DIAGNOSIS

VOLUME I, ISSUE 2

Letter From The Editor

Dear Reader,

I am excited to release the second issue of Diagnosis, Horace Mann's premier medical journal! I am so proud to display the hard work of all of the writers and editors, and hope you enjoy reading!

In this issue, you'll find articles on risk factors for COVID-19 in prisons, color geometry in the brain, the yellow fever resurgence in Nigeria, and much more! There also is Part 1 of a two-part interview with Dr. Chidi Akusobi '08 on how HM sparked his interest in medicine, how his routine as an MD-PhD student has changed in the pandemic, and advice on what high school students who are interested in pursuing a career in medicine can do.

I would like to extend special thanks to all of the writers and editors for all of the time and effort they've dedicated to this issue. I would also like to thank our faculty advisor, Mr. Epstein, for his constant support, guidance, and advice.

Sincerely,

Lauren Ho
Editor-in-Chief
Volume 1, Issue 2

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https://www.pinterest.com/pin/611152611909965402/

COVID-19 Vaccine: Allergy Hazard?

Athena Rem

The Pfizer/BioNTech vaccine was approved on December 11th, 2020 for emergency use after a phase three trial proved the vaccine to have a 95% efficacy rate. The Pfizer vaccine requires two shots, three weeks apart. The first dose has already been administered to approximately 11.1 million people—a number that's continuing to rise. The vaccine is only approved for those over 16 years old, though clinical trials are underway to test the vaccine on children. Thus far, the vaccine has been made available to some teachers, healthcare workers, and the elderly. However, these are not the only restrictions. After allergic reactions to the Pfizer vaccine became evident, it has been recommended that individuals who are allergic or have reactions to medicine, foods, or vaccines should hold off before being vaccinated.

The first round of immunizations was administered from December 14th to 23rd. Out of the 1,893,360 vaccinated, 21 people experienced anaphylaxis. Thus, the CDC is discouraging those with severe allergies from getting the vaccine, in case they are allergic to a compound or ingredient in the vaccine. Fifteen of these 21 people had their reactions within 15 minutes of their vaccination, and during this period of time patients are required to wait at the vaccination site to prevent any deaths.

Allergies present a problem in conjunction with getting vaccinated. They are a common cause of chronic illness and may cause various life-threatening reactions (such as anaphylaxis) and side effects. Allergies are widespread, so the risks may discourage many from taking it. However, despite the obvious downsides of the allergic reactions, detecting problems and reactions early helps scientists know what to fix and may shed light on any other potential problems. As Professor Peter Openshaw of Imperial College London said,

"The fact that we know so soon about these two allergic reactions and that the regulator has acted on this to issue precautionary advice shows that this monitoring system is working well."

https://www.poynter.org/reporting-editing/2020/the-state-of-covid-19-vaccines-today/

While adapting and developing the vaccine to prevent further reactions, it is imperative to know what exactly the allergen is. Nick Wood, of the National Centre for Immunisation Research and Surveillance, hypothesizes that polyethylene glycol, or PEG, could be the allergen. PEG has never been used in a vaccine until the Pfizer vaccine, however, it is used in certain drugs, including Neulasta and Pegintron, a bone marrow stimulant and hepatitis C medication, respectively. These drugs were both found to trigger anaphylaxis. Those who took medications containing PEG may have developed antibodies,

https://people.com/health/queens-nurse-first-person-united-states-coronavirus-vaccine/

causing them to reject (and react to) the vaccine. But what role does PEG actually play in the vaccine?

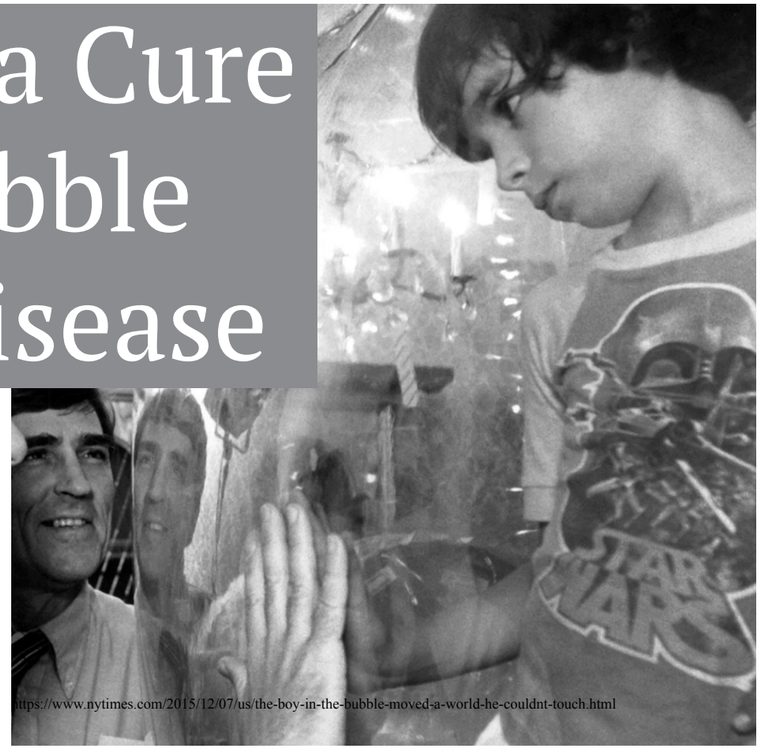
The Pfizer vaccine is an mRNA vaccine; COVID-19 has a "spike" protein on its surface. The vaccine's mRNA makes our cells produce this protein, allowing us to build a tolerance and develop antibodies. If the real protein enters the body, the cells will know to produce antibodies to fight it. Lipid nanoparticles surround and carry the mRNA, allowing it to get to the cells. They are covered with PEG molecules in order to improve their stability and longevity. According to a 2016 University of North Carolina—Chill study, about 7% of people have enough antibodies against PEGs to trigger a reaction. Logically, approximately 100,000 people should have had reactions instead of the 21 that actually did. This means one of two things: 1) The PEG is not the problem with the vaccine, or 2) Discontinuation of PEG drugs would naturally decrease the level of antibodies people have, accounting for the significantly smaller number of predicted anaphylaxis patients. Let's discuss this second option more in depth.

Multiple drugs containing PEG have been discontinued (such as PEG 3350) or discouraged from being used as a result of detrimental side effects and reactions experienced. In addition, warnings about allergens within the vaccine have undoubtedly dissuaded many from taking it, accounting for far fewer people experiencing side effects than anticipated. Perhaps the vaccine is not available to the majority of the 7% of people with antibodies reported by UNC Chapel Hill; after all, children are most likely to experience allergies, and they have not received the vaccine yet. A final—but unlikely—possibility is that others had a less severe allergic reaction but did not report it or make sure it was noted as a result of the vaccine.

The hope is that the allergy risk will be taken care of in time to prevent any further reactions. While it is still uncertain if PEG is the exact allergen, it seems to be a strong contender. Even if it turns out not to be the allergen in question, the effectiveness and organization of tracking those who got the vaccine to see if there were any negative effects shows great promise for coming adaptations and solutions. Even in the worst case scenario, where those 7% are not able to get the vaccine, herd immunity can still be achieved if the majority of the 93% are vaccinated. Of course, this is not entirely realistic as not everyone has equal access to the vaccine, but hopefully because the vaccine is still in its early stages of development, more people will be able to be vaccinated as time passes. The Pfizer/BioNTech vaccine's allergy warnings are still a relatively small problem, and developments have already been, and will continue to be, made to remedy this issue.

HIV as a Cure for "Bubble Boy" Disease

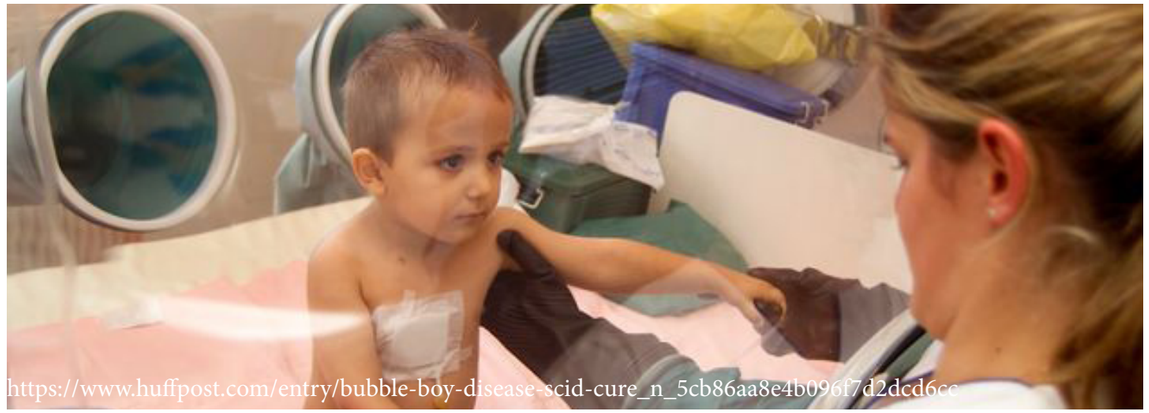
Dasha Dolgonos


https://www.nytimes.com/2015/12/07/us/the-boy-in-the-bubble-moved-a-world-he-couldnt-touch.html

Affecting 50 to 100 kids annually in the US, Severe Combined Immunodeficiency (SCID), also known as "Bubble-Boy disease," is a rare disease primarily found in boys. SCID is caused by a genetic mutation that leaves an infant with virtually no immune system and is usually fatal by two years old. The child's bone marrow is unable to produce T-cells, B-cells, and natural-killers, which are needed for the immune system to function, and the patient is not able to develop sufficient, if any, immune cells. This means that they cannot fight off any disease or virus, and even the common cold can kill the child. Bone marrow transplants have helped SCID patients in the past, but it is usually very difficult to find a suitable donor. Even when there is a donor, the surgery is very risky and there is no guarantee that a person's immune cell levels will become normal.

SCID can be diagnosed by a blood test and a blood cell count but is often only caught after the infant develops an infection. Symptoms of SCID include respiratory illnesses, rashes, and stunted growth. There is currently no cure for SCID, but the most common treatment is simply isolating the baby and keeping it away from all possible sources of infection. David Vetter is one of the most famous SCID patients. He lived his entire life in a plastic bubble, and that is where SCID gets its nickname, "Bubble-Boy disease." He lived to the age of 12, which is one of the longest amounts of time that an untreated SCID patient has survived. Eventually, he died of cancer that was brought on by an infection from a bone marrow transplant that was not a perfect match.

Many treatments for SCID have been tested in the past 20 years. One of the most effective ones involved gene therapy and was done in France where an altered gene was placed into the bone marrow. At first, this treatment seemed to work, but three to six years after the gene was implanted many of the patients developed leukemia because the implanted gene activated other cancer-causing genes. The most recent development in finding a cure for SCID also involves gene therapy to correct the patient's genetic code for the mutation that causes the disease. Gene therapy is a novel technique of curing previously untreatable diseases by inserting, replacing, or turning off the functionality of a gene. In this case, scientists have experimented with injecting a corrected gene into the patient's bone marrow using a deactivated form of HIV as a vector for the gene. HIV is another disease that causes an immunodeficiency, and using an altered form of HIV has been shown to have positive effects on SCID patients. The virus is inactivated and made non-infectious so that it can not transmit its virulent properties into the patient but the virus itself is still there. First, doctors extract blood stem cells from the bone marrow of a person with SCID. Then, a corrected form of the mutated gene is fixed onto the HIV and injected into the blood cells in the laboratory. The HIV acts as a vector for the corrected gene and helps transfer it into the stem cells. Next, the child is given a low dose of chemotherapy to make space for the modified cells in the bone marrow, which will allow those cells to fully enter and incorporate into the bone marrow. After the chemotherapy, the cells with the corrected gene are transplanted into the bone marrow and infused into the child. Once the new, healthy cells are incorporated into the infant, the bone marrow is able to produce its own immune cells, helping the infant fight off any possible infections.


https://www.huffpost.com/entry/bubble-boy-disease-scid-cure_n_5cb86aa8e4b096f7d2dcd6cc

This method was developed by a group of doctors led by Brian Sorrentino at St. Jude Children's Research Hospital in New York. So far this gene therapy has only been tested on eight infants. Seven of those eight infants' immune cells returned to normal after the procedure and the eighth infant's immune cell levels returned to normal after a second round of the therapy. The researchers monitored the children for a while, but months after the procedure, their immune levels were still normal. Some of the patients who received the HIV were even able to be vaccinated, which was a huge breakthrough with SCID patients, because previously even the deactivated virus in a vaccine was enough to kill a SCID patient. Now those patients are able to build up antibodies against the diseases for which they were vaccinated. Dr. Sorrentino had spent many years researching and developing gene therapies for SCID, and this treatment has shown great promise in its early trials. Sadly, soon after the initial success of the clinical trial, Dr. Sorrentino was diagnosed with lung cancer and died less than a year later.

Even after Sorrentino's death, the trial is still continuing and the infants who were given the HIV treatment have shown many signs of improvement under the care of other doctors. This method was different from previous attempts at cures, because the scientists were using HIV as a vector, and they used chemotherapy to create space for the altered gene. Additionally, Sorrentino devised a plan to add insulators to the HIV gene which prevented other genes from being activated. Some of the other later treatments that were tested only restored T-cells, while B-cells and natural-killers (other types of immune cells) were still insufficient. The HIV treatment is still being tested, but the results so far have only been positive. Finding a cure for SCID would be a huge breakthrough, because currently, almost no one survives past the age of two, and even when they are treated, the patient's quality of life is greatly reduced. A successful gene therapy would allow them to live a much longer, fuller life and could set an example for other gene therapies in the future.

Bone Marrow: The New Gamete

Malcom Furman

Recent studies have challenged the traditional notions of fertility and reproduction, as scientists research the role of bone marrow in pregnancy. These studies have shown that bone marrow can be used to artificially fertilize a woman's egg and is an imperative biological mechanism to the success of a pregnancy. Bone marrow is a semi-solid tissue found within parts of bones. In mammals, it is the primary location of hematopoietic stem cells, which eventually become blood cells. Bone marrow is significant in creating new blood cells and is crucial to a successful pregnancy as it supplies the stem cells that become the cells which nourish a fetus. Doctors and scientists have been trying to create human eggs and sperm from stem cells for many years, Stanford University stem cell biologist Vittorio Sebastiano said. Scientists have been able to create healthy baby mice using cells from bone marrow along with harvested immature human egg cells from stem cells, but there is still much research to be done.

The first-ever conception of a baby using in vitro fertilization (IVF) in 1978 was a monumental step in reproductive science. Nevertheless, it is not an option for every individual or couple looking to have a child due to many different variables, including embryo quality, age, or chromosomal defects, according to the Southern California Reproductive Center. This new technique of using stem cells from bone marrow could offer these individuals another option.

https://www.childrenscolorado.org/doctors-and-departments/departments/cancer-and-blood-disorders-pro-grams/bone-marrow-transplant/

The next major innovation in reproductive fertility emerged in 2006 when a Japanese lab discovered that somatic cells could convert into induced pluripotent stem cells (iPSCs). These cells were taken from blood or skin cells and are reengineered to be embryonic-like cells. Ever since the discovery of this technique, scientists have been trying to find ways to create human gametes out of stem cells. Sebastiano believes that these stem cells could one day help those struggling with infertility.

In 2009, microbiologist Karim Nayernia of the North East England Stem Cell Institute discovered that stem cells harvested from bone marrow can turn into immature sperm cells. This experiment was the first time any nonreproductive human tissue transformed into gametes. This technique could allow for men without working sperm to have biological children.

However, there are ethical implications that need to be carefully considered when working with the biological creation of a human such as the concern of future ramifications. For instance, individuals may be able to edit genes in the gametes to create "designer babies" or produce offspring from hairs stolen from unsuspecting celebrities. Instead of needing the sperm of a male to create offspring, DNA from other parts of their body can be used to fertilize an egg. With the ability to create embryos without sperm, this technique brings about similar issues that many other genetic engineering models, such as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) technology, a method of gene editing, encounter. Many bioethicists believe the medical and legal issues need to be investigated before using these techniques.

In addition to bone marrow being used to fertilize eggs, bone marrow can help determine a woman's ability to start and sustain a pregnancy, according to Yale researchers in PLOS Biology. Their study determined that during a process called implantation, stem cells migrate from bone marrow to the uterus, where they help transform the uterine lining (endometrium) for a process called implantation. The embryo then travels into the uterus and implants itself to begin a blood supply to develop into a fetus. If the lining does not go through this transformation, the embryo cannot implant into the uterus, and the pregnancy becomes unviable.

"Some of these bone marrow-derived mesenchymal stem cells travel to the uterus and become decidual cells, which are the cells that are essential for the process of implantation and pregnancy maintenance," said Dr. Reshef Tal, the first author of the study and assistant professor of obstetrics, gynecology, and reproductive sciences at Yale.

In two mouse models with a Hoxa11 gene defect, which presents in mice as a defective endometrium, the researchers concluded that a bone marrow transplant from a healthy donor could improve the fertility of the affected mouse. These therapies could potentially help women with infertility or repeated pregnancy loss because of a damaged endometrium.

A 2007 study conducted at the Massachusetts General Hospital involving female mice that were sterile due to chemotherapy found that these mice had successful pregnancies after a bone marrow transplantation, showing that bone marrow could restore fertility. This is another example of the impact that bone marrow has on pregnancy and the possibilities that it presents in helping women and men create biological children.

According to a study done by the Pew Research Center, 33% of US adults say they have used or know someone who has used fertility treatments. With staggering numbers of people having trouble conceiving naturally and other fertility options like IVF not being completely reliable, new methods of conception have become increasingly valuable and necessary in society. Although there are challenges, the possibilities that bone marrow presents for pregnancy are extensive, wide-ranging, and will have a lasting impact on worldwide fertility in the upcoming years.

https://www.discovermagazine.com/health/babies-from-bone-marrow

Tear Testing: A New Way to Diagnose Disease

Sammi Strasser

Human eyes, precious yet extremely sensitive, require our tears to act as our first ocular defense line. Tears lubricate our eyes, remove irritants, reduce stress hormones such as cortisol and adrenaline, and fight approaching bacteria. Water, chemicals, over 1,500 proteins, and electrolytes such as sodium and potassium make up our tears.

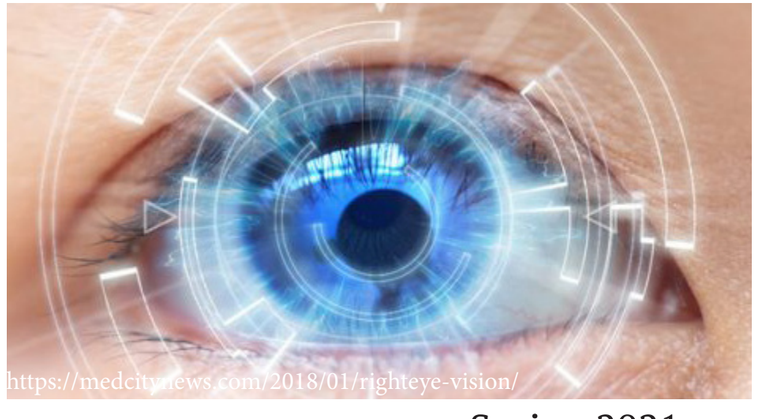
Most animals produce both reflex tears and continuous tears. Reflex tears clear out irritations, such as smoke. Continuous tears keep our eyes lubricated using the antibacterial enzyme lysozyme. Humans, as well as other more emotionally developed animals, produce emotional tears as well. From the moment of birth, crying comes naturally to human beings. Emotional tears contain "stress hormones that get excreted from the body through crying." Tears exhibit similar qualities to saliva, as they are primarily water. They also are like blood since tears deliver oxygen and nutrients to the eyes and remove waste. How come saliva, blood, and urine remain more prominent than tears in testing, when tears offer so much to modern medical testing?

The main answer to this question is that not enough research has been conducted for tears to enter the mainstream world of medical testing. However, many researchers have made developments in using tears to identify and possibly fight disease.

For example, doctors often use blood tests to analyze the presence or absence of cholesterol in the body. Urine tests can determine the presence of kidney infections or urinary tract diseases. Both of these types of tests have many other applications; however, they have specific limits. Urine contains high amounts of salt and crystals, making it harder to analyze protein biomarkers and diagnose disease. Blood's high concentration of proteins can mask fainter traces of abnormal proteins that mark specific diseases. Tears offer the opportunity for testing in scenarios where blood and urine are not primary choices of action. For example, the PSA blood test for prostate cancer is not ideal because it is often inconclusive and can yield false positives and negatives. However, recent studies have shown that tear tests could help defeat such identification processes and identify early on if the cancer is treatable with surgery. Researcher Natacha Truck, who studies protein markers in tears, found that "tears can detect viral infections, determine diagnoses, identify the risk of stroke, or improve [the] monitoring [of] disease." Tear tests work by counting the number of specific biomarker proteins in a human tear and then comparing these protein levels to different disorders. A biomarker is a measurable substance that, if found, indicates the presence of specific substances that can indicate diseases and infections. Diagnostic tests work by analyzing the number of certain proteins in the sample and comparing those to a healthy control sample.

For example, a group of scientists published a study in the BMC Ophthalmology journal analyzing the tear protein profile of patients with Herpes Simplex Virus type 1 (HSV-1) keratitis to identify the potential candidate biomarkers of the disease. This disease often causes corneal blindness, and defining its biomarkers in tears could help improve early diagnosis and prevention rates. The scientists found that there are 326 "proteins unique to the tear fluid of [patients with] HSV-1 epithelial keratitis" compared to healthy control samples. The researchers also found that those proteins can subsequently help in pre-diagnosing the disease in the future. Another experiment worked to link specific protein biomarkers to specific eye conditions by collecting and analyzing tears. They found that the "analysis of tear fluid has proven to be a promising method in gaining more information about the pathogenesis of diseases."

Tears are also proven to be a convenient and easy method of diagnostics. For example, mammograms currently remain the primary method of testing for breast cancer. These bulky, painful, and time-consuming pieces of equipment compress the breast to spread tissue and then take x-rays to test for cancer. At Kobe University, researchers created a new piece of technology called the TearExo, "wherein a glass chip with an antibody to the cancer cell exosome could detect proteins of the exosome present in tears." This chip can quickly and easily inform the patient whether or not cancer is present in the tear or not. It is able to detect around "50 exosomes—very small vesicles full of biomolecules released from a cell—in a 100 microliter tear sample in just ten minutes." Breast cancer, one of the most prominent and dangerous types of cancer, could be easily diagnosed with this methodology. In addition, tears can be useful in finding biomarkers of disease years before the symptoms become irreversible, allowing for safe and preliminary precautions to be taken at the appropriate time. For example, researchers at the Keck School of Medicine found that tears can help recognize changes in alpha-synuclein levels, which make up proteins in the brain. These changes can possibly help diagnose Parkinson's disease, whose "process can begin years or decades before symptoms appear."



However, tears are not only found promising in medical testing. They also can be used for monitoring pre-existing diseases, particularly by looking at proteins. For example, major companies such as Novartis and Google have looked into tear technology that can monitor the presence of biomarkers of certain diseases in the form of a contact lens. Most recently, a stand-alone contact lens meant for "monitoring glucose levels and as a diabetic retinopathy treatment," was made by a team at POSTECH, a South Korean research university.

Interestingly, NASA has taken advantage of this new tech and is considering utilizing tear markers to track astronauts' health and biomarker presence of certain diseases, helping establish a more in-depth understanding of the effects outer space has on protein development in our bodies. Although they have not done this with tears yet, they have made advancements with salivary testing. For example, astronauts' circadian rhythms are strongly affected in space due to the unsuitable timing of light. Testing the amount of cortisol in saliva can help identify issues in the sleep cycle. This advancement does not specifically recognize tears, which also release cortisol. However, it introduces a strong possibility for tears to become a new, easy method of identifying circadian rhythm issues as well as other diseases in space, possibly using contact lenses as a way to collect them.

In current times, learning about other possibilities for medical testing is extremely important, considering the current circumstances surrounding the COVID-19 pandemic. Researchers have found that "the coronavirus RNA can appear in tears and that antibodies for coronavirus can be measured from tears." Such research offers promising opportunities for a self-administered, cheaper, tear based COVID-19 test and antibody test. However, tear tests are still a new piece of technology, and more preliminary testing needs to be done before administering tests like these to the public. Finally, our tears stimulate the production of endorphins—the body's natural stress reliever. Multiple studies have shown that crying is the best possible way to naturally release stress and calm down, even when a problem lies ahead. In times like these, doctors advise us all to take advantage of our tears and cry them out, because why not produce a little bit of "feel-good hormones" when we can?

https://twitter.com/chidiakusobi/status/1311764560714575873

Interview with Chidi Akusobi '08

Interviewed by Lauren Ho

Chidi Akusobi was born in Nigeria and grew up in The Bronx, NY. He participated in Prep for Prep and graduated from Horace Mann, Class of 2008. He next attended Yale University where he majored in Biology and graduated Phi Beta Kappa. After Yale, Dr. Akusobi was awarded a Gates-Cambridge scholarship to pursue an MPhil in Biochemistry from the University of Cambridge in 2013. Currently, Chidi is a seventh-year MD-PhD student at Harvard Medical School. He completed his PhD in infectious disease in June 2020 and is currently finishing his MD studies. As a future physician-scientist, Chidi hopes to combine clinical practice, teaching, and conducting pioneering research that contributes to the better treatment of infectious diseases.

Lauren Ho: How did your time at HM shape who you are today and influence your decision to become a physician?
Dr. Chidi Akusobi: Before HM I went to a public school in the Bronx, and I did well in public school, but we had science classes that were taught only once a week, if that. The classes were rudimentary, and we didn't do experiments. So when I came to HM, that was the first time I was actually taking science classes that challenged me. I was doing science experiments that were interesting and also piqued my interest in the natural world. I learned how science is the tool that we can use to understand the natural world. Horace Mann was really the place that sparked my interest and love for science, but also did so in a way that made it challenging. I always wanted more and was always trying to do better. And specifically, classes like AP Chemistry and AP Biology sparked my interest in science because they were tough, but they also introduced me to biological and chemical studies. So I really credit Horace Mann for my foundation and also for sparking my drive.

LH: Was there an experiment or topic that particularly interested you?
CA: In Physics with Dr. Palfrey, who no longer teaches at HM, we had crazy class projects. I remember one time we had to create solar houses, structures that could capture heat, and there were no guidelines. So I got to be really creative because while we were taught the science, it was up to me to figure out how to apply it. That's what makes science so fun, because yes, you learn the laws and the fundamentals, but to have a good scientific mind you have to apply them to generate new knowledge.

LH: One of your goals in pursuing an MD-PhD is to understand the biology of infectious diseases—why does this interest you so much?
CA: I would say for two reasons. First, I am from West Africa. I was born in Nigeria. My parents grew up there, and most of my family's still in Nigeria. I grew up in a household where medicine was always a part of our home because my parents were studying to become nurses. I grew up looking through nursing textbooks and trying to understand all the different pictures of organs. Coming from West Africa, where a lot of people suffer from communicable diseases, I've had family and friends who have come down with infectious diseases that you don't really see here in the West, like diar-

rheal diseases or HIV. I think the proximity to medicine and to infectious disease that I had as a child was the substrate that grew my interests, to be very biological about it. And the second reason is that I have always been fascinated by evolution. Studying microbes, the evolution of microbes, and the idea that human beings and microbes have been combating each other but also living peacefully with each other just fascinated me. I entered college wanting to be a biology major, and then the first research lab that I joined was a microbiology lab that was studying virus evolution. I loved that experience and haven't looked back since.

LH: How has your day-to-day routine as a medical student changed as a result of the pandemic? What do rotations look like now?
CA: So many aspects of people's lives have been changed. As a medical student, we definitely have been impacted by the pandemic. In the very beginning, from March to May, we weren't even allowed to be in the hospital, because hospitals were trying to completely pare down and only have essential personnel who could provide direct COVID care. In those months, school just paused. Now that we have some understanding of the virus, of the precautions necessary to keep ourselves safe, and vaccines are out, medical school students have been back in a hospital, with some extra precautions. For instance, at my hospital, they try to limit how many medical school students are in the emergency room because an emergency room is where a lot of people who have COVID will come in. The hospital's whole goal is to protect us. We're not in emergency rooms with people who are COVID-positive, and depending on which rotation you're on, you're not even allowed to see COVID-positive patients. Hospitals themselves also are very different. The way that teams are structured, the way that we sit, how we eat food with each other, the way we sign into the hospital, all of these things have been changed in order to minimize risk. Thankfully, vaccines are coming out, and I was vaccinated, along with many other medical school students. As more people become protected, the goal is for us to start resuming more of the responsibilities and the actions that we were able to do before the pandemic.

LH: Any rotations that have piqued your interest?
CA: I really do enjoy so much of the field of medicine. Coming from completing a PhD and spending four years in a lab, everything is cool in the hospital! Just a couple weeks ago I was doing pediatrics, which was fun because there are a lot of patients where you don't know what's going on; they have some disease that just doesn't make sense. It's a medical mystery. In kids, a lot of times you have to set up genetic studies and sequence their entire genome to see if anything in their genome can explain this interesting, weird, never-seen-before presentation of a disease. So that's been cool. Internal medicine has also been interesting. Especially in COVID times, there are a lot of new symptoms that people are coming in with. And after you realize that they were COVID-positive three months ago, you begin to wonder if it is a manifestation of post-COVID. It's been interesting to see medicine change in real-time, because we have a pandemic and a new illness that has affected millions of people, and every now and then you're gonna have that patient that has this weird post-COVID presentation.

LH: As vaccines are being rolled out, what do you think the pandemic will look like over the next 12 months?
CA: I am not going to make any predictions because every prediction that people made in 2020 came out to haunt them. There's no way to know. But to answer your question, I would say with vaccines coming out, I would love to see a vaccine rollout that gets the vaccine to people who need it the most. People who are older and have pre-existing conditions, people who are essential workers, etc. And I would love to see a real, efficient, competent vaccination effort that gets 50, 60, 70% of Americans vaccinated by the end of this year so that we can stop the outbreak. Secondly, I would love to see the US and also the other countries do a better job of tracking the evolution of this virus over time. To me, that is the biggest thing, because now we're seeing all these new variants that are coming out, that are more infectious, and it's only a matter of time before there's a variant that is resistant to the vaccines that we have. It's better to be on top of that and know about that variant before it spreads widely and we're back to square one with having to vaccinate against an entirely new strain of COVID. If we actually want to be on top of this pandemic and not make this something that lasts for the next 15 or 20 years, we have to be sequencing the virus and learning how it evolves. The third thing is that I hope that our Congress and government will recognize that in order to beat this pandemic, you also have to help people economically and give them an incentive to stay home. As long as we don't do that, this pandemic is going to continue unabated. I hope that there's a better understanding of the economic impact of this virus on everyday Americans, and that you can tell people to wear masks all day, but if they can't eat, then it doesn't mean anything. If they're afraid of losing their homes, it doesn't matter if they will get the vaccine in two months.

LH: And finally, what advice would you give to high school students who are interested in pursuing a career in medicine?
CA: Medicine is taking a love of science and applying it to helping people. Good doctors have to love science and, over time, be good at science. But they also need to want to help people. Because when patients talk about how their doctor is the best, it isn't because their doctor remembered the 20 different diseases that cause shortness of breath. What they actually are talking about is how the doctor made them feel like they were listened to, protected, taken care of. Taking that into consideration, some words of advice for people who are interested in medicine is first to explore science classes, especially biology, chemistry, and physics, and try to do your best in them. The foundation of medicine is biology and the foundation of biology is chemistry. Physics teaches you how to think critically and solve problems. Second, you need to be a good person who wants to help people. You can get involved with community service projects, different extracurriculars that allow you to give back to a community. I think doing these activities allows you to build that muscle, and also develop empathy.

This is Part 1 of a two-part interview with Dr. Akusobi. Part 2, which discusses race and the school to doctor pipeline, among other topics, will be released in Issue 3.


https://www.pdsoros.org/meet-the-fellows/chidiebere-akusobi

Nigeria and the Yellow Fever Resurgence


https://thenativeantigencompany.com/products/yellow-fever-virus-ns1-protein

Lola Stern

Prior to the year 2017, there had not been a yellow fever outbreak in Nigeria for over 20 years. The original approach to fighting the disease was mass vaccination, but due to factors like climate change – catalyzing a rise in the mosquito population of the region – and the coronavirus pandemic – causing a prioritization in Covid cases – vaccination numbers have decreased, and thus, yellow fever numbers have risen once again. Concern decreased, and vaccinations stopped throughout the 20-year, dormancy period, making the initial methods of preventing the spread of the disease ineffective.

Yellow fever is spread by mosquitoes that pass the sickness on to humans and other creatures, meaning the spread of the disease increases in heavily mosquito-populated areas. The World Health Organization (WHO) said that although only a small portion of the infected show severe symptoms, at least half of these people die as a result of this virus-induced disease. In Africa, yellow fever is known to have three transmission "cycles": urban, zoonotic, and intermediate. The urban cycle describes an explosive outbreak mediated by Aedes Aegypti mosquitoes, which cause a sudden increase of the disease. The zoonotic cycle includes the spread of the disease mediated by various mosquito types who pass yellow fever to a non-human primate. The primate is typically unaffected, but the uncontrollable spread resulting from that initial infection is drastic. Particular kinds of mosquitoes also mediate intermediate yellow fever spread, but it is spread to humans and non-human primates and contracting the disease from another human is unlikely in this case. According to researchers, it is believed that Nigeria's patterns mostly follow that of a zoonotic cycle.

Between September 2017 and September 2019, a suspected 7,894 cases of yellow fever were present in all Nigerian states combined, with 287 cases laboratory-diagnosed. Considering the impacts of COVID-19, a recent presumption is that over 70 people died from yellow fever during 2020 between September and mid-November. Research shows that, on average, the fever infects males slightly more often than females, and a large majority of cases occur in those below the age of forty-five. Those younger than forty-five are mainly ones who get vaccinated, due to their increased vulnerability to the disease. The yellow fever vaccine is an effective preventative that provides lifelong immunity in 95% of cases if given within 30 days of contact.

Due to climate change, temperatures in Nigeria have been increasing. Mosquitoes, being creatures of warm weather, thrive in this climate, further increasing the presence of the species that cause yellow fever. Specific breeds like the Aedes Aegypti mosquito are responsible for altering their global population distribution in relation to climate changes, spreading the diseases they carry to new locations. Overall, the current population of mosquitoes can transmit yellow fever to more non-human primates who carry the disease and increase the chances of a mosquito transporting yellow fever to a human.

The effects of the pandemic have also been attributed to fueling the resurgence of the epidemic. As stated by WHO spokeswoman Tarik Jasarevic, "National and state authorities are currently focused on the COVID-19 pandemic response, limiting the human resources required to conduct investigations and response activities for the yellow fever outbreaks." Despite Nigeria's relatively low coronavirus case count, the numbers still exceed that of yellow fever deaths and cases, causing the prioritization of the treatment and prevention of the coronavirus over all else. The country has been forced to utilize most of its resources in battling the coronavirus, leaving the revival of yellow fever unattended.

Another factor to consider is the effect that the dormancy period had on the mindsets of Nigerians. With yellow fever relatively resolved in society, the distribution of vaccinations began to stray from the original protocol, leaving more and more people susceptible. Factoring in the migration of people to and from the country, over time, the concept of mass vaccination proved ineffective.


https://thenativeantigencompany.com/products/yellow-fever-virus-vaccine-serum-12-month-inactivated/

According to the Center for Disease Control and Prevention, there are major outbreaks in the states of Bauchi, Benue, Delta, Ebonyi, and Enugu. The government declared that any travelers to these regions must be vaccinated and are encouraged to avoid these areas. The most effective strategies to avoid contracting yellow fever are getting the vaccine and avoiding or protecting against mosquito bites. Wearing bug repellent is recommended for those regularly exposed to the disease.

Yellow fever's recent resurfacing in Nigeria has occurred due to multiple factors, leading to a devastating outcome. Climate change, the coronavirus pandemic, and government inaction allowed for this spike in cases that had previously been avoided. With better distribution of resources and worldwide support, the resurgence of yellow fever in Nigeria can hopefully be contained and reduced.


http://www.who.int/news-room/fact-sheets/detail/yellow-fever


https://www.theaustralian.com.au/news/latest-news/300-hospitalised-by-mystery-illness-in-eluru-in-andhra-pradesh-india/news-story/64facf5b9c57ce42a5980c71809023aa

Mystery Illness in India Puzzles Scientists

Ari Borut

In early December 2020, over 500 people in Eluru, a city located in Andhra Pradesh, India, were reportedly hospitalized, and one 45-year-old man died. Yet, the cause behind these hospitalizations and death was, and continues to be, unknown. Many citizens in Eluru contracted the mystery illness, puzzling health experts over the cause of the outbreak.

The man who died was reported to have experienced symptoms similar to epilepsy and died due to cardiac arrest. Even after conducting an autopsy, no helpful information was provided as to the source of the illness. Common symptoms among patients include nausea, loss of consciousness, anxiety, dizziness, and seizures. Most patients admitted to the hospital were children, most of whom were discharged from the hospital within a day. They were treated with antiemetic and antiepileptic treatments used to reduce the symptoms of nausea and seizures. Some patients have reported still experiencing symptoms such as seizures and amnesia, but the long term effects are still unknown.

Initially, health officials in Eluru were skeptical if those falling ill had contracted COVID-19, considering India has the world's second-highest number of COVID-19 cases. However, this hypothesis was quickly shut down because all of the hospitalized patients tested negative for COVID-19, along with other viral diseases such as dengue and chikungunya. Aside from COVID-19, scientists wondered if the patients' water and food sources were the cause of the illness after running blood tests and discovering high content of lead and nickel present in 10 samples of the patients' blood. India has had issues with contamination, so it would not surprise experts if metal contamination was the cause. When high levels of lead are found in the bloodstream, such as the levels found in the hospitalized patients, it can impair the development of the brain, nervous systems, and other vital organs, which could be connected to the symptoms the patients were experiencing.

A 2019 report found that over 40 million people living in India's rural areas consume contaminated water with metals such as arsenic and nitrate, which are known to cause illnesses such as cancer. Water samples were tested by a team from the All India Institute of Medical Sciences (AIIMS); however, no traces of lead or nickel were found. Additionally, many of those who have fallen sick reported not using municipal water, so it is unlikely that the source of contamination is in a municipal water source.

Health experts believe that a more likely cause is that the illness is a reaction to being exposed to organochlorines, found in pesticides used for mosquito control. Organochlorines are highly toxic compounds present in pesticides such as DDT and are known to have links to cancer. Many countries have banned the use of organochlorines, but in India, the chemical is unregulated. This is why, others have fallen ill and died after being exposed to a high amount of this toxin in the past. According to the World Health Organization (WHO), children are more vulnerable to organochlorine poisoning because they absorb higher levels of heavy metal. The similarity in trends of those infected to organochlorine poisoning symptoms makes for another viable argument for the pesticide to cause the illness.

Ingesting pesticides can also have symptoms similar to those patients were experiencing, such as confusion, seizures, and muscle tremors, making organochlorine exposure a reasonable hypothesis.

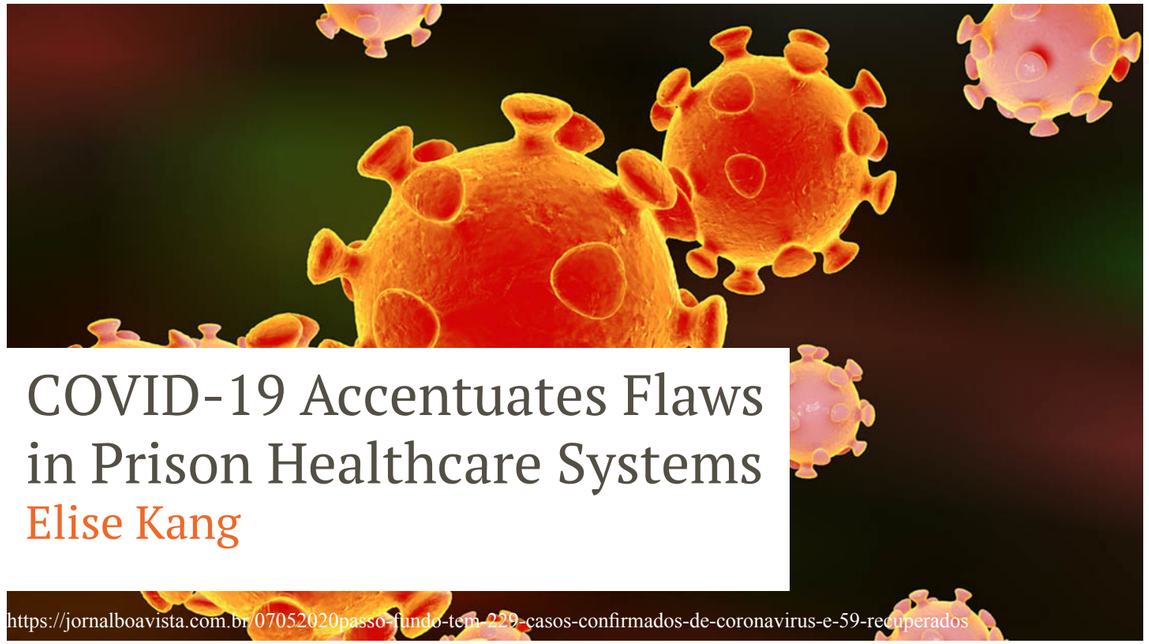

https://apnews.com/article/india-mystery-illness-baffles-experts-f607e38af215896bca5276ded25bf893

In the past, people have fallen ill and died due to exposure to chemicals used in pesticides. According to a report by the University of Illinois, it is estimated that three million people are exposed to organophosphates, an ingredient in pesticides similar to organochlorines, which leads to around 300,000 deaths annually.
Three years prior, farmers in Maharashtra, a western state in India, fell ill due to exposure to pesticides, causing 700 hospitalizations, similar to the current situation. Additionally, in 2013, at least 25 children died due to eating food cooked in oil that contained high levels of pesticides, demonstrating the risks of unregulated dangerous pesticide use.

In light of this hypothesis, experts ran tests on water, milk, vegetables, and fish in Eluru to see if any food or water sources were the cause. Whether or not organochlorines were found in the water varies based on the different sources tested, so further tests need to be conducted. One private lab found raised pesticide levels in drinking water in certain areas, yet these areas' locations were not specified. DDD, an insecticide, was found at a thousand times its permitted level. DDT levels were also found at a high of 14.16mg/L compared to the permitted level of 0.001mg/L. To further investigate the water, the Indian Government plans on taking samples across a broader range of neighborhoods with the help of the WHO to see where and if toxins are detected.

Since the reports of the illness in early December, there has been no follow up of any promising evidence of pesticide contamination or other possible causes, nor have the cases increased dramatically. In late January, the illness appeared again in a village near Eluru, called Pulla, where patients experienced similar symptoms such as seizures, and frothing at the mouth. Blood tests from those who fell ill in Pulla did not show any abnormalities, and vegetable and water samples have been collected for testing to search for the cause.

As more cases develop, and the possibility that the illness may continue to spread to other villages is present, health experts race to find the cause behind this mystery illness.



https://jornalboavista.com.br/07052020passo-fundo-tem-229-casos-confirmados-de-coronavirus-e-59-recuperados

COVID-19 Accentuates Flaws in Prison Healthcare Systems

Elise Kang

The coronavirus spreads five times faster than the national average amongst incarcerated people. Incarcerated people are also three times more likely to die from the coronavirus. Furthermore, the chances of having high blood pressure, asthma, or diabetes is 1.5 times higher amongst prisoners, therefore rendering prisoners a high-risk population for the novel coronavirus. Even though the incarcerated are suffering at much higher rates, the media rarely covers this issue. Undoubtedly, you've heard more about outbreaks in cities on the other side of the country, like San Francisco, than those in prisons. Many prisons do not have adequate space to allow symptomatic or new prisoners to quarantine. Despite this, the incarcerated are often overlooked or excluded from important policies regarding the spread of the novel virus.

Proper social distancing in prisoners is near impossible. According to the World Prison Brief, many prisons are barely under their maximum capacity; the American prison system is currently at 99.8% capacity. In addition, some prisons are operating significantly above their capacity, such as San Quentin State Prison in California, at 122% of its maximum capacity. These large numbers of people reduce the space allotted per person, thus contributing to the spread of COVID-19. The design of detention complexes only worsens the situation, as it includes placing multiple inmates in the same room and communal dining and bathing. Compare this to restaurants in New York, where it is mandatory to reduce capacity by 50%, accompanied by social distancing and various other precautions to operate safe indoor dining. Using this standard, the US would have to cut their prisoner population in half to slow the spread of COVID-19. Eleven states have yet to release any prisoners at all. Among the states that have released prisoners, none have released enough to reduce capacity by 50%. For example, California currently has around 115,000 prisoners. However, as of December 2020, California has only released around 18,300, reducing their population by approximately 16%. To meet the 50% reduction standard, they would have to release over double the number of people they already have. Protests and other forms of prison activism regarding their release have arisen, but so far, the movement hasn't grown large enough to gain considerable traction or create any change. Most activists and protestors have family ties with inmates. Forms of dissent are primarily demonstrated through local organizers, but there isn't currently an overseeing body towards this cause, further reinforcing how easily prisoners are overlooked.

The prison system is intentionally designed to make access to medical care challenging to discourage "frivolous use." This is problematic, especially during a pandemic. Even though the Eighth Amendment gives incarcerated people the right to access healthcare, studies have repeatedly shown that the accessibility of this care frequently falls short. To obtain healthcare, inmates must pay a copay, typically three to five dollars, but it can cost as much as eight dollars. Although this may not seem like much at first glance, these amounts can be difficult for incarcerated people to obtain. According to the United States General Accounting Office, courts have ruled that prisoners are not entitled to the minimum wage since their labor helps keep operation costs for detention centers down. Inmates typically receive 14 to 63 cents per hour for their work. Over a month, they generally earn 10 to 20 dollars, which they use to purchase things such as toothpaste, shoes, and snacks for consumption outside of rationed meals.

Furthermore, sanitation and hygiene supplies can be difficult to attain in detention centers. Although water and masks are provided at detention centers, soap is considered a commodity that needs to be purchased. In addition, it's not uncommon for many sinks to be broken and paper towels to be nonexistent. This leads to many inmates wiping their hands dry on dirty clothing, defeating the effectiveness of washing hands. Moreover, according to the National Institute on Drug Abuse,

https://www.nbcnews.com/news/us-news/prisoners-new-york-city-jails-sound-alarm-coronavirus-spreads-i-r1172306

an estimated 65% of prison inmates have a substance use disorder. As a result, hand sanitizer is on the contraband list for prisons for its high alcohol content since alcohol can be separated from the rest of its ingredients, posing the potential for drug abuse. Texas prison systems have attempted to implement an alcohol-free alternative to hand sanitizer. However, CDC guidelines are very clear: hand sanitizer needs at least 60% alcohol to be effective. Furthermore, the CDC explicitly outlines to not use sanitizers without alcohol. Without access to soap, clean towels, and hand sanitizer, it is very difficult to maintain good hygiene, and thus, prevent the spread of COVID-19 in detention facilities.

Since most prisoners are not located in federal detention centers, the national government has done very little to standardize the efforts to mitigate the spread of COVID-19 in prisons. Thus, the measures taken vary widely from state to state. Some states have released prisoners who are near the end of their sentence or have severe chronic medical conditions. Other states have reduced the number of new people they are placing in prison, reserving the space for those with more severe crimes. In addition, some states have eliminated copays, either for those demonstrating symptoms of the virus or for all medical visits. While these are all great signs of progress towards protecting the incarcerated from the novel disease, the measures are still inconsistent amongst the states. Prisoners are often dehumanized and face lots of discrimination, which can cost them their lives. Ultimately, detention centers are too often overlooked, and much more needs to be done to, at the very least, bring down the rate of infection and death to be comparable to the national average.

https://apnews.com/article/pandemics-race-and-ethnicity-prisons-united-states-coronavirus-pandemic-0bef0673013aa579551d-b5ad61b885e0

The Shortage of Tuberculosis Supplies in North Korea

Mira Bansal

Tuberculosis is a serious disease all over the world, but especially in North Korea, a medically underdeveloped country. Globally, tuberculosis is one of the top ten causes of death and in 2019 alone, it infected 10 million people.

Tuberculosis (TB) is an infection that generally affects the lungs. It spreads through face to face contact in small droplets formed when coughing or sneezing. Symptoms include prolonged coughing, coughing up blood, pain while coughing, excessive weight loss, fever, and night chills. People who are immunocompromised are more likely to contract TB because TB attacks the immune system.

There are two types of TB: Latent TB and Active TB. Patients with Latent TB show no symptoms, are not infectious, and can be easily diagnosed. Latent TB has infected approximately two billion people throughout the course of history. Active TB, on the other hand, is symptomatic and infectious.

https://www.pulmonologyadvisor.com/home/topics/lung-infection/bcg-tuberculosis-vaccine-potential-protection-against-covid-19/

Latent TB turns into Active TB over time, so it must be treated immediately. After having Latent TB, symptoms of Active TB can develop weeks or even years later.

There are several drugs and vaccines for TB, but there are also many different strands of the virus, so the drugs are not 100% effective. Diagnosis of the different strands is further complicated as proper medical equipment such as capable doctors, blood tests, and access to vaccines and various treatments is needed. A useful vaccine that tends to be administered to newborn babies is one that does not directly prevent TB, but instead builds up their immune system to fight the infection, making it harder for them to get the disease later on in life.

One strand requires a medicinal cocktail for treatment, which must be administered every day for one month in order for them to be effective. If someone misses even one dosage, the whole treatment is rendered ineffective. All treatments require a six to nine month dosage. Because it is possible to be infected with different strains of TB, patients may need to take multiple drugs.

http://www.asianews.it/news-en/North-Korea,-no-stopping-tuberculosis-scourge,-as-5-thousand-deaths-registered-in-2014-35744.html

North Korea has closed its already tight borders due to the coronavirus pandemic; thus, cargo ships holding tuberculosis vaccines are not allowed passage into the country. 300,000 babies were going to receive the vaccine to prevent TB, however, the supplies are now just sitting in warehouses. Officials have found supplies that were set to be transported to North Korea in a warehouse in India, and these drugs, worth an estimated $400,000, will expire in 2022. In the meantime, North Korean citizens will continue to be infected without access to a cure.

North Korea claims to provide full coverage health care for all, but a 2014 survey conducted by North Korean refugees says otherwise. Out of 238 refugees, half of them reported that they had received health care in North Korea. The other half were primarily made up of people who did not have a high social, political, or economic standing, and they said that most of them were forced to rely on black market drugs. Some of these drugs included those to treat symptoms of TB.

The government has discriminated against certain groups of underprivileged North Koreans or North Koreans with different religious values than them, especially prisoners. In North Korea, many actions, such as the practice of religion, espionage, taking of photos that may damage the image of the nation, or even just entering the country, are deemed illegal. Most of these prisoners are not dangerous and are only imprisoned because of the corruption in the government, yet they live in squalid prisons. The prisons are unsanitary, lack basic medical supplies, and are similar to those in Russia, which were nicknamed “TB colonies.” Scientists from the United States said that one in every 200 citizens are taken to one of these prisons. According to previous patients, there are few doctors or medical staff within these prisons and prisoners often have to help the medical staff with simple procedures. A proper diagnosis of TB is virtually impossible because they do not have the necessary resources to detect the disease. Moreover, epidemics within these prisons are easily spread, which causes mass death and sickness.

The recent COVID-19 pandemic has brought hardships to North Korean health care, such as the disrupted foreign supply of medicine from other countries. Because the government of North Korea has decided to cut the country off from contact with other nations, not much is known about what is happening. Due to the restrictions placed on all travel, both commercial and business related, no one has contracted the coronavirus thus far. This could also be due to the fact that North Koreans are watching for anyone with COVID-like symptoms, which are often confused with the symptoms of TB because they are so similar. This is a step in the right direction for the prevention of TB, because anyone with symptoms remotely resembling COVID will be tested and screened, then treated immediately.

Does Palforzia Provide Hope for a Cure for Peanut Allergies in the Future?

Zahra Motwani

Children with peanut allergies can die due to exposure to a single peanut. In fact, there has never been, and still isn't, a cure for peanut allergies. However, a new therapy on the market for allergies could provide additional coverage for children with life-threatening peanut allergies. Almost one million children in the US are allergic to peanuts, and only one in five children outgrow the allergy. Palforzia, a pediatric oral immunotherapy treatment, is not a cure for peanut allergies; still, it can reduce the severity of an allergic reaction or anaphylaxis to peanuts that might come from accidentally being exposed to peanuts.

Immunotherapy treatments are designed to retrain a patient whose immune system has developed an allergy. People who are allergic to peanuts have to be hypervigilant about what they touch, smell, and eat, but Palforzia offers the potential to alleviate some of that stress by giving those people the ability to withstand some exposure without a medical emergency.

Being "allergic" to certain foods is sometimes used as a catch-all term to describe a dislike or intolerance. However, allergies are actually an immune response in which the immune system is overly sensitive to a specific substance. During allergic reactions, the immune system reacts to the allergen—the substance it perceives as harmful—with inflammation, hives, swelling, nausea, and fatigue. When the immune system responds this way to an inherently dangerous substance, like poison, it is an adaptive response, but when it becomes hypersensitive to an otherwise harmless food, it damages the quality of life.

Anaphylaxis is a more severe and potentially fatal allergic reaction that can cause a person's throat to close rapidly. During anaphylaxis, the patient's blood pressure drops and their airways narrow, putting their body in shock and causing rashes, nausea, and vomiting. Anaphylaxis usually results in hospitalization and is treated with epinephrine. Epinephrine, also known as adrenaline, is a hormone naturally secreted by the adrenal glands on both kidneys, but during an allergic reaction, extra adrenaline is needed to open up the narrowed airways and constrict blood vessels to increase blood pressure. In essence, epinephrine reverses the most severe effects of anaphylaxis and can be life-saving. Epinephrine is typically administered in injectable form, commonly known as the EpiPen, which is painful and unpleasant, so most people with anaphylactic allergies tend to be extremely cautious to avoid needing it. Many people are excited about potential treatments that could reduce the severity of their allergies, such as the Palforzia treatment.

The first of the two trials was 12 months long, and the highest tolerated doses were 600 mg in North America and 1000 mg in Europe. The second trial was also conducted in North America and Europe, and the final doses were 300 milligrams and 600 milligrams, respectively. In total, 700 patients received the peanut powder, and 300 received placebo powder. 9.4% of the patients who took the peanut powder and 3.8% of the placebo recipients underwent anaphylaxis during the initial dose or the updosing phase. In the maintenance phase, 8.7% of the peanut powder recipients and 1.7% of placebo recipients experienced anaphylaxis.

The Palforzia treatment is a series of incrementally increasing oral doses of peanut allergen powder that desensitize a patient's response to the allergen over a year. Despite this immense potential benefit, it comes with significant side effects. Patients might undergo a severe allergic reaction to the powder, and therefore, they must be monitored. Additionally, while taking Palforzia, the patient must avoid peanuts in all other situations. Parents, guardians, and patients must know the signs of an allergic reaction and have an EpiPen at all times to be eligible for Palforzia. If either the patient or their guardians are unable to administer an EpiPen, taking Palforzia is discouraged.

The most common side effects of the drug include stomach pain, itching or burning in the mouth or throat, a runny nose, sneezing, wheezing, shortness of breath, and hives; all of which are symptoms very similar to an allergic reaction. However, if a patient experiences nausea, has a previous gastrointestinal disease, or has inflammation to the esophagus (eosinophilic esophagitis), they might have to stop taking Palforzia. Furthermore, there are a few conditions which prohibit the use of Palforzia. For example, patients with uncontrolled asthma or a history of eosinophilic esophagitis cannot take Palforzia because these conditions compromise breathing, making an allergic reaction to Palforzia much more dangerous. Additionally, patients who take antibiotics, chemotherapy, narcotics, or monoclonal antibodies, should not take Palforzia because they increase the risk of severe allergic reactions.

There are three phases of Palforzia: initial dose escalation, updosing, and maintenance. Initial dose escalation is when the patient is given the first dose of three milligrams of the peanut protein powder and monitored for an allergic reaction. If they tolerate it, they self-administer at home for two weeks before beginning updosing, which takes


https://news.hamlethub.com/carmel/publicsafety/3431-fda-approves-first-drug-for-treatment-of-peanut-allergy-for-children

11 months. Every two weeks, the patient is given a slightly higher dose while being supervised by a medical professional. If they tolerate Palforzia, then they continue self-administering that dose at home. This cycle repeats until the patient has ideally reached tolerance for 300mg. Palforzia powder is administered by being dissolved in semi-solid food such as applesauce or pudding. It is taken at the same time daily to help the immune system become desensitized to peanuts quicker. The dosages for Palforzia increase incrementally every two weeks. Finally, the maintenance phase is when the patient can take the full 300 milligrams of peanut powder each day.

The highest risk for an allergic reaction is after the initial dose and updoses because the change in quantity can shock the patient's system into a more severe response. Additionally, Palforiza can only be administered in a location that is registered with the Risk, Evaluation, and Mitigation Strategy program (REMS). The REMS program tests the safety and benefits of a specific drug and ensures the drug is safely administered and the patient is appropriately monitored. Registered locations have staff that know the risk of using Palforzia and the risk of anaphylaxis. Additionally, the staff know how to monitor patients and identify and treat anaphylaxis.

Palforzia was created in two international, multicenter, randomized, double-blind, placebo-controlled studies that tested the safety and efficacy of using

https://www.allergychoices.com/blog/sublingual-immunotherapy-for-peanut-allergy-research-update/

peanut powder to desensitize peanut allergies in children, four to seventeen years olds, with the allergy in North America and Europe. The trial tested how many milligrams of peanut powder the patients could tolerate to deduce a safe but efficient goal in the future. All participants were children with peanut allergies, and some received a placebo (a pill with no peanut powder), while the other participants received the actual peanut protein. Both powders were given in the same packaging to maintain the trial's accuracy by ensuring neither group knew which option they were receiving.

Although the possibility of fatal reactions makes Palforzia extremely risky for those with peanut allergies, many people are willing to take the risk. Peanut allergies take a toll on a person's life, causing them to worry about their surroundings and need to ask about the presence of peanuts, potentially causing them anxiety or embarrassment. Hundreds of people are willing to risk their lives by taking Palforzia to have a chance at a more relaxed life where the constant possibility of anaphylaxis is reduced. Additionally, Palforzia brings hope that there might be permanent cures in the future for peanut allergies and that there could be treatments, like this, for other allergies.

https://geneonline.news/en/aimmunes-palforzia-scores-fda-win-becomes-the-first-ever-treatment-for-peanut-allergy/

New Treatment Approved For the Fast Aging Disease, Progeria

Sophie Rukin

On November 20th, 2020, the US Food and Drug Administration approved the first ever treatment for the rapid aging disease known as progeria. The drug called Zokinvy has potential to increase the lifespan of those who suffer from progeria. With an otherwise short lifespan averaging 15 years, this new drug is a revolutionary development.

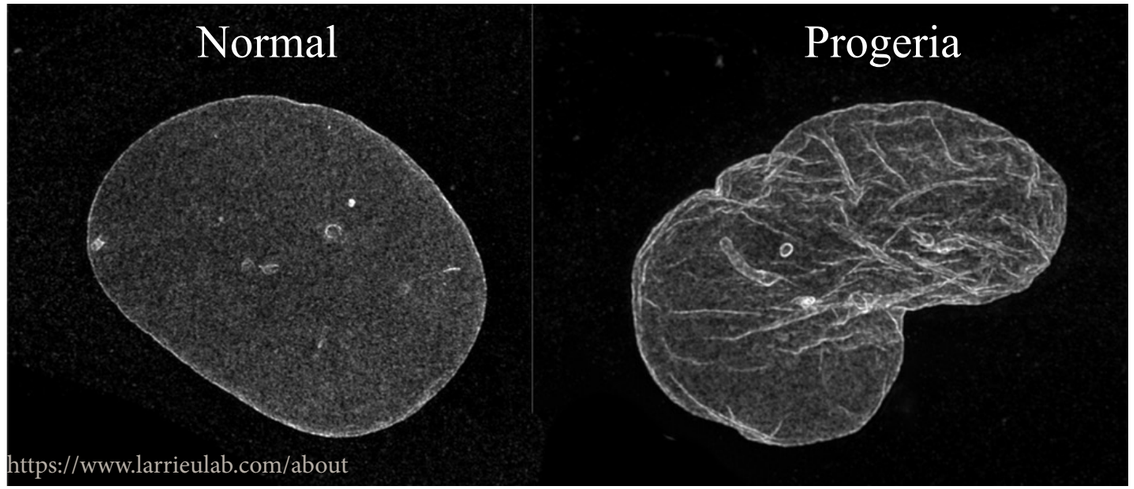
Hutchinson-Gilford progeria syndrome, commonly known as progeria, is an extremely rare rapid aging disease that affects roughly one in 20 million people worldwide, with 350 to 400 children currently affected. Children with progeria suffer from a series of symptoms typically recognized at around two years old. These symptoms can be physical, including slowed growth, a beaked nose, high pitched voice, disproportionate sized head in comparison to face, and hair loss. These symptoms can also consist of health problems, including severe heart and cardiovascular issues, hip dislocation, and stiff joints.

The disease is caused by a single mutation of a gene known as LMNA. This gene is responsible for creating a protein called lamin A, which helps to hold cell nuclei together. If nuclei are not held together, the cell structure becomes weak. As explained by Monica Kleiman, a pediatric doctor at Boston Children's Hospital who played a key role in the clinical trial, when this mutation occurs, a new protein called progerin is created in abundance. Progerin is very similar to lamin A, but has an additional piece. Progerin gets caught inside of cell membranes, which inhibits the protein's ability to recycle into fresh proteins. This process causes cells to age at a rapid rate, causing harm to blood vessels and connective tissue.

Eiger BioPharmaceuticals, Inc. created Zokinvy to limit the production of the progerin protein in progeria patients' cells, causing less buildup, and therefore slowing the aging of the cells. The Zokinvy trial, conducted on 62 patients, showed that there was an average of three months added on to the lifespan for patients on the drug for the first three years, in comparison to the control group of 81 other patients who weren't being administered the drug. Additionally, it was found that on average, 2.5 years were added on to the lifespan of those on the drug for 11 years, therefore turning the average lifespan of 15 years into 17 and a half years.

Zokinvy is not a cure, but rather a treatment which can lengthen a short prognosis due to progeria. "We've hopefully extended the life span that [the children] have by slowing the pace of the disease," Kleiman says, but she acknowledges that the drug still does not provide a normal lifespan. The oral pill is able to stop some production of progerin, but due to side effects, it can not completely halt progerin creation. The side effects of the treatment include fatigue, nausea, vomiting, diarrhea, decreased appetite, and vomiting. If higher doses of the drug were to be administered, these side effects would completely destroy the quality of a patient's life.

https://www.britannica.com/science/progeria



https://www.larrieulab.com/about

The new drug was created upon many years of researching the lamin A protein. It took time to identify what was primarily causing progeria, but when it was discovered how important the protein was, drugs similar to Zokinvy were researched. Tom Misteli, a cell biologist who works at the National Cancer Institute in Bethesda, Maryland and was not involved in the trial or with work on the drug, said, "Nobody studying this protein or the modification could have expected it to become a drug target." The significance of the protein seemed to have been undermined before a link to progeria was discovered.

Certain patients who received Zokinvy experienced certain irregularities in their tests, specifically in their sodium and potassium levels. Some patients also experienced low white blood cell count, and an excess of liver blood tests. In animal tests certain vision-related issues also appeared. All of these things must be kept in mind for patients using the drug, although they are not of extreme or common concern at the moment.

The FDA granted the Orphan Drug destination to Zokinvy, which creates an incentive for production of drugs for rare diseases. The creator of Zokinvy received a rare pediatric disease priority review voucher. This voucher is administered by the FDA to promote the treatments and drug production to fight rare diseases. These awards are meant to encourage others to follow in the footsteps of drugs like Zokinvy.

The creation of Zokinvy is a step in the right direction, but research continues to create an even better solution for progeria patients. There is hope of extending the lifespan even further, and possibly generating a cure to eliminate the disease all together. Current technology suggests gene editing could be an option in the near future, with promising results in animal trials. In these trials, mice treated with gene editing technology lived for 500 days longer than untreated mice. This genetic therapy has the ability to prevent the fatal heart conditions that come with progeria. With gene therapy in the picture, and Zokinvy in action we can expect to see real advancement in finding a long awaited cure for progeria.

One Man's Red is Another Man's Blue: Do We All See the Same Colors?

Myra Malik

https://www.wired.com/story/a-new-study-about-color-tries-to-decode-the-brains-pantone/

Do we all see the same Do we all see the same colors? Scientists have spent years conducting various studies about biological, cultural, and linguistic effects on color vision differences. New studies on different colors' effects on the brain ultimately reveal whether we truly all see the same colors.

Eurasian cultures historically lack a term for the color blue, evidenced by Homer's "wine-dark-sea." (Historians have long wondered whether this descriptor, used several times in both the Iliad and Odyssey, represents a lack of modern color or is simply a poetic device.)This example pushes a compelling argument against the theory that all humans can see the same colors. Furthermore, biological differences among people's vision, such as the amounts of rods and cones in each eye, which are responsible for low light vision and color vision respectively, vary among different groups. Biological differences account for different color vision, from colorblind dichromacy to tetrachromacy — the theory that some people can see colors in more detail than others.

For instance, men are more likely to be colorblind because the gene coding for red-green colorblindness is X-linked, meaning it is coded for by the X chromosome. Since men only have one X chromosome, a colorblindness gene will be expressed since it is on the X chromosome. In contrast, a woman with two X chromosomes would have a smaller chance of getting two genes with the colorblindness trait and thus would be less likely to express colorblindness. The presence of the colorblindness gene results in only two functional cones, as opposed to the typical three. The third cone in a colorblind person's eyes is mutated and non-functional. Tetrachromats are women with four cones, the fourth typically being mutated and non-functional. Tetrachromats with four functional cones are theorized to be able to see a broader range of colors, as established by the only confirmed "functional" tetrachromat, who was able to see colors in much more detail than other test subjects, according to a 2010 study. The existence of colorblind and tetrachromatic people gives biological credence to the statement that "we don't all see the same colors." However, this still doesn't explain the "wine-dark sea," as no form of colorblindness nor tetrachromacy is known to make blue appear purple. Therefore, the next possible explanation is cultural differences.

A differing amount of rods and cones among people may partially explain color vision differences but the cultural argument against homogenous color vision brings more evidence both for and against this theory. After analyzing ancient Icelandic, Chinese, Hindu, Arabic, and Hebrew texts, Lazarus Geiger, a philologist—someone who studies language and words—found no mention of the color blue. In fact, awareness of the color blue seemed to have spread after Egypt developed and began to trade blue dye. In addition, there is evidence that even currently, different cultures' descriptions of color vary. For example, a 2009 study from the Journal of Experimental Child Psychology working with the Namibian Himba tribe, revealed significant differences between English and Himba. The Himba people, who have no word for blue in their language, were shown an image of many green squares in a circle with one blue square among them.

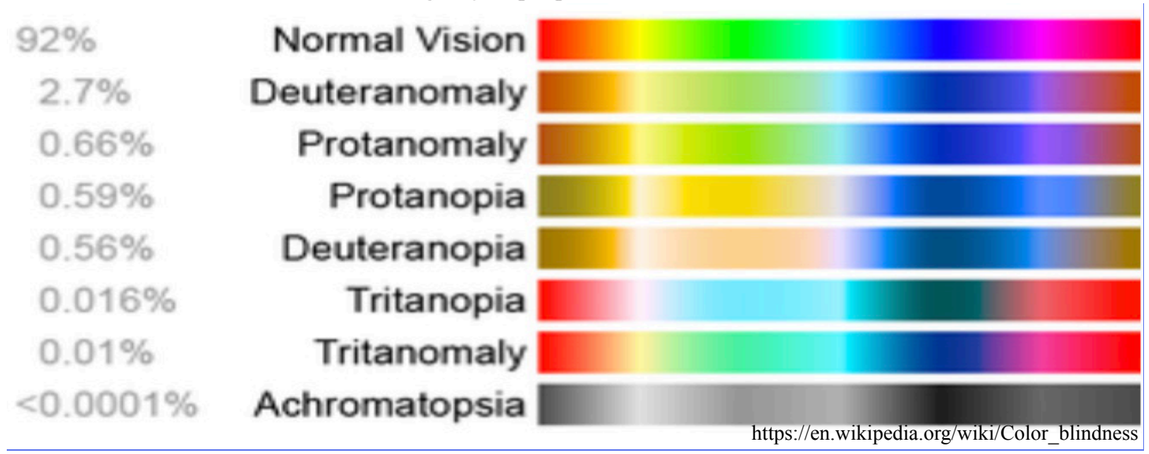
Many test subjects had trouble identifying the blue square, while those who did took significantly longer than control subjects. However, the Himba have a much more comprehensive range of words for green than English speakers. So, when shown a similar test with a different shade of green instead of blue, they could identify the odd one out much quicker.

Although the Himba could see the blue square in the first test, they couldn't point it out from the circle presented to them. However, they could identify the slight difference in greens as their language enables and encourages them to do so. As a result of this study, we now know that different cultures and languages can affect differentiation between certain hues, tints, or shades. However, this leaves the question: what about people speaking the same language or members of the same community?

There is no evidence so far to demonstrate that people speaking the same language or members of the same culture see colors in significantly different ways, such as seeing blue as purple. In fact, the similar effects of particular colors on people's emotions has been well-documented across cultures. Furthermore, a recent study has demonstrated that most people's brains activate in the same zones when shown spirals of the same color—evidence that we do all see the same color. A 2020 study from the journal Psychological Science asked people from 30 countries to assign emotions to colors. Most notably, red seemed always to elicit a response similar to passion, whether it be love or rage.

Additionally, yellow was associated primarily with happiness or cheerfulness, and blue with stability and serenity. The similar emotional responses to colors are evidence that humans see the same colors. Otherwise, it would be much less likely for the vast majority of people to feel similarly about specific colors. Another 2020 NIH study compares how the brain responds biologically to certain colors. The study used a brain mapping method called magnetoencephalography (MEG) to see where neurons fire in the brain in response to seeing certain colors. Although it used a small sample size of just 18 people, the study revealed that similar patterns emerged when people were shown the same colors. These results indicate that people's brains respond in the same way to the same colors on a small scale.

After considering multiple studies, the most recent ones show more evidence that we do, in fact, see the same colors. Although cultural and language differences contribute to differences in distinguishing between colors, people speaking the same language have been shown to biologically respond the same way to the same colors. The starkest groups of people physically seeing different colors are colorblind and functional tetrachromat people due to their significantly different amounts of cone cells. However, within cultural groups, we all likely see the same colors.



https://en.wikipedia.org/wiki/Color_blindness

Developing Nations' Struggle to Obtain COVID-19 Vaccines

Bodhi Lavine

To date, there have been over 75 million cases of COVID-19 across the globe. Despite that, only one out of 10 people in developing countries will be vaccinated in the next year, leaving countless lives in danger.

Wealthy, developed nations have used their money to secure over half of the available COVID-19 vaccines, even though they make up only 14% of the world population. These developed countries have also reserved more COVID-19 vaccines than they need, leaving poor, developing nations, which do not have the money to reserve vaccines, with a shortage of supplies. For example, Canada, one of the biggest hoarders of the vaccine, has secured enough vaccines so that every citizen can become immune five times over. Likewise, the United States has the second most vaccinations at four per person, followed by the United Kingdom, which has ordered three vaccinations per person. Developing nations cannot afford to buy vaccines for their citizens puts them at risk of being left behind in this pandemic.

Between Kenya, Myanmar, Ukraine, Pakistan, and Nigeria, there have been over 1.5 million reported cases of COVID-19, excluding the cases that were not reported due to a lack of access to medical assistance. It is clear that these nations cannot be overlooked and must be given equitable healthcare like developed nations. Oxford/AstraZeneca, one of the vaccine manufacturers, promised to provide 64% of their produced vaccines to people in developing countries. Despite their ambitious goals, they are projected to create enough vaccines for less than 18% of the world population in the next year, meaning that developing nations will likely not be getting the number of vaccines they need. Additionally, developed nations like China and India have made deals with Oxford/AstraZeneca and other vaccine providers to obtain doses for their citizens, while developing countries have not, due to a lack of funds, connections, and resources. Steps must be taken to expand the access of the COVID-19 vaccine beyond the scope of wealthy, developed nations to encompass developing nations. COVAX and the People's Vaccine movement are two groups advocating for this access.

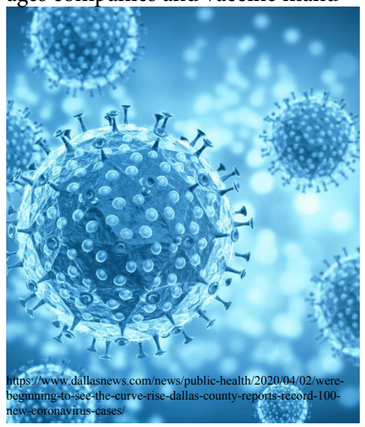
COVAX is a part of the Access to COVID-19 Tools Accelerator, a response plan to the pandemic formed by the European Commission, France, and the World Health Organization (WHO). COVAX aims to gather together many organizations and people, including governments, manufacturers, scientists, and philanthropic organizations, to create an equitable distribution of COVID-19 vaccines. This is one of the most essential worldwide solutions to this pandemic, as it aims to help people worldwide gain access to vaccines, regardless of money.

https://thepulse.org.au/2019/07/09/gp-rules-for-vaccine-storage-strengthened/

Many organizations are currently part of COVAX, including Gavi, the Coalition for Epidemic Preparedness Innovations (CEPI), and WHO. In order to effectively achieve the goal of increasing access to vaccines, COVAX will support research, development, the manufacturing of many vaccines, and help create fair pricing. They met their fundraising goal of $2 billion in 2020 through philanthropists, private companies, and participating countries, and they hope to raise an additional $4.6 billion this year. In return, every country that participates in this plan will receive equal access to the created vaccines, regardless of development or economic status. The first priority is to generate two billion vaccines by the end of 2021 to protect those at the highest risk of contracting COVID-19 and healthcare workers. To ensure the manufacturers will be able to create enough vaccines, COVAX creates incentives and invests in these manufacturers with the money that it has raised. Also, because COVAX is contributing to the creation of the vaccines and ordering so many vaccines, they can negotiate fair prices that then translate into creating fair prices for people around the world and increasing the accessibility of the vaccine.

For the countries—including 67 developing ones—that have not made any purchases of vaccines or made deals with distributors, this program is essential. This plan benefits all involved parties, even developed nations, because it provides a safety net that increases countries' chances of securing more vaccines, simultaneously preventing a resurgence of this disease by ensuring that people in other countries around the world get the help they need. COVAX will increase the chances of successfully creating a vaccine in enormous amounts, meanwhile ensuring that financial status does not become a barrier to receiving the medical attention that people in developing nations deserve.

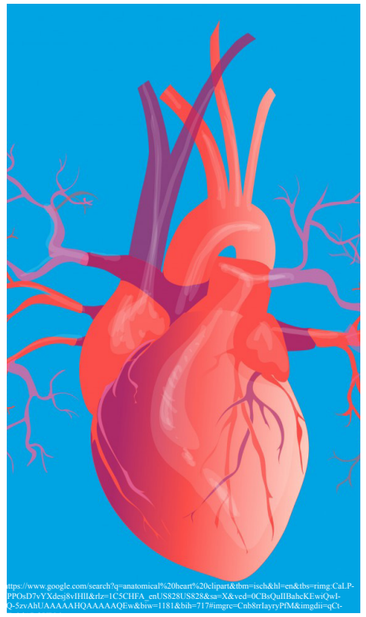
The People's Vaccine Alliance is an organization that includes groups like Amnesty International, Frontline AIDS, Global Justice Now, and Oxfam. It is also supported by world leaders, health experts, and former members of Congress. This alliance supports the idea of a People's Vaccine, meaning that the COVID-19 vaccine should be viewed as a global benefit made available to all. The People's Vaccine Alliance encourages companies and vaccine manufacturers to work together and share information to develop vaccines instead of keeping information to gain individual profits. Companies' use of patents also inhibits a quicker overall development of vaccines and contributes to some companies' ability to monopolize vaccines' creation.



https://www.dallasnews.com/news/public-health/2020/04/02/were-beginning-to-see-the-curve-rise-dallas-county-reports-record-100-new-coronavirus-cases/

Furthermore, companies are raising the vaccines' prices, limiting the applicability and accessibility of these vaccines to people in developing countries. Scientists theorize that if companies only view the vaccine as a way to make money and do not share research, then there will not be enough vaccines created. The People's Vaccine movement promotes the availability of these vaccines by encouraging drug companies and the government to provide these vaccines to people in all countries, including developing nations, without any payment. It is important to remember that although The People's Vaccine Alliance has ambitious goals for the future of the vaccine, the alliance is not directly involved in creating vaccines and can only try to advocate for what they think is right: for all people to obtain the COVID-19 vaccine. If vaccine manufacturers and drug companies listen to the idea of working together, instead of monopolizing a worldwide necessity, they can make an effective vaccine, produce it at a faster rate, and be able to provide more vaccines to people in developing countries.

Moving forward through this world pandemic, developing countries need organizations like The People's Vaccine Alliance and COVAX in order to stand a chance against COVID-19 and the threat it poses to the population of those countries. Moreover, assistance from wealthy countries might provide developing countries with similarly powerful connections, increasing the accessibility of vaccines in developing nations. Developing nations are still at high risk of being left behind in the pandemic due to lack of vaccines despite the attempts of these organizations. This shows how collaboration between countries and manufacturers is necessary to create more vaccines, protect people in developing countries, and give them a chance at surviving this pandemic.



Congenital Heart Defects: What They Are, Who They Affect, and How to Treat Them

Emily Salzhauer

Congenital heart defects (CHDs) are one of the most common types of birth defects. They affect about 40,000 children each year, about 1% of children around the world. There are at least 36 different types of congenital heart defects. Each one is different, ranging from fatal to benign, so they all require specific treatment. Currently, doctors do not know what causes CHDs; explanations range from genetics to medication that the mother may have taken during pregnancy.

A CHD forms when there is a problem in utero during the heart's development. In order for a heart to form correctly, there are a number of specific steps that must take place at specific times during the fetus' development. If one step occurs too early or late, a CHD could form.

There are many levels of severity of CHDs. A more mild example of a CHD is a ventricular septal defect, a hole in the wall between two of the chambers of the heart, which typically does not cause serious health complications. Some of the more severe types of CHDs involve a missing valve or chamber of the heart.

Many of the more mild cases will not affect the child's daily life. In some cases, the patient will not even know that they have a CHD because they will never experience any symptoms.

One of the most common symptoms of CHDs are arrhythmias, which is a problem with the heart's rhythm. Due to a malfunction with the heart's electrical system, the heart beats either too fast or too slow. This causes a heart murmur, which is when the heartbeat sounds abnormal. Other symptoms include bad circulation, rapid breathing, fatigue, and blue coloration of the skin.

Some CHDs, mostly the more severe ones, can be detected using an ultrasound before the baby is born. Most of the mild cases are detected in the few days after birth.

Most children with CHDs will go to a pediatric cardiologist, which is different from their regular pediatrician. These cardiologists will follow the patient's defect at regular checkups using tests like electrocardiograms, which measure the electrical activity of the heart, and echocardiograms, or ultrasounds of the heart.

Not every CHD requires treatment, but for the ones that do require more extensive care, there are many different treatment options. Some of the most common treatments for congenital heart defects are open heart surgery, cardiac catheterization (a minimally invasive type of heart surgery) and prescribed medicines. In the most severe cases, a heart transplant is required to treat the defect.


https://www.cdc.gov/ncbddd/heartdefects/index.html

The most severe CHDs can drastically affect a child's quality of life. Many of these children must endure many long hospital stays and have multiple open heart surgeries in their lifetime, each of which has a long and painful recovery process. They also might take many medications or be on supplemental oxygen, meaning they are not able to have a normal childhood.

For the defects requiring surgery, the operations often will take place during the first days of a baby's life. In other cases, surgery occurs when the child is months or even years old. Surgery is currently one of the best treatments for CHDs for both mild and severe cases. After surgeries, many children who have been treated for mild CHDs have minimal symptoms and are able to live long and healthy lives.

There are many highly trained pediatric cardiothoracic surgeons that treat CHDs. These surgeries are so complex because many of them occur just days after the baby is born. This means that the hearts are incredibly small and fragile. For this reason, these surgeons use 3D printed models to practice these procedures before they do it on a patient.

Since there is so much research happening for CHDs right now, the field is evolving and changing every day. There are many foundations and labs dedicated to researching CHDs. The Babies Heart Fund at Columbia Hospital in New York and the Children's Heart Foundation research what role genetics plays in CHDs and what causes CHDs. They also look into more minimally invasive surgery techniques rather than open heart surgery.

The mortality rate of kids with CHDs in the US and Europe has decreased by 37.5% in the past twenty years. For this reason, kids with CHDs are now living longer and their quality of life has improved. There is a new field developing in cardiology for adults who had CHDs when they were kids. These doctors are different from any other cardiologists because they are specifically trained to follow CHDs long into adulthood.

Even though surgery is a plausible treatment option, after a surgery children still have to be monitored by a doctor and continue to have cardiac testing done to ensure the surgery is still functioning. Although these treatments, surgeries included, are getting more and more effective, there is currently no cure for CHDs. There are lots of scientists doing research to look for a cure, but there have been no breakthroughs. Hopefully, with advancing technologies, a cure or more universal treatment will emerge in the years to come.

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