In this Issue:
Can a piece of gum keep you running?
By Najnin Rimi
Dear Reader,

I first started working with Osmosis as a Sophomore when Alex Long was preparing to gather together its second issue. He heard through the grape vine that I knew how to use Adobe InDesign. At first, I saw Osmosis as purely a healthcare magazine, and as a non-pre-med, just-pre-graduate-school student—  I thought it wasn’t for me. Through my ~3 years with Osmosis, I have come to the conclusion that Osmosis is NOT just a healthcare magazine, and contrary to our title, it is NOT just a science magazine. Osmosis is for everyone. Osmosis is for the pre-law, the environmentalist, the faculty, and the conscious citizen. I am so grateful that I have been able to watch Osmosis grow through my time at UR, and I’m even more grateful that some loyal Osmosis writers have been here since the beginning. Adriana Grimes is a graduating senior that has been writing since the first issue! I hope that in the future we are able to gather even more loyal team members and continue to grow in the right direction. I know from personal experience that Osmosis has helped me grow in the right direction. Throughout my short scientific career, Osmosis has reminded me of the importance of communicating science to a wider audience. As I prepare to graduate and go off to graduate school, I know I would not have had nearly the same undergraduate experience if it was not for Osmosis. Good luck to next year’s editor, Anthony Isenhour, I know I’m leaving Osmosis in good hands :) 

Your editor,

Mickey Murvin

Letter from the Editor

Thank you to our staff!

The Executive Board

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Our Graduating Seniors:

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Major: Chemistry
Minor: Business Administration
Next Year: Biomedical research postbacc before medical school
Favorite part of Osmosis: Being able to bring to life the stories/topics through design and imagery

Adriana Grimes
Major: Biology
Minor: Healthcare Studies
Next Year: Working as a medical assistant in Boston
Favorite Part of Osmosis: Being able to write about academic passions that don’t get covered in classes

McKenzie Murvin
Major: Biochemistry and Molecular Biology
Minors: Mathematics and Integrated Science
Next Year: Biological and Biomedical Sciences PhD program at UNC- Chapel Hill
Favorite Part of Osmosis: Being able to combine my love of science, writing, and graphic design.

Melanie Lippert
Major: Biology and Journalism
Next Year: Joining the peace corps in Senegal as a forestry and environmental change agent.
Favorite Part of Osmosis: Getting to read through everyone’s really cool stories while editing.

Anvi Savani
Major: Biology
Minor: Healthcare Studies
Next Year: Working as a dental assistant before applying to dental school.
Favorite Part of Osmosis: Learning about science and social implications

Osmosis Executive Team

Melanie Lippert (Vice Executive Editor), Adriana Grimes (VP PR and Marketing), Sanitra Desai (VP Design/ Managerial Editor, graduated Fall 2018), McKenzie Murvin (Editor-in-Chief)
6 Can a piece of gum keep you running?
Najnin Rimi

7 Bingeing on carbs might make you drunk?
Anthony Isenhour

8 The science of Fetishes
Adriana Grimes

10 Snake Venom as a Cancer Therapy
George Qiao

12 Necessity of receiving the flu vaccine and recent research trials
Lizzie Godschall

14 Lack of Diversity in Genomics Research
Savannah Del Cid

16 DNA on Trial
Nathan Dinh

18 Retail Clinics: Risky or Reviving Primary Care?
Dana Oriana Morcillo

20 Interview with a Specialist
Joseph McEachon
Neuro Gum contains natural caffeine, L-theanine, and B-vitamins that were combined to give a longer attention boost than regular caffeine. Forty milligrams of caffeine was incorporated into the gum to provide better results than the energizers used in the morning routine? Do we have to run on Dunkin? Kent or more, a day. But, could there be an alternative to this discomfort, and stress.4 Sixty milligrams of L-theanine are not unfamiliar with the idea of a cup of coffee, and Kent-2. Its purpose is to boost energy, cognition, and focus. Neurogum contains natural caffeine, L-theanine, and B-vitamins which contains only about 20 milligrams of the substance. Which contains both a role in protecting against the onset of Alzheimer's disease. The L-theanine directly affects brain waves, called alpha waves, which reduces stress without the somnolent effects of relaxation.3 The L-theanine affects one's ability to create the desired effects for consumers. For example, this gum is made using a cold compress rather than applied heat, which allows it to maintain all of its ingredients upon utilization.4 The creators also stress the importance of knowledge in their written work, as they justify other decisions when manufacturing this gum that help maximize the ingredients. This product is a seemingly easy-to-use replacement for coffee, and with zero grams of sugar, Neurogum may be worthwhile for busy students seeking healthier livelihoods.

References
A fetish is defined by the Oxford Dictionary as a "form of sexual desire in which gratification is linked to an abnormal degree to a particular object, item of clothing, part of the body, etc." The diagnostic statistical manual (DSM), which defines psychological disorders, has also defined fetishes. Fetishes, however, are not defined as a disorder unless they confer a serious or significant detriment or distress to the person. Most individuals who self-describe as having fetishes or being fetishists do not fall into the category of having clinical impairments due to the fetish. So how do sexual fantasies differ from fetishes? Sexual fantasies are broader than fetishes and include sexual desire for certain behaviors but may also include fetishes. This article aims to examine fetishes as defined by the Oxford Dictionary in which the person is not clinically impaired. In other words, this article will explore fetishes between consenting adults for the sexual enjoyment of all parties involved.

So how common are fetishes and "deviant" sexual fantasies? Unsurprisingly, this is an understudied area of research. In preliminary studies, many interesting patterns are present in the data. Of fetishes, which are the most common? A survey of nearly 400 discussion groups, which looked at approximately 5,000 individuals, calculated the prevalence of different fetishes. They found that fetishes for body parts and objects related to the body were the most common at 33 and 30 percent, respectively. Preferences for other people's behavior comprised 18 percent; while, a person's own behavior and social behavior each made up 7 percent. Objects unrelated to the body made up just 5 percent. Within the category of body parts, the most frequently by a large margin is feet podophilia, at 47 percent relative frequency. This is followed by body fluids (urine, feces, blood, etc.) at 9 percent and body size (tall, short, weight, etc.) also at 9 percent. With regards to objects associated with the body, the most common are objects worn on the legs and buttocks at 33 percent, followed closely by footwear at 32 percent. The next largest category is underwear at 12 percent.

Why and how do humans develop fetishes? There are two main theories to explain why and how humans develop fetishes. One of the most popular is the "signals crossing" theory, which helps explain the etiology of foot fetishes. In the human brain, the senses are mapped; specific locations in your brain correlate to specific locations on the body. The part of the brain that is triggered when the genitals are stimulated is adjacent to the part of the brain that is mapped to the feet. It is theorized that some people have an overlap in neurons of these areas. Bascially, the boundaries of the feeling that feet can cause sexual arousal in a person. This includes looking at, touching, and smelling feet, either their own or another individual's. This is what is defined as a foot fetish. This also may be the reason that foot fetishes are one of the most popular fetishes.

The second theory is "early childhood imprinting", which states that early childhood experiences are reflected in the fetishes present in adulthood. Within this, there are two proposed theories: the conditioning and the trauma theory. The conditioning model theorizes that fetishes develop when a stimulus is paired with sexual thoughts or behavior. Studies have shown that men can be conditioned to have erections from traditionally non-sexual stimuli (i.e. types of clothing) if they were first paired with sexually explicit photographs. Researchers paired sexually explicit photos with a pair of women's boots and colored geometric figures and found that some men could develop erections in response to the non-sexual stimuli alone. These results, however, should be taken with a grain of salt due to small sample sizes and lack of control variables. The trauma model is based on the idea that fetishes are rooted in either emotionally or physically traumatic experiences in childhood or adolescence. This also includes unresolved emotions from childhood or growing up in sexually restrictive households. However, most experts agree that the conditioning and trauma models do not fully account for the development of fetishes because not everyone develops fetishes and some stimuli are fetishized more easily.

There are a lot of reasons why sexual fetishes could develop and in whom they develop. There are interesting patterns that are present in preliminary studies, but more in-depth research is needed before any concrete statements can be made about fetishes and sexual fantasies.

References
Snake Venom as a Cancer Therapy

George Qiao

Cancer is a deadly disease affecting and killing many people every year. For 2019, the estimated number of new cancer cases exceeds 1.5 million, and the estimated number of deaths caused by cancer exceeds six-hundred thousand.1 Treatments for cancer certainly exist; although current treatments are often costly and are not always effective in the long-run. The treatments also come with side effects often associated with the destruction of healthy, noncancerous cells. The expansion of alternatives for treating cancer is a constant objective for the medical community, and researchers are experimenting with many new solutions in order to provide new opportunities to treat cancer. One potential treatment in development is snake venom, a substance that is normally poisonous to humans in its unmodified form.

Although snake venom as a whole can be harmful to humans, it is composed of many different proteins, enzymes, and carbohydrates. If the different molecules constituting the venom are extracted and isolated, the treatment in the venom becomes beneficial for humans without the harmful effects of the entire venom. For example, the drug captopril is derived from snake venom and treats high blood pressure and heart failure. As long as the entire venom is not used, the separate components can elicit healthy effects in humans. In the 1940s, researchers began isolating enzymes and non-enzyme proteins from snake venom and experimented with the proteins for effects on tumor cells. Clinical testing with the venom became more prevalent from the 1960s onward.2,3

The technique of encapsulation, however, has not fully been mastered and is currently in development.2,3 Furthermore, the mechanisms of action of many cancer-fighting proteins have not yet been confirmed, which is why many of these proteins are not yet available for purchase from pharmacies.11 Until the exact behavior of the snake venom components are made certain, there is no guarantee that these proteins cannot destroy healthy, noncancerous cells. Although many of the proteins have demonstrated selectivity towards tumor cells in experiments, further research should be done to confirm the abilities of these molecules to discriminate between cancerous and healthy cells and to determine potential methods to circumvent any possibility of the proteins harming healthy cells.

Snake venom as a treatment for cancer is promising and could be an effective alternative to current treatments. Whether or not the use of snake venoms would be more cost effective or less painful than current treatments has not yet been confirmed, as the treatment is not a common practice. Further research on the behavior of these proteins and on potential costs of treating cancer patients with the venom should provide more insight about the value of the venom. In the future, when more information is made available, snake venom could potentially serve as an incredibly valuable alternative to current cancer treatments.

Cancer-fighting characteristics. One such type of protein is the disintegrin. Disintegrins are non-enzymatic proteins found in snake venom and inhibit angiogenesis, the development of new blood vessels. Angiogenesis allows tumor cells to invade nearby healthy tissue and metastasize. Treatment with disintegrins has been shown to suppress the spread of tumors due to the antiangiogenic activity of disintegrins.4 L-amino acid oxidases (LAAOs) are enzymatic proteins found in snake venom and demonstrate anti-tumor effects. LAAO converts L-amino acid to alpha-keto acid and releases the byproducts ammonia and hydrogen peroxide. Hydrogen peroxide is a major proposed mechanism of LAAO-induced toxicity, as it can act as reactive oxygen species (ROS) that can diffuse into cancer cells and cause cell death. Studies have shown that the effects of ROS are more likely to harm cancer cells than normal cells, possibly due to the higher metabolic activity present in cancer cells. The higher metabolic activity leads to higher levels of ROS in cancer cells; hence, the cancer cells are more susceptible to further increases in ROS levels than normal cells. The evidence of selectivity of LAAO activity towards cancer cells is beneficial for cancer therapy, as the enzyme does not seem to have a high potential to harm healthy cells.4 Metalloproteases (MPs) are another group of enzymes derived from the venom and can also exhibit anti-tumor activity.4 One type of MP, known as jarahagin (produced by the species Bothrops jararaca), has demonstrated cytotoxic effects on melanoma cells, as well as inhibition of cancer cell adhesion.4 Cell adhesion contributes to tumor spread; thus, by inhibiting adhesion, jarahagin can prevent metastasis, which is the spread of cancer to a secondary site. Phospholipase A2 (PLA2) is another enzyme belonging to snake venom and has demonstrated cytotoxic and antiangiogenesis effects.5 Lectins (proteins that bind to sugars) belonging to snake venom have been shown to inhibit the growth of certain types of cancer cells, such as renal and pancreatic cancer cells.6 The proteins have also demonstrated cytotoxic activity. In a particular experiment, the lectin B1L, belonging to Bothrops leucurus venom, was tested and induced apoptosis on a variety of cancer cells, including myeloid leukemia cells, lung carcinoma, and larynx carcinoma cells. Furthermore, healthy cells were not harmed by the protein.7 Thus, snake venom lectins can be especially helpful in treating certain types of cancer.

The process of collecting the venom and determining its effects on cancer takes multiple steps. The species of snake from which the venom is collected depends on the proteins of interest, as the type of venom varies among species. It may be easier to collect venom in the summer as opposed to the winter, as the venom is more liquefied in the summer.8 Once the species is identified and captured, the snake must be kept in conditions suitable for living. A snake can die when kept in conditions unlike its environment.9 Once the species is identified, the venom is collected and extracted from the snake. Most of the venom is collected from the mouth of the snake, although some species’ venom is collected from the anal duct.10

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Snake venom as a treatment for cancer is promising and could be an effective alternative to current treatments. Whether or not the use of snake venoms would be more cost effective or less painful than current treatments has not yet been confirmed, as the treatment is not a common practice. Further research on the behavior of these proteins and on potential costs of treating cancer patients with the venom should provide more insight about the value of the venom. In the future, when more information is made available, snake venom could potentially serve as an incredibly valuable alternative to current cancer treatments.

References

Necessity of Receiving the Flu Vaccine and Recent Research Trials

Lizzie Godschall

To this day, smallpox is the only disease confirmed to be eradicated worldwide. This would not have been possible without the first widely utilized vaccine developed nearly 200 years prior by Edward Jenner. Inspired by Jenner’s methodology of using the cowpox virus to protect against smallpox in humans, vaccine innovations and their significance to public health took off after Louis Pasteur’s discovery of the rabies vaccine in 1885. Vaccines are perhaps the greatest immunological feat of the 20th century (Doherty, 2018). Vaccines have been developed to protect against smallpox, yellow fever, and many more diseases (CDC). Today, we will explore the influenza virus and discuss the flu shot.

Flu History

World War I played a significant role in the first influenza outbreak. The war brought the mass mobilization of over 60 million soldiers with significantly different backgrounds and immune systems to highly concentrated war zones in Europe. This, coupled with years of unsanitary lifestyles, facilitated high transmission rates leading to the H1N1 influenza pandemic outbreak in 1918 (Matthews, 2014). Over 50 million people died and many more were infected by the end of this pandemic. At the time, the only preventative measure that was exercised was quarantine.

About twenty years later, the influenza A and B viruses were isolated in the lab. Although vaccinations against this virus have been in development since the 1930’s, numerous clinical trials have debunked the effectiveness of the influenza vaccine for decades after the 1918 pandemic (National Vaccine Information Center). A century after the first influenza outbreak, the CDC reported that the flu vaccine decreases the prevalence of flu related illness, hospitalization, and death, especially in young children and elderly people. Numerous studies have suggested that the trivalent influenza vaccine significantly reduces flu-related hospitalizations and fatalities (Nichols, 2018). The effectiveness of the flu vaccine varies from year to year depending on how well the projected vaccine antigen sequences matches the actual seasonal viral antigen. Although some years have better predictions than others, the overall effectiveness of the vaccine tends to be 40-60% (CDC).

What is the Flu Virus?

The influenza virus is characterized by two envelope proteins. Hemagglutinin (HA) is the protein that allows the virus to attach to host cells, while neuraminidases (NA) release the virus from the host cell (Morgan). There are sixteen known types of hemagglutinin and nine known types of neuraminidase, which gives 144 different possible combinations of these proteins (Morgan). Different viral strains contain distinct hemagglutinin and neuraminidase proteins, such as H1N1, the most common influenza A known as the “swine flu.” Influenza vaccines contain three to four of the most common influenza strains, which are typically H1N1, H2N2, H2N3, and influenza B. The flu vaccine tends to be twice as effective in preventing H1N1 than H2N3 and influenza B (Rondy et al., 2018). This is one reason why the vaccine is not effective for everyone.

Why Do We Need the Flu Shot Every Year?

There is a need for a new vaccine every year due to antigenic drift. The antibodies that your body produced in response to last year’s flu shot are specific to the viral antigens from that year’s version of the vaccine. When a mutated version of that virus enters the body, these antibodies are no longer able to evoke an immune response (Potter, 2008). Since the virus mutates slightly each season, new vaccines with slightly different antigens must be developed to recognize the hemagglutinin and neuraminidase proteins of the mutated virus. Once the vaccine is administered, your innate immune system will create a cascade effect to activate B-cells to produce antibodies. If you were to contract the influenza virus, ideally your body would already have the necessary antibodies to fight the virus and produce minimal flu-like symptoms. The vaccine enables our bodies to combat the virus by generating antibodies in advance. Within two weeks of vaccination, the adaptive immune system should have generated appropriate defenses against contracting the seasonal strain of the flu (CDC).

How Do I Choose a Vaccine?

The two most conventional types of flu vaccinations are egg based. These include the killed vaccine, taken as an intramuscular shot or live attenuated nasal spray vaccine (CDC). The killed vaccine involves injecting a fertilized hen egg with the influenza virus and later harvesting the viral fluid to acquire the inactive, or inactivated viral antigen. The live attenuated vaccination is a weakened version of four common strains of live influenza virus. The live attenuated nasal spray is not recommended for people over 50 or immunodeficient recipients. Live attenuated vaccine is cold adapted, so the virus cannot survive and replicate in the warm environment of the lungs and cause an infection. Although vaccines are developed using viruses, the flu shot cannot cause the flu.

Innovations within the past five years include cell-based and recombinant technology (National Vaccine Information Center). The inactivated cell-based flu shot is produced in a similar way to the egg-based killed vaccine, but the viral antigen is extracted from a mammalian cell culture rather than utilizing chicken eggs. The recombinant vaccine requires isolating a gene expressing viral specific protein. Typically the gene encoding for HA is injected into an insect virus, so it can be replicated within insect cells. This process is faster than other methods because the virus does not need to undergo an attenuation phase to grow in eggs or cell cultures (CDC).

Recent Trials for Vaccine Development

Since the first influenza outbreak 100 years ago, a universal flu vaccine may become available in the near future. BiondVax’s M-001 peptide vaccine has reached a phase 3 clinical trial in Europe. Instead of targeting the seasonally variable HA antigen surface of hemagglutinin and neuraminidase proteins, M-001 targets nine highly conserved epitopes of the flu virus. These epitopes, which are part of an antigen that are recognized by the adaptive immune system, don’t change seasonally. So, ideally you would only need one universal flu shot that would be effective for your lifetime. This approach allows for protection against all strains of influenza virus (B). Setting the universal vaccine in conjunction with the seasonal vaccine stimulates antibody production against hemagglutinin and has the most promising immunological success rate according to data acquired so far from the clinical trials (Taylor, 2018). About a dozen more influenza universal vaccines, each founded on slightly modified approaches, are in the earlier stages of clinical trials (CDC). Innovative cooperation coupled with advancements in biomedical vaccination technology will hopefully lead to the stark decrease and eventual eradication of influenza viruses.

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Precision medicine is a movement that seeks to serve a patient's individual medical needs with a tailored level of treatment. Such a practice requires an essential framework of genetic information to allow doctors to make accurate treatment decisions. Genome-wide association studies (GWAS) provide massive amounts of information for databases, such as the GWAS Catalog; however, there is an apparent lack of diversity in the genomics data available to researchers and drug developers. The majority of participants in GWAS are of European descent. As of January 2019, 78 percent of genomics contributed by GWAS have been of European descent; while, only 22 percent are minorities (Yeager 2019). Stemming from a history of discrimination and unfair logistics, the lack of diversity in genomic databases undercuts the accessibility and function of Precision Medicine, and this issue needs to be resolved.

After the completion of the human genome project in 2003, the ability to conduct GWAS and create a database of genetic information became possible and affordable. Over the past two decades, the data on human genetics has grown. Based on this growth, one would assume our knowledge of treatment based on the unique genetic makeup of patients would be vast and precise by now. At times, however, the proclamations of Precision Medicine overlook the history of genetics—race from ethnicity when gathering patient samples, is the blatant harm genetics research has inflicted on uninformed populations. One of the most striking examples concerns the Havasupai tribe in Arizona (Santos 2008). The Havasupai tribe agreed to a genetic study proposed by Arizona State University in the 1990s and were under the impression that they would be distributed among other universities, where studies deviating from the original agreement were conducted without their consent (Santos 2008). Consequently, the Havasupai tribe filed lawsuits on the grounds of “exploitation and violation of civil rights” (Santos 2008). Numerous incidents similar to this have historically occurred in minority populations; a well-known example being the exploitation of cells from Henrietta Lacks, also known as HeLa cells. With such an unethical history of interaction with research endeavors, minorities commonly refuse to participate in genetic research studies, which contributes to the lack of diversity in GWAS (Santos 2008). Along with ethical issues, genetics research has also been conducted with certain assumptions in mind that simply do not hold true. As Adebowale Adeyemo, deputy director of the Center for Research on Genomics and Global Health at the National Human Genome Research Institute, highlights in an interview, there have been assumptions that destitute populations and minority populations do not need genomics testing because infectious illnesses are a more prevalent and pressing concern than genetic diseases in such populations. However, over the years it has been proven that genetic diseases, such as heart disease and other chronic diseases, are also a significant concern in poor populations and minority populations just as in affluent or majority populations (Mullin 2016).

Moreover, the genomes of many minorities and indigenous populations are more difficult to decode because of the numerous diverse communities within each minority and indigenous population. This complexity appears to deter researchers because of the assumptions that the complexity will not provide accurate data to produce treatments (Santos 2008). For those few who do take on the challenge, the difficulty comes with great reward in discovering mutations and variants that often prove useful for medicine (Santos 2008). The unique qualities of minority and indigenous genomes provide greater knowledge on how genetics influence drug interactions during treatment and other health issues like diabetes (Poppejoey 2016). Therefore, concerning medical care, minority patients require just as much genetic data as the European patients, if not more because of the great diversity within the genomes of minority and indigenous populations that can provide great benefit to treatment and drug development. While ethics and assumptions show how the research community has been wrong in its execution of genetic studies, some aspects of the logistics of GWAS can hinder the ability to achieve diversity in studies. The primary logistical issue connects to historical points already mentioned. If people do not wish to contribute their genetic information due to historical oppression, discrimination, and unethical practice under false assumptions, then it proves extremely difficult to gather data on such populations today. The inability to attain samples from minorities slows progress towards diversifying the GWAS Catalog and other genetic databases, despite efforts by programs like All Of Us, which was created by the NIH in 2018 to develop a database of at least a million diverse patient genomes (Yeager 2019). Due to how long the databases have been filled with European majority, another logistical issue stems from the analytical models used to process the data produced by these massive GWAS. Analytical methods called ancestry metrics are used to process genomic data found in GWAS databases, but these metrics do not properly analyze an individual of a diverse background (Bustamante 2011). As a result, our current methodology of analysis likely produces a significant amount of error for genomes that carry more variants and deviate from the more homogenous populations that the metrics are based upon (Bustamante 2011).

The history of genetics research is riddled with ethical and logistical issues that have contributed to the present lack of diversity in GWAS. Incidents such as sampling bias based on supposed “race” and violation of minority patients’ consent rights have caused logical issues for present day GWAS that seek to gather diverse genomes but cannot due to a lack of trust in research. Thankfully, several programs, similar to All Of Us, have been commissioned in recent years to create a better relationship between the public and research. While the past cannot be changed, the way in which future GWAS are constructed and conducted can be adjusted to achieve a genetic database that properly represents and provides Precision Medicine for the entire human species.

References
n March 4, 1974, a nine-year-old boy was raped in his home in Lake Wales, Florida. When the police arrived, their description of the suspect as possibly 17 or 18 years old with a mustache and thick sideburns and named “Jim” or “Jimmy.” After being identified in a photograph lineup by the victim, Jimmy Bain, who said that he was at home watching television with his sister, was arrested and charged with child sex abuse, kidnapping, and burglary/unlawful entry. During the trial, the prosecutors relied on both the photograph lineup and semen that had been found at the scene. The analyst identified that the semen came from a person with Type B blood, but Bain had Type AB blood. However, because the analyst said that Bain’s blood type was a weak A, he could not be excluded from the list of suspects. He was eventually convicted and sentenced to life in prison based on shoddy forensic science. Bain was serving his life sentence when Florida passed a statute in 2001 that allowed for DNA testing.

In criminal cases where the perpetrator is unknown, detectives look for articles that may contain the perpetrator’s DNA including hair, saliva, semen, sweat, blood, or even skin cells. The cells are lysed, the DNA is isolated, then amplified and multiplied using polymerase chain reaction (PCR). The DNA sequence can then be used in short tandem repeat (STR) analysis. An individual has 3-7 base pair repeats, called loci, distributed throughout their DNA. The type and number of loci repeats are unique in each person. In STR analysis, these loci are amplified and sequenced. Variability in a person’s STRs is enough to differentiate between individuals, which allows for DNA sequences to be compared between suspects for criminal investigations. In 1994, the FBI established the Combined DNA Index System (CODIS), a national DNA database that allows for DNA comparison to known criminals. However, this is not the only DNA database that law enforcement uses. Third-party DNA sequencing companies that analyze customers’ DNA sequences to determine ethnicity or family lineage including 23andMe, AncestryDNA, and LivingDNA have been known to share data with police in investigations. According to 23andMe’s website, they “do not share customer data with any public databases” but “may be required by law to comply with a valid court order, subpoena, or search warrant for genetic or personal information.” These “voluntary” databases have been used before in investigations. A 1993 murder case was reopened in 2015 due to the new advances in DNA testing and these private companies. Investigators sent samples from the original crime scene to a private DNA sequencing company and ran them through an online genealogy website. The test connected the DNA to Jerry Westrom. Using social media, the detectives followed Westrom, eventually recovering a napkin that he had used in prison. King appealed his case, arguing that the cheek swab “involves but a light touch on the inside of the cheek . . . The fact that an intrusion is negligible is of central relevance to determining reasonableness, although it is still a search as the law defines that term.” Essentially, because the swab is unobtrusive, it is not unreasonable for a police officer to undergo a “search” without cause. This allows for police officers to utilize the wide capabilities of DNA testing to solve crimes without needing to obtain a warrant. Although this would bring a host of good in crime solving, it could be readily abused, which the Fourth Amendment is meant to protect against. Justice Scalia, writing a dissenting opinion in which justices Sotomayor, Ginsburg, and Kagan joined, categorically prevents officers from performing a search without cause. The Court has always held that “no matter the degree of invasiveness, suspicionless searches are never allowed if their principal end is ordinary crime-solving.” Scalia continues saying that the Court’s ruling “will, to be sure, have the beneficial effect of solving more crimes; then again, so would the taking of DNA samples from anyone who flies on an airplane, applies for a driver’s license, or attends a public school.” The increasing capabilities of DNA testing should be carefully regulated just as with any new technology that can have implications on the legal system. As powerful as these new technologies are for exoneration and crime solving, individuals’ privacy should be given proper weight and protections in the face of the extraordinary capabilities of DNA testing.

References
It’s that time of the season again, as the sniffles and coughs begin to rapidly spread throughout campus. Despite how hard you try to avoid all who are infected, no doubt you will wake up soon enough with a tickle in your throat and a waterfall running from your nose. As a college student, you can’t go all the way back home to your family physician, and the university’s clinic is booked for days. So, you drive to the nearest Walgreens and walk into the MinuteClinic. Here, within an hour you’re able to check in, get evaluated and diagnosed by a healthcare professional, and walk out the door with a prescription in one hand and a copy of your medical results in the other.

**History**

The MinuteClinic is one of the many branches of retail clinics growing across the US as an alternative for primary care treatment. First opened in 2001, retail clinics began with a Rick Krieger’s frustrations when he was put on a long standby, waiting for his son’s diagnosis and treatment. Because of this frustration, Krieger became the cofounder of the first MinuteClinic. It wasn’t until 2006 that these retail clinics would rapidly expand with CVS Caremark Corporation buying the rights to the MinuteClinic. This led to the establishment of over 1,000 clinics within the next five years. Now in 2019, there are over 2,800 retail clinics throughout the US available for screening and diagnosing patients (Burkle, 2011).

**Why the rise in retail clinics?**

Retail clinics have developed from the one value that our culture holds highest: convenience. For retail clinics, the convenience of widely-accepted insurance, low costs, and flexibility in location and times acts as a catalyst to their rapid expansion and takeover of the primary care market. Before visiting any provider, insurance is the first concern for any patient. The 2010 Affordable Care Act resulted in an increased number of individuals able to gain insurance. As a result, retail clinics thrive on their ability to accept these, and many more different types of insurance, despite what reimbursement they may receive. This includes private insurances from employers to public ones such as Medicare and Medicaid, which reimburse at lower rates than private. Even after insurance, co-pays can still be an expensive chunk out of anyone’s pocket. The staff and model employed by retail clinics, however, have shown to cost less than that of other health providers. On average, a visit to any retail clinic costs about $110 versus a range of $150 to $570 for a visit to a physician, urgent care clinic, or the emergency room (ER) (Mehta et al, 2009). These low costs, in comparison to other medical providers, are a high incentive for patients who aren’t able to afford the high costs of healthcare or whose insurance doesn’t completely cover the costs of physician visits.

Lastly, is the availability of these retail clinics—both in location and hours. While the number of clinics in each state varies, for 35 percent of Americans a retail clinic is no less than a 10-minute drive away. The close proximity of these locations in combination with extended weekday and weekend hours only widen the range of patients able to be seen. In comparison, physician’s office are usually a solo location that have limited hours on the weekend, if any. This facets them severely limit the patients able to be seen in comparison to a retail clinic.

**Are retail clinics helping or hurting?**

Despite all the patients that retail clinics are accessible to, due to their costs and availability, it’s important to ask: Are patients getting the quality of care needed by these retail clinic providers? According to studies, it depends. A study done by Shrank and other researchers in 2014 looked at over 20,000 medical cases from 2009 to 2012 to study if a measured and objective standard quality of care was met by these retail clinics. Their results showed that the quality of care was not only competent, but in the case of certain acute conditions, the quality of care was better than other medical providers. In addressing common conditions such as the flu or urinary tract infections (UTIs), retail clinics can be excellent providers in terms of lower costs and availability and an uncompromised quality of care for patients.

**Chronic conditions, on the other hand, are a different story. Nitin Damle, MD and President of the American College of Physicians (ACP), states, “We don’t think there is enough evidence to say that they are able to take care of chronic disease to manage complex problems.”**

Chronic diagnoses can be intricate diagnoses that often require a team of healthcare providers—each specialized to address some aspect of your diagnosis, whether it’s a nutritionist or a gastroenterologist. These types of teams can typically only be established in a physician’s office or the hospital.

**Future of retail clinics**

What will be the role of retail clinics be in the future then? While retail clinics continue to outcompete other primary care providers in terms of convenience, patient safety and quality of care comes first. This has been the basis of rivalry between retail clinics and physicians as physicians strongly believe there is no role for chronic care management in retail clinics. While it may seem like the path ahead would be filled with competition between these two in addressing primary care shortages, another path is being paved. Rather than attempting to outcompete each other, physicians’ offices and hospitals have joined in collaboration with retail clinics in order to bridge the gaps in patients. In Ohio, Walgreens’ MinuteClinics are now partnering with hospitals like the Cleveland Clinic. Through this partnership, the two can evaluate all the facets of primary care to ensure the delivery of what either system may lack in caring for its patients. With that idea in mind, it’s important to note that retail clinics can be an adequate, if not convenient, primary care provider when used properly. However, these clinics are not cure-alls, but rather a single facet in the healthcare system of delivering care. By continuing to work together and not against each other, the future looks bright for a more integrated health care delivery system using a collaboration between retail clinics, physician’s offices, and hospitals.

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**Retail Clinics: Risky or Reviving Primary Care?**

Dana Oriana Morcillo
Interview With a Specialist:

Dr. Christopher S. Thomas, MD
Invasive Cardiology
Virginia Cardiovascular Specialists

Interview by Joseph McEachon

1. When did you first learn of your interest in medicine?
   • I always wanted to go into medicine. There was no clear, inciting event that led me that way. In general, I enjoyed figuring things out and putting the pieces together to solve problems. I was always drawn to the human element of working with people and helping them through difficult situations. These were the main reasons that I pursued medicine.

2. How did you know it was right for you? Did you know?
   • I knew I had the right skill set for medicine. I liked directly helping people. I considered other things, such as law, but none of them appealed to me in the same fashion.

3. Where did you go to undergrad, and what did you major in?
   • I attended UVA and majored in Biology and American Politics.

4. Where did you go to medical school and why?
   • I went to Eastern Virginia Medical School (EVMS). I chose it because it was close to home without being too close. I wanted to stay in Virginia. I liked that it had a smaller class size than VCU and I liked that I wouldn’t get farms out to other locations like UVA does.

5. What other passions do you have that are either in medicine or outside of medicine?
   • I’m very interested in sports and music. I was head assistant of the basketball team at my old high school before my son was born. Additionally, I am learning to play the piano right now.

6. What is your specialty?
   • Cardiology.

7. Where did you do your residency?
   • I did my residency and fellowship at VCU.

8. Years in Practice?
   • I am finishing up my third year.

9. What is your practice setting/employment Type?
   • I work in a community setting for a private group. I am currently on a partnership track.

10. What kinds of other practice settings exist?
    • Many practice types exist; other cardiologists are employed by a hospital corporation or by an academic institution.

11. What does your specialty entail?
    • Cardiology involves both inpatient and outpatient care. I perform cardiac catheterizations and implant temporary internal pacemakers and internal monitoring devices to measure intracardiac pressure and arrhythmias. Additionally, I interpret transesophageal echocardiograms, Holter monitors, nuclear stress tests, and PET stress tests. Other types of cardiologists include interventional cardiologists and electrophysiologists. Interventional cardiologists put in stents, artificial valves, occluder devices, and valve clips. Electrophysiologists’ duties include pacemaker and defibrillator implantation and ablations. Ablations are procedures to make an electrical map of the heart and then destroy abnormal electrical tissue which leads to irregular heart rhythms. This can be done by using cryoablation (cold), radiofrequency ablation (heat), or lasers.

12. What does a typical day look like for you? If you can call it typical.
   • A typical day involves a half day of clinic where I see 10-12 patients, on average. The other half of the day involves treating hospital patients. This is when I do procedures or interpret studies, as well as make phone calls to my patients.

13. What was the path to your specialty? (medicine-residency-fellowship?)
   • I graduated in 2002 from UVA. From there, I worked for one year as an emergency room scribe. I continued working from 2003-2005 while I earned a master’s degree in physiology from VCU. I went to EVMS from 2005-2009. Next, I did an internal medicine residency at VCU from 2009-2012. I worked one year as a hospitalist (inpatient medicine) at VCU from 2012-2013. Finally, I did my fellowship at VCU from 2013-2016.

14. What is your favorite part about Cardiovascular or about medicine in general?
   • Cardiology is an extremely flexible and growing field. Tasks, which were previously surgical in nature, can now be done using catheters. It is flexible in that you can be procedurally oriented or never do procedures. I like to say that you can customize your practice to whatever you enjoy. You can wear scrubs all day and perform procedures, or you can work in a clinical setting and never see a drop of blood. The field is also very cutting edge and guideline driven with strong research predicating our recommendations. It is very satisfying to directly impact patients’ lives.

15. What is your least favorite part about your job?
   • As a cardiologist, many other fields defer to you as the final gatekeeper for a procedure or decision. “If it’s OK with cardiology” or, “cardiology has cleared them” are things that are said and written all the time. If bad things happen, it can be frustrating for people to look at you when you really had nothing to do with the outcome or situation. It is, however, neat to be held in that regard, but it adds pressure and anxiety to the job.

16. What was your most challenging/difficult case and why?
   • In general, arterial procedures can be quite difficult. You can follow the procedures and do everything right, but you may still end up with some bad outcomes. There are safe guards in place to ensure that all of the instruments are working properly, but, the “swiss cheese theory” can still apply. There can be procedures where “the holes” in all the bits of cheese line up. In this analogy, it means that sometimes, things can happen that are out of your control. The hardest part is going into the next procedure with another patient and maintaining your confidence. Confidence is vital for working in a procedural field.

17. Do you have a time that you experienced failure or struggle in med school or residency, and how did you overcome it?
   • Everyone fails and struggles at some point. Long hours and lots of stress can be difficult to manage. Often times, family and friends don’t understand what you are going through. Many decisions are made, and some are wrong. You overcome it by being honest with yourself and honest with your colleagues. Don’t be afraid to ask for help; take advice from people who care.

18. What specialty(s) did you originally think you were going to end up in when you entered medical school? What changed?
   • I thought I would end up in either a subspecialty of medicine or surgery. I wasn’t sure which one. I wanted something with flexibility where I could do many different things, as it keeps work from getting mundane.

19. What was your favorite part about medical school/residency?
   • The friends that I made through all of the steps was the best part. It makes working hard more tolerable and allows for you to lean on others and become stronger.
20. What is one skill that you have that you feel has helped you achieve all that you have?
• I think that I am pretty empathic. When you are able to put yourself in another’s shoes and try to better understand and appreciate another person’s situation, it makes you and your recommendations more effective because it allows you to be both a better listener and more persuasive.

21. What personality do you think are required or necessary in Cardiovascular?
• No specific personality is needed because there are so many different types of cardiologists.

22. What is one piece of advice you would give to those pursuing medicine today?
• Becoming a physician is a marathon. Don’t get too high when things are going well and don’t get too low when you have a setback. Everyone will have highs and lows; it’s just part of the game. I recommend pursuing interests outside of medicine. It gives you something to look forward to and gets your mind off of work/studying.

23. What are the fields/aspects in medicine you feel are on rise? What fields or aspects are on the decline?
• Rise – more research-based guidelines with strong scientific background are on the rise. Recommendations are now, more than ever, founded in research. Cardiology is one of the fields that has the most scientific studies and clinical trials. I can point to specific trials to inform my patient why I am recommending certain treatments. Technology advancements are on the rise too. We have access to new tools that make procedures less invasive.
• Decline – autonomy. Many jobs now involve being employed by others such as a hospital system or a university. I know of physicians who are less aggressive with patients as they fear bad outcomes to which they have to answer to someone who has little health care experience and is only looking at the bottom line.

24. How has medicine affected your home life? Do you feel that you have missed out on any aspect of life because of medicine? Is it possible to have a full life in your field?
• Medical training dominates your 20s. There will be times where you won’t be able to do something you want to do because of work/tests/call/whatever. Some relationships (romantic or non-romantic) may suffer because of your stress/hours. There are things that you will miss out on. However, it is definitely possible to have a full life and have interests and pastimes outside of medicine. One just needs to be prepared that priorities need to be sound and not get completely wrapped up in medicine. You can’t do your best job if you are miserable because you will burn out, cut corners, and not be as diligent as you should.
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