

It's Vaccine Time, Vaccine Time, Vac Vac Vaccine Time!

(Sung to the 1958 hit song "Summertime, Summertime")

It's me again! Set for another story of "In the beginning....." This time we're looking at the history of vaccines. Evidence exists that shows the Chinese employed small pox inoculations in the year 1000: telling us that vaccines to prevent disease in humans is certainly nothing new.

Reliable documentation exists detailing an influenza-type illness in 1510. Documentation also exists that shows the "1st" pandemic, fitting the symptomatology of influenza, occurred in 1580. Fast forward 309 years to 1889, when Spanish physicians thought diseases were caused by a number of scenarios: cannon fire on the western front, the building of the Madrid underground, air pollution, sun spots, or smoking poor quality tobacco.

It would be another 43 years when, between 1932-1933, English scientists 1st isolated the influenza A virus in the nasal secretions of an infected patient. The 1st clinical trial of a flu vaccine was documented in the mid-1930's. Influenza B was discovered between 1942-1945. As of the 1940's the stated objective of the flu vaccine was two-fold: to protect against influenza & to achieve a vaccination rate that would serve to protect UNvaccinated people. (Hold on to those objectives!)

Finally, in the late 1960's a flu vaccine was licensed for use in Europe. In the United States the vaccine was recommended for people at risk of complications of the flu: 450 years after written documentation of the 1st flu-type illness. Vaccines have, over the ensuing years, come a long way, baby!

Types of vaccines, that we are familiar with today, include:

Killed, (inactivated) whole organism vaccines. These vaccines are what they sound like; vaccines where the actual disease causing organism has been killed in a lab by chemicals, heat or radiation. This type of vaccine results in a moderate immune response; it therefore requires booster shots. The injectable polio vaccine is an example of a killed, whole organism vaccine.

In the 1950's advances in tissue culture techniques led to the development of live attenuated vaccines. Live what? Live attenuated. These are vaccines that contain a disease causing organism which has been weakened in a lab so that it is incapable of causing disease. (Picture a virus the size of a pin head, being smacked on the noggin with a 2x4 the size of the pin. It knocks the virus loopy so that it can't remember how to be infectious! It helps our immune system "learn" to fight against that organism if it is encountered in the future.) This type of vaccine stimulates a strong, long lasting immune response that typically does not require a booster. Live attenuated vaccines include those for smallpox, measles/mumps/rubella, & chicken pox.

Recombinant/conjugate vaccines. These vaccines use a specific piece of a disease causing organism: a protein, sugar, or capsid molecule. This type of vaccine typically produces a very strong immune response to a targeted part of the disease causing organism. However, a periodic booster may still be necessary. Types of recombinant/conjugate vaccines include those for whooping cough & shingles.

Toxoid vaccines. Some disease causing organisms produce toxins. A toxoid vaccine creates immunity to the parts of that organism that cause the disease, rather than the organism itself. The immune response is targeted to the toxin produced by the organism, rather than the organism itself. With toxoid vaccines booster shots may be necessary. Examples of toxoid vaccines include those for diphtheria & tetanus.

Now that we've taken a trip Back to the Future of vaccines, let's make the jump to hyperspace for an introduction to a newer technology vaccine.....mRNA vaccines.

What is mRNA? The acronym stands for "messenger ribonucleic acid"; it is one piece of genetic material in a biologic system. mRNA was discovered by Jacob, Sydney Brenner & Matthew Meselson in 1961 at Cal Tech.

mRNA vaccines appeared on the horizon in the early 1990's. mRNA vaccines have been studied for use in such diseases as: rabies, Zika, CMV

(cytomegalovirus), & influenza. mRNA has also been used in cancer research to trigger the immune system to target specific cancer cells. So while mRNA certainly isn't as old as the previously listed vaccine types, in science circles it isn't really a new technology. mRNA technology is what has been used to create the Pfizer & Moderna COVID vaccines.

mRNA vaccines are developed in a lab using readily available materials. mRNA vaccines do NOT contain any disease producing organism. Let me repeat that...mRNA vaccines do NOT contain any of the organism that is capable of causing the disease it is designed to fight. Ergo, the Pfizer & Moderna COVID vaccines do NOT contain any part of the SARS-CoV-2 virus. One CANNOT get COVID from these vaccines.

The process used to produce mRNA vaccines is able to be standardized & therefore can be scaled up quickly in order to make vaccine development faster than the processes to develop the vaccine types above. When COVID hit our world, & researchers had the necessary information about the virus' genetic code, work began on designing the mRNA instructions needed for a vaccine to attack the spike protein on the virus' surface.

So how does an mRNA vaccine work? It teaches our cells how to make a protein, or part of a protein, that will trigger an immune response. That immune response produces antibodies. It is those antibodies that protect us from becoming infected if we are exposed to the SARS-CoV-2 virus.

Is the vaccine 100% effective at preventing me from getting COVID? Unfortunately, no. Many factors play into how effective any vaccine is: age, prior exposure to the disease, amount of time that has elapsed since receiving the vaccine, type of vaccine received, comorbidities (diseases that existed prior to vaccination such as: diabetes, obesity, kidney disease). Additionally we have to remember that we are dealing with a novel (new) virus AND a novel vaccine. It will take, in all likelihood, years before we know all there is to know about COVID & how well the current vaccines have worked against it. Remember, we are flying this plane while we are in the process of building it. But in all honesty, the current

situation is still much better than waiting 450 years for a vaccine to combat COVID-19. I, for one, don't think I can wait that long!

What is the goal of the COVID vaccines, then? Do you remember the 2 goals from the 1940's for the 1st influenza vaccine? The goals are to protect against COVID & to achieve a vaccination rate that would serve to protect UNvaccinated people.

What about the side effects that have been in the news? Allow me to be perfectly blunt here. There is no drug known to man that does NOT have side effects. A side effect is an effect of a drug that is not the intended therapeutic outcome. These include things such as: headache, body aches, tiredness, elevated temperature, & soreness at the injection site. Side effects are different than adverse reactions.

An adverse reaction is an unintended pharmacological effect, such as: hives, skin rash, fast heart rate, swollen tongue. Have there been adverse reactions to the COVID vaccines? Yes. Again, I'm rather certain there are no drugs known to man that have not caused an adverse reaction to someone, somewhere, sometime. Why is that? Because while we may all be built the same, we are not at all built the same.

Going forward I would encourage everyone who is able to get a COVID vaccine. That being said I will also say that the best defense is a good offense. Have a conversation with your doctor if you have any misgivings about receiving the COVID vaccine. Have a conversation with your doctor if you have any on-going health issues. Your family physician knows you! He or she is the person best able to guide you in this matter.

I am reminded of a cartoon I recently saw. A young girl was talking with her mother:

Girl, "Mommy, what's that little round scar on your arm?"

Mom, "That's my smallpox vaccination."

Girl, looking at her arms, "I don't have one of those."

Mom, “That’s because it worked!”

Information gleaned from: CDC (Centers for Disease Control)

WHO (World Health Organization)

Nature.com

www.vaccines.gov

HHS (Department of Health & Human Services)

NIAID (National Institute of Allergy & Infectious Diseases) – you
know, Dr. Fauci!