

NIAID: Challenging the variable paradigm of infectious diseases

The National Institute of Allergy and Infectious Diseases (NIAID), part of the US National Institutes of Health (NIH), has been a key player behind the creation and success of the US President's Emergency Plan for AIDS Relief, the biodefense strategy following 9/11 and the research efforts to find new ways to prevent and treat infectious diseases. **Dr Anthony Fauci**, the Director and man in charge, spoke to *Research Features* about NIAID's recent research successes, outlining where science currently stands on preventing infectious disease onset worldwide.

Only a very select number of people in the world have been awarded the Presidential Medal of Freedom. Even fewer have been asked directly by the President himself to set up a government-funded initiative to combat the HIV/AIDS pandemic. And yet, Dr Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases (NIAID), has received both of these prestigious honours.

Back in 2003, when George W. Bush was President of the United States, he came to Dr Fauci asking him to work with White House staff to set up what came to be known as PEPFAR – the President's Emergency Plan for AIDS Relief. In the thirteen years that have followed, the initiative has been a huge success, resulting in millions of HIV-infected men, women and children being provided access to lifesaving antiretroviral treatment. In 2008, Dr Fauci was deservedly awarded the Presidential Medal of Freedom for his groundbreaking scientific work at NIAID.

NIAID's focus is not solely on HIV/AIDS though. As the name suggests, their research

is aimed at a whole variety of different allergies and infectious diseases – including the recent Ebola and Zika virus outbreaks. Dr Fauci, responsible for managing NIAID's \$4.6 billion annual budget, recently spoke to *Research Features* about his institution's current areas of clinical study, shedding light on some of the successes and challenges he has encountered during his time as Director.

What does your role involve as Director of the National Institute of Allergy and Infectious Diseases (NIAID) and what kind of responsibilities do you have?

I'm responsible for setting the institute's scientific agenda, providing scientific and administrative leadership, outlining the strategic plan of where we're going, and managing our budget. Currently, we have a budget of \$4.6 billion dollars per year, most of which we award in grants and contracts. As Director, it is my overall responsibility to plan and implement the research, both intramurally with our scientists here at the NIH, and at universities, centres, and institutions throughout the country and the world. In fact, about 80% of our budget is directed to these external organisations through the grant process.

In order to develop and implement an appropriate research agenda for a disease like HIV, you have to be global. Our international collaborations are inherent to what we do here ”

NIAID is renowned for its collaborative work worldwide. Why are these global collaborations so important for scientific research?

Science overall, and particularly science involving infectious diseases and global health, really transcends any national boundaries. The economy has become global, security has become global and science has always been global. So collaboration is important in order to implement the kind of science that we are responsible for, but it is also necessary to answer the questions that we need to answer.

Let me give you some examples. A major part of our research portfolio is involved with HIV/AIDS which, as you know, is a global problem – 67% of HIV-infected individuals are in Southern Africa and more than 90% are in the developing world outside of the United States. In order to truly develop and implement an appropriate research agenda for a disease like HIV, you have to be global.

Other good examples include malaria, tuberculosis, neglected tropical diseases, and influenza, which are also important parts of our research portfolio. Influenza by its very nature spreads globally, starting in different parts of the world. The last flu epidemic we had, the 2009 H1N1 influenza, started in Mexico and the United States, so I think our international collaborations are inherent to what we do here at NIAID.

Do you mainly work in South African countries and areas that are more affected by infectious diseases, or are your collaborations mainly America-focused?

Our research is global because infectious disease is global. Let me give you an example. Several years ago, in collaboration with the Thai government and the United States Department of Defence, we did a vaccine trial for HIV in Thailand. It was only modestly protective with a 31% efficacy, which really is not ready for the primetime.

From this collaboration and the partially successful results of this trial, we have now recently started a follow-on HIV vaccine trial in South Africa called HVTN 702, in the hopes of building upon that earlier modest success in Thailand, to create an even better HIV vaccine. We are conducting the study in South Africa because that is where a safe and effective vaccine to prevent HIV infection is most needed, but certainly an effective vaccine would have worldwide implications for HIV prevention.

We frequently collaborate with the South African government and the Medical Research Council there because of the terrible burden of HIV in certain Southern African countries, particularly South Africa. But we also conduct and fund research in the US and throughout other parts of the world.

Will that HIV vaccine trial be a follow on from the President's Emergency Plan For AIDS Relief (PEPFAR) that you had such a big part of setting up?

Yes, it will be indirectly connected. PEPFAR was not a research endeavour but instead is something that I got involved in developing with President Bush. It is a programme measured in many billions of dollars for the prevention, treatment and care of HIV-infected individuals, and is not predominantly research-focused. I got involved in it after President Bush asked me to go to Africa and put together a programme that would help deal with the ravaging HIV/AIDS pandemic in Africa. It was not really a research issue but more of an implementation and treatment issue to help prevent new HIV infections and provide treatment and care for those individuals infected with HIV.

What kind of impact have you seen from that initiative?

It has been extraordinary. PEPFAR ranks among one of the most important things the United States has ever done in global health. It is certainly a major contribution to President George W. Bush's legacy. What he has done with PEPFAR and what he allowed me to do to put it together, is something that is truly quite transforming. It has literally saved millions of lives.

In terms of modern day research do you think infectious diseases are still as recognised as they should be, especially in terms of funding?

As researchers have developed effective vaccines and therapeutics to guard against infectious diseases, such as polio and smallpox, there has been a misperception in the developed world that infectious diseases were essentially well-controlled and would soon be a thing of the past. That was a failure on the part of the developed nations to look beyond their borders. Even though certain infectious diseases are prevented or very well controlled through vaccines and drugs in many parts of the world, in other places, infectious diseases are a leading cause of death.

In addition to the established infections, such as malaria, tuberculosis, and HIV/AIDS,

there is always a threat of emerging and re-emerging infectious diseases. We have experienced two major occurrences in just the last three years – Ebola in West Africa in 2014 and now Zika in the Americas.

There is a continual challenge with infectious diseases because of the global nature of our society and the ever-evolving nature of infectious diseases. The idea that infectious diseases are something we no longer have to worry about is a really dangerous misperception.

In terms of NIAID's goals, is vaccine research the main aspect of your work or do you focus on other areas as well, such as education?

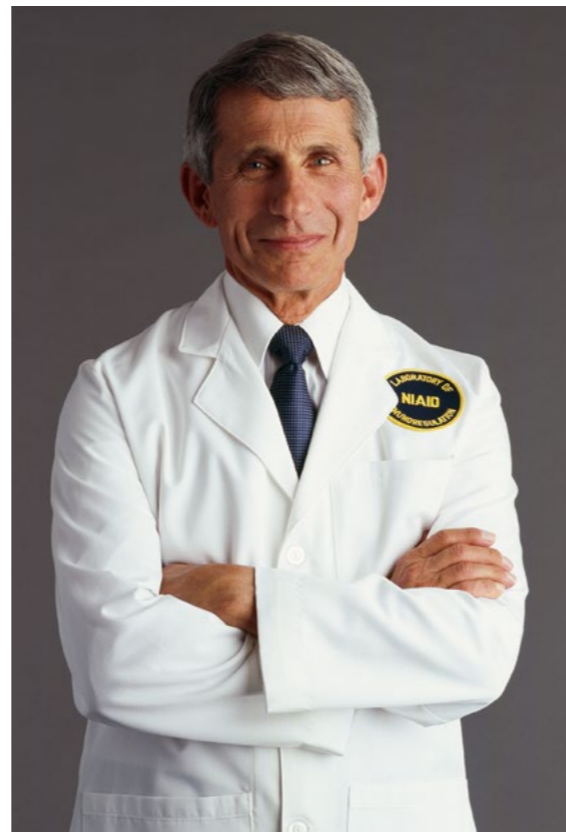
That is a good question. Vaccine research is a key focus of our research portfolio because an effective vaccine can be so transformative in its ability to end or significantly curb disease. However, we do a lot more research on infectious diseases than just vaccines. We conduct research aimed at understanding the epidemiology and pathogenesis of infectious disease-causing organisms, as well as the development of diagnostics, therapeutics, and, as you correctly mentioned, vaccines.

When I first started taking care of HIV-infected patients in 1981, we did not even know what the virus was, and we certainly did not have any treatments for it. Over the past 35 years we have played a major role, in fact the major role, in the research and development of most of the drugs that are now used to save the lives of HIV-infected individuals. The fundamental underlying research that led to the development of these drugs came largely from NIAID-funded research conducted by scientists at the NIH and all over the world.

In terms of the future, which direction do you see NIAID's research going in the next ten years or so? Do you think we will be able to find cures for particular infectious diseases?

Oh, I think so. For example, some of the work that we are most proud of went into finding treatments for HIV infection; however, NIAID was also instrumental in the development of curative drugs for Hepatitis C – the leading reason for liver transplantation in the United States and the developed world.

The PEPFAR initiative has been extraordinary. It ranks among one of the most important things the United States has ever done in global health ”



Dr Anthony Fauci was appointed Director of NIAID in 1984. He oversees an extensive research portfolio of basic and applied research to prevent, diagnose, and treat established and emerging infectious diseases such as HIV/AIDS, Ebola and Zika virus. Credit: NIAID

We hope to get a vaccine to prevent HIV infection, so that we can turn the trajectory of the epidemic. That would be an enormous accomplishment and we are making our way closer to that goal. Whether or not we will be able to find an absolute cure for HIV is still an open question, but we are learning more about the virus all the time.

We also hope to develop a universal influenza vaccine that can be administered maybe once every ten years that can protect against multiple strains of influenza. Not only would this mean that people would not need to get an annual, seasonal flu shot, but the universal vaccine could presumably protect against a new influenza strain to which people had not been previously exposed. Those new influenza strains are the ones that can cause global flu pandemics.



Dr Nancy Sullivan of NIH's National Institute of Allergy and Infectious Diseases discussing Ebola research with President Barack Obama as NIAID Director Dr Anthony Fauci and HHS Secretary Sylvia Burwell look on. Credit: NIH

to understand the latest developments in a given field and how to apply them. As you highlighted in your first question, science really is a global issue.

From a more personal perspective, your research into HIV/AIDS has led to numerous awards over the years, and you are often described as America's Man on Infectious Diseases. How does it feel to be such an internationally-recognised peer of infectious disease research, and what does winning these awards mean to you?

It is always nice to be recognised for what you have done, but I have to tell you, when there is so much unfinished business and so many challenges, I spend very little time savouring awards. I mean, it is very nice – it is always gratifying to be recognised for your work – but you cannot take your eye off the ball when there are so many different emerging and re-emerging infectious disease challenges that remain. Being recognised is a great thing, but it is not the reason I do it.

• *NIAID is one of the 27 institutes that make up the National Institutes of Health (NIH). For over 60 years, it has supported basic, clinical and translational research to improve scientific understanding on how to better treat and prevent infectious, immunologic and allergic diseases. Under Dr Anthony Fauci's directorial leadership, NIAID has improved the health of millions of people worldwide, developing countless new vaccines, therapies and diagnostic tests through research.*

As you mentioned, with the Ebola outbreak occurring in 2014 and the Zika epidemic happening just last year, are there concerns that a future epidemic could be just around the corner? Is there a plan in place in case another outbreak occurs next year?

The most important thing that you can predict about an emerging infectious disease is that it will be unpredictable. No one expected that Zika would have such a devastating effect throughout the Americas. In order to prepare for it, you try to develop vaccines and diagnostic platforms that can be rapidly extrapolated to the next disease that emerges. You also want to have a good surveillance system in place to see if there are emerging threats that go unnoticed. That surveillance aspect is more the responsibility of the US Centers for Disease Control and Prevention than that of the National Institutes of Health (NIH), but we do get involved in developing the diagnostics that support their surveillance plans.

After 9/11, NIAID was involved in the biodefense research following the attacks.

Could you tell us some more about this?

Our institute led research efforts to find counter-measures against anthrax, amplify the supply of smallpox vaccine and develop antidotes against botulism and other potential biodefense weapons. After 9/11 and the subsequent anthrax attack, the United States government invested about a billion and a half dollars in NIH, asking us to develop counter-measures against potential bioterror threats.

So having that governmental backing must be very important?

Yes – it is absolutely vital to our research.

NIAID conducts and hosts many scientific events, seminars, and lectures. Why are these so important to progressing research?

Science not only involves discovery but also incorporates communication – giving ideas to others and receiving ideas from them. Communicating with scientists through lectures, events and seminars is very important to establish the kind of scientific information exchange necessary



Contact

NIAID Office of Communications and Government Relations
5601 Fishers Lane, MSC 9806
Bethesda, MD 20892-9806
USA

E: ocpostoffice@niaid.nih.gov

T: 866-284-4107

W: www.niaid.nih.gov

f /niaid.nih

t @NIAIDNews