from understanding poor uptake of the influenza vaccine in at-risk populations to utilizing your immune system to improve the efficacy of anti-cancer vaccines.

In an attempt to better understand the concerns surrounding vaccines, Hausman and colleagues examine the relationship between Progressive Era immunization concerns and those being voiced in today's society. In a rhetorical analysis, the authors determine that many of the motives of vaccine resistance today are rooted in the historical concerns for vaccine safety and efficacy. In an effort to ease some of these concerns, Federman suggests improved vaccine education as a public imperative in his perspective piece. He advocates that widely improving vaccine understanding will improve public perception of immunization and promote vaccine acceptance.

Lack of vaccine education and acceptance is one reason that many vaccines are under-utilized. One such vaccine is the influenza vaccine, which is one of the most complex and useful tools for preventing the spread of influenza. In this issue, both Lawrence and Murphy examine the lack of influenza vaccine coverage in at-risk popu-

lations, namely college students and pediatric asthma patients, respectively. Both suggest a lack of understanding as a barrier to proper vaccine acceptance. In an interview, pediatric infectious disease specialist Marietta Vázquez, MD, describes her innovative work studying maternal immunity and indicates that a lack of vaccine education is responsible for poor influenza vaccine acceptance among pregnant women. Additionally, she provides insight into the future of the immunization field, highlighting the pipeline of vaccines on the verge of approval.

Similar to the influenza vaccine, the hepatitis B vaccine lacks coverage in at-risk populations. Frew and colleagues examine the reasoning behind suboptimal immunization rates among Vietnamese Americans, an at-risk group for hepatitis B. Importantly, there is a vaccine available to combat this disease, which is not always true for infectious diseases that often predominate in underprivileged populations. In his perspective, Erfe elaborates on the need for vaccines in developing nations and suggests a plan to mobilize pharmaceutical companies to research and produce vaccines for diseases such as Ebola, which have very little threat to the First World, but are ravaging sub-Saharan Africa and other vulnerable populations.

In addition to infectious disease-targeted vaccines, a recent endeavor has begun in the pursuit of anti-cancer vaccines. Similar to the foundation of infectious disease vaccines, anti-cancer vaccines stimulate an immune response to target cancer-specific antigens. In a comprehensive review, Liu describes the initial progress made and the potential for expanding the field by describing both therapeutic and preventive types of anti-cancer vaccines. In an equally thorough review, Datta and colleagues discuss the role of dendritic cells in cancer immunotherapy, not just in regard to the success of the FDA-approved sipuleucel-T for prostate cancer, but also the potential advancements for dendritic cell immunotherapy in other cancer treatment.

Although the field of immunization is currently experiencing controversy, the future of vaccine research is quite promising. In our final focus topic article, we sit down with Erol Fikrig, MD, to discuss his successful career in microbial pathogenesis and the development of the first and only vaccine to prevent Lyme disease. In addition to discussing his work, Dr. Fikrig also shares his outlook on the prospect of the vaccine field, both from a research and public perspective, leaving us with an optimistic vision for the future of immunization.