Alexander Robinson-Gabel

Senior Capstone

There are many things that interest me as far as my senior project goes. I have many interests and have really tried to delve into a lot of them over the years to the point where I am fairly seasoned in the mechanics of each one. From scuba diving in Mexico, Hawaii and Honduras to taking part in various medical opportunities. I guess it was the trip to Mexico where I became a rescue diver that I really decided on the life path I was going to take. Prior to the trip, I had very little self-confidence and really had no idea what I was interested in taking as far as career and school were concerned. But then I was able to muster up the courage and smarts to effectively gain my rescue diver certification, and that was really the first time I felt like I could do anything I put my mind too.

I wound up in the liberal studies program more for the fact that it is a highly malleable subject in that the classes I have to take for the degree aren’t as set in stone as they would be in some other degrees. That freedom really let me workout the direction I was going to take in life because the more science, psychology and sociology classes I took, the more interested in those subjects I became. I almost wound up as a cognitive neuroscience major but the school didn’t accept all of my credits when I transferred, so they told me that entering the program as I was would effectively knock me down 2 years to a freshman. That kind of thing was definitely not on the life plan I had mapped out for myself in my head so I went with liberal studies since it let me take a lot of science and psychology classes without adhering to their strange major requirements. The freedom to choose classes I was interested in played a big part in how well I performed. From behavioral neuroendocrinology to the basic anatomy of the human body, I was really able to focus on the medical related classes I felt would best suit me for the career ahead of me.

Once I have graduated in the fall of 2019 I plan to enter the military as a medic and gain ground experience. I need to know how locals are treating their own wounds and what methods service providers have been using to really increase the access to medical care in war torn areas. I believe that in doing this, really gaining face to face time with these people, I will be able to learn a lot more at a faster pace than if I was just reading about it online and in books. From there I want to move into the officer career path so that I can start having and effect on the policy that is handed down to the lower ranks. I want to try and limit civilian casualties and provide more funding for civilian aid programs. Getting the ground medical staff what they need to care for the general population is literally the least we can do as we go around blowing things up and kicking down doors. From there I will have the military pay for me to go to either PA school or medical school. Ideally I would work in an FOB before leaving the service to service the civilian population as an emergency room doctor. A lot of people are unaware of the fact that many without insurance or a primary care doctor actually use the ER as their primary means of getting medical care. I want to be there to help people when they are at their most vulnerable and show them that the world has not forsaken them. I would be getting to deal with both the best and worst that humanity has to offer throughout the course of these jobs, but I feel like the outcome will be well worth the pain. The only way to change the way people view our medical system and get the deserved aid to those who need it is to dive in head first myself. I could never be a politician or a lobbyer, so this is really the only way I can think of to help the largest amount of people. ‘

These high hopes of mine are what spurred the thought process for my senior project research for the semester. I want to really focus on the medical viability of indigenous and traditional medicine in today’s modern, tech driven world. There are still many people who don’t have access to the resources that we do, but that doesn’t mean that they deserve inferior medical care and interventions. I want to try and find ancient remedies for sicknesses, to prevent infection and create more sterile environments and provide the working ones to people with lesser resources at their disposal. I feel like we could learn a lot from these methods, and even apply them to ourselves in order to prevent a lot of small time medical emergencies. It would give validation to thousands of years of tradition and research done by the many longstanding cultures of our world, and really show that humans have been highly advanced in their medical practices, even in the most dire of environments. What indigenous and traditional medicine is scientifically and medically viable in today’s world? What sort of tests did old doctors perform to reach these conclusions? Were they aware of the full span of the effects their treatments had, even if they were unintended? There are so many questions I have about old medicine and only a single semester to try and dig as deep as I can into the collective medical knowledge of the human race. Even if it seems like a short span of time, I believe that with the right resources and the help of others, I can dredge up some amazing answers to some of my biggest questions. There is plenty of great information out there, like the use of Euphorbia Resinifera to mitigate neuropathic pain. While there is a newer form that came to the market in recent decades, it “has been in medicinal use since the time of recorded history” (Appendino).

I could use this opportunity to delve into the medical marijuana argument as well, but I actually feel as though it may hurt my overall method. Marijuana has a lot of good potential medically, but the social stigmas surrounding it and preventing researchers from studying are the two things putting me off it. I believe that once people realize through my research that there is actually some validity to the claims that natural remedies can work, research on marijuana can begin. As of now though, I believe that the argument for the legalization and study of marijuana best be left to the internet.

Annotated Bibliography

- Appendino, G., & Szallasi, A. (1997). Euphorbium: Modern research on its active principle, resiniferatoxin, revives an ancient medicine. *Life Sciences, 60*(10), 681-696. doi:10.1016/s0024-3205(96)00567-x
    - **The article goes over use of the resiniferatoxin derived from the Euphorbium, “a dried latex of E. resinifera” (Appendino) as a useful mediator for pain perception as well as neurogenic inflammation. The journal is a review of previous research and gives a lot of great examples of other research done over the years. The journal also talks about similarities and differences shared between resiniferatoxin and capsaicin responses. They share a lot of properties but capsaicin is ultimately more volatile and a hypothetical “double-edged sword” (Appendino). RTX (resiniferoxin) is actually currently in clinical testing, but it remains to be seen if they will pass through the CDC’s rigorous process.**
    - **The article will be a big boon to my overall research paper since it is a collection of other articles. This will let me pick and choose how to weave it into the paper multiple times. This is the only review journal that I have included in my research paper. There are a lot of useful sources in here all connecting a widely used traditional medicine to current medicine, the whole point of my research paper.**

- Liao, J., Zhao, L., Yoshioka, M., Hinode, D., & Grenier, D. (2013). Effects of Japanese traditional herbal medicines (Kampo) on growth and virulence properties

ofPorphyromonas gingivalisand viability of oral epithelial cells. *Pharmaceutical Biology, 51*(12), 1538-1544. doi:10.3109/13880209.2013.801995

  - **The article talks about the viability of a traditional Japanese herbal medicine in the prevention of Porphyromonas gingivalis growth in the oral cavity. Throughout the course of the research they used a microdilution broth assay to apply the Kampo to the P. gingivalis. In the end, they found 7 herb mixtures that actually had conclusive effects in stunting the growth of the bacterium, with one kampo really standing out against the others and causing a 83% reduced adherence rate of P. gingivalis to epithelial cells. The 7 mixtures that had a good effect shoed no affect on the “viability of oral epithelial cells” (Liao).**
  - **This research really fits right into my project template because it could help provide a cheap dental/oral health alternative to those in low-income areas around the world. Herbs will always be cheaper than medicine. This bacterium has the severe effect of collagen degradation. So the more we can get these herbs out to local clinics and doctors, the easier it will be to provide care to those in need. I can’t wait to really delve into the possibilities that this research provides. There are even journals out there talking about how this bacterium plays a role in the process of acquiring Alzheimer’s and rheumatoid arthritis.**

- Kim, K., Quang, T. H., Ko, W., Kim, D., Yoon, C., Oh, H., & Kim, Y. (2018). Anti-neuroinflammatory effects of cudraflavanone A isolated from the chloroform fraction of Cudrania tricuspidata root bark. *Pharmaceutical Biology, 56*(1), 192-200. doi:10.1080/13880209.2018.1447972
  - **This was a very interesting article to read since it has such large implications for a medicine that has been used for thousands of years in both Korean and Chinese medicines. A plant called Cudrania Tricuspidata has a chloroform compound in it. From this chloroform compound, you can extract cudraclavanone, which has an amazing set of applicable effects for the human brain and fighting disease. This extract has the potential to prevent neuroinflammatory disease. It could even be used as a substrate for the development of other medicines, either amplifying its effects or helping to create entirely new ones!**
  - **This journal is a gold mine of data and possibilities for my research paper. The fact that such compounds can even be extracted from a natural plant is amazing, but that it was passed over for so long is even more mind baffling. While I’m sure there were technological handicaps that prevented its discovery, I feel like western medicine decided a long time ago to prefer man made compounds to natural ones. This source alone gives me so many ideas about where neuropathic treatment could be in future years. So many people could be helped if the extraction process could be done cheaply.**

- Buranasukhon, W., Athikomkulchai, S., Tadtong, S., & Chittasupho, C. (2017). Wound healing activity of Pluchea indica leaf extract in oral mucosal cell line and oral spray formulation containing nanoparticles of the extract. *Pharmaceutical Biology, 55*(1), 1767-1774. doi:10.1080/13880209.2017.1326511
    - **The article went into how nanoparticles could be used alongside the Pluchea indica leaf extract. Now they were looking initially to see if nanoparticles had any effect on cytotoxicity, cell survival and cellular migration in the oral mucosal cell line. They had to extract the compound and combine with nanoparticles to find the data they needed. In the end they concluded that the combination could be used as a good drug delivery system.**
    - **This research could really help out the dentistry industry and especially in third world countries. Finding cheaper delivery methods for drugs will really help lower costs for doctors who don't have access to large amounts of funding like the ones in the united states. Low income areas in and out of country could really benefit from this. Combined with some other drugs or even traditional herb extracts, this could really create a more accessible healthcare system for all.**
- Lu, J., Chen, J., Kang, Y., Wu, J., Shi, H., Fu, Y., . . . Zhao, X. (2018). Jinfukang induces cellular apoptosis through activation of Fas and DR4 in A549 cells. *Oncology Letters*. doi:10.3892/ol.2018.9149
    - **The data in this research is imperative to the survival of thousands of cancer patients. The Jinfukang actually had some pretty significant effects on cell apoptosis and damage to cancer cells. The cancer cells were treated**

with JFK actually had their nucleus condensed and disintegrated. When applied to A549 cells, which are found in the tumors, JFK actually caused total cell apoptosis (programmed cell death).

- **This journal has serious medical implications for not only low income and 3rd world countries. This has the potential to be the next step in the cure for cancer. If they could use modern technology to buff out the effects and spread them out to the cancer cells specifically, it would effectively relieve the body of cancerous cells and tumors. I can't wait to delve even further into this and really bring to light the potential advancements herbal and traditional medicines could have for the human race.**

- Yones, D. A., Taher, G. A., & Ibraheim, Z. Z. (2011). In Vitro Effects of Some Herbs Used in Egyptian Traditional Medicine on Viability of Protoscolices of Hydatid Cysts. *The Korean Journal of Parasitology,49*(3), 255. doi:10.3347/kjp.2011.49.3.255
    - **The experiment was looking to see if the alcoholic extracts of salvia, thyme, menthol thymol on the "viability of echinococcus ganulosus protoscolices via in vitro injection. They were injecting it into cyst cells essentially. They found that the effects were essentially the same as those in the currently prescribed medicine. The effects came into being within the first day, and "all protoscolices died at day 7 PT when treated with the other concentrations" (Yones).**
    - **This means a cheap and viable option could be created for people unable to afford the original medication for hydatid cysts. It tied in perfectly with my topic concept and I believe that in a more in depth dissertation of the material, I will be able to show how it can affect the whole human race. It**

only goes to support my hypothesis that there are traditional and ancient medicines with the potential to lower medical costs for all and create a better healthcare system, especially when combined with modern technology.

- Motohashi, N., Shirataki, Y., Kawase, M., Tani, S., Sakagami, H., Satoh, K., . . . Molnár, J. (2002). Cancer prevention and therapy with kiwifruit in Chinese folklore medicine: A study of kiwifruit extracts. *Journal of Ethnopharmacology, 81*(3), 357-364. doi:10.1016/s0378-8741(02)00125-3
    - **The journal goes into detail about a process where they took kiwifruit extract mixed with hexane, acetone, methanol and lastly 70% methanol individually. They were testing to see if any of the extracts could be used for cancer prevention and anti HIV activity. The piece concluded that it indeed had effects upon both tumors and HIV. It was actually highly effective in that it specifically targeted the cells they wanted without hurting any of the non-cancerous cells**
    - **This piece is great for tying together some of the other pieces I have. I have several pieces that relate to cancer prevention and apoptosis. I believe that I am even beginning to see a pattern in what diseases and afflictions ancient and traditional medicine affects.**
- Zeng, K., Wang, X., Ko, H., & Yang, H. O. (2010). Neuroprotective effect of modified Wu-Zi-Yan-Zong granule, a traditional Chinese herbal medicine, on CoCl2-induced PC12 cells. *Journal of Ethnopharmacology, 130*(1), 13-18. doi:10.1016/j.jep.2010.03.018
    - **They were testing to see if a traditional Chinese herbal medicine had neuroprotective properties. They caused PC12 cells to enter a state of**

neurotoxicity and then they attempted to treat the cellular symptoms with a concoction. The results actually showed that it suppressed apoptosis and increased cellular viability. The MWG (Wu-Zi-Yan-Zong Granule) actually showed great promise and performed in a more favorable manner than they had hypothesized.

  - **This is a big revelation for neuroscience as it could lead to a cheaper medicine for neurodegenerative diseases. This would make it an affordable alternative for low income areas in contrast to the current, highly expensive methods. This fits perfectly with my thesis and I can't wait to weave it into my overall research paper.**

- Garrick, R. (2008). Triptolide is a traditional Chinese medicine-derived inhibitor of polycystic kidney disease. *Yearbook of Medicine, 2008*, 254-255. doi:10.1016/s0084-3873(08)79154-5
  - **This journal talks about how a traditional Chinese medicine can be used to treat a specific kidney disease. The disease in question is Autosomal Dominant Polycystic Kidney Disease, which affects the reception of calcium by the kidneys and causes cysts, renal failure and even death. The triptolide in Lei Gong Teng induces the release of calcium and helps get the kidneys back on track for normal function. It helped reduce the overall cyst formation and really provided the researchers with some solid results.**
  - **This fits well with my overall theme since it is an ancient Chinese medicine combined with current medical techniques. This combination of old and new is essential to the body of my overall research paper. Traditional Chinese medicine seems to be a hot bed of potential innovation from what I**

am seeing. There are several other journals I am using that use information derived from traditional Chinese medicine.

- Fau, D., Lekehal, M., Farrell, G., Moreau, A., Moulis, C., Feldmann, G., . . . Pessayre, D. (1997). Diterpenoids from germander, an herbal medicine, induce apoptosis in isolated rat hepatocytes. *Gastroenterology, 113*(4), 1334-1346. doi:10.1053/gast.1997.v113.pm9322529
  - **This article was centered around the negative effects of Germander on liver cells. Ther was a time when it was given out as weight loss supplement and it was linked to a giant outbreak of hepatitis. This reading goes on to test the effect of Germander on liver cells. The result of the testing concluded that it was highly toxic to the rat hepatocytes. It caused programed cell death within 2 hours .**
  - **This article is important to my research paper because it demonstrates the potential dangers that come with the type of medicine I am studying. There will always be things we don't know lurking in the dark, just like this. It was assumed to be a boon to aid in the loss of cellulose, but wound up being the exact opposite. Hepatitis is only curable if it is hepatitis C, all other versions have no cure. This is a good piece of literature to include because it helps provide the whole picture when it comes to traditional and ancient medicine.**

- Guo, Y., Li, Y., Xue, L., Severino, R. P., Gao, S., Niu, J., . . . Brömme, D. (2014). Salvia miltiorrhiza: An ancient Chinese herbal medicine as a source for anti-osteoporotic drugs. *Journal of Ethnopharmacology,155*(3), 1401-1416. doi:10.1016/j.jep.2014.07.058

    - **The article goes into a preliminary exploration of using Salvia militiorrhiza to help treat osteoporosis and various other brittle bone diseases. So far, there are so few medications that can actively fight these diseases at the source. Through their tests they found that the concoction they created seemed to have anti-osteoporotic effects. They believe that if it is researched more and combined with current medical practices, it could yield some very potent medications that could have profound medical effects.**
    - **Osteoporosis affects so many Americans in their old age, but finally, with this herb in hand there may be some headway made. This article is a great example of why we need to start pouring money into these zones of research. They can yield so much good if they were just given the funding and time they so badly need. I like this article because it helps back up my claims that we need to be combining the old with the new when it comes to medicine. Humans have survived for millions of years, we can't just discard knowledge from the past just because we can synthesize chemicals. Nature has, and always will, be able to create chemicals better than us.**

- Hu, B. (2011). Modified Yi Guan Jian, a Chinese herbal formula, induces anoikis in Bel-7402 human hepatocarcinoma cells in vitro. *Oncology Reports*. doi:10.3892/or.2011.1414

- **This journal talks about how a modified version of Yi Guan Jian can induce programmed cell death in liver tumors. The modified structure was applied in-vitro to Bel-7402 cells and yielded great results. Cell death was accomplished via the inducement of caspase mediated anoikis. They say it may even be “associated with down regulation of p38 MAPK”, which is a kinase that helps signal transduction in solid tumors.**
- **This is yet another Chinese herbal medicine with large implications. It could really help fight different kinds of liver disease and cancers. With more research and funding they could probably combine it with other medicines into a cocktail and create and overall cure for some liver diseases that cause tumors.**

Literature Review

The purpose of this research project is to find a new method of combining traditional/ancient medicine with more modern medical practices to find a way to create a cheaper alternative for the 3rd world and low income communities. The collection and dissemination of data relating to traditional medicine and how it can help provide the cheaper drug to people in 3rd world countries is my ultimate goal. This is crucial to the medical field in a couple of different ways. Firstly, it expands the reach of medical institutions into areas where previously they may not have had much sway due to lack of funds or innovation. There is also the potential open up new revenue opportunities for the medical centers in low income and impoverished areas. Secondly, this can help convince those sitting in higher government positions that this is the kind of research that needs to be funded in order to provide better quality of life to be delivered to the citizens of this world. The current blanket health care system struggles so much when it comes to treating illnesses on a larger scale that we can't even keep the population vaccinated cheaply. The largest downfall of the system in place is that, "those who are sick and need care would come forward to purchase (health insurance), but among the sick, only those who could afford it would actually receive care" (Stone, 1993). When we are giving other countries access to our medical advancements, the price decreases for countries with struggling economies still isn't enough due to the price disparity afflicting those with low income and high need. I will be addressing many themes relating to functional traditional and current medical combinations such as neurological function, oral cells and bacterium, cancer, different kinds of cysts, bone diseases and even about research that went wrong and resulted in what could be viewed as adverse.

Effects On Neurology

There has been significant research on the various effects that traditional medicine has on neurology. There was a study conducted by Kim (2018) revealed that traditional medicine could be used to treat neuritis and inflammation. After separating the cudraflavanone from the roots of the C. tricuspidata plant they tested its effects on different cells in a neurotoxic environment. As a result a significant amount of data revealed cudraflavanone A prevented neuroinflammatory diseases (Kim, 2018). If a proper treatment were created using the compound, it would pair nicely with Resiniferatoxin, a mixture extracted from the latex of Euphorbia resinifera (Appendino, 1997). Akin to the cudraflavanone, the researchers acquired the plants extract and studied its effects in a neurotoxic environment. They got results that were so promising it made it to clinical trials. The trials are for “patients suffering from painful diabetic neuropathy” (Appendino, 1997). Neuroprotective treatments seem to be almost formulated for traditional medical interventions.

A Chinese herbal medicine showed strong neuroprotective properties as well and fell in step with the previous study. Wu-Zi-Yan-Zong is a granule that was prescribed as a “treatment for neuronal disorders, especially for senile dementia” (Zeng, 2010). They treated the PC12 cells with phosgene to try and induce cell death, but the extract was able to protect the cells. It was able to protect the cells by preventing one of the cellular cycles that lead to cell death (Zeng, 2010). As a result, the third world could benefit from neurological medications made from these more affordable, traditional methods.

Oral Cells

Traditional medicines effects aren’t limited to a single part of the human physiology, they can have cause reactions in all kinds of cells. When it comes to the oral cellular structure, traditional medicine is best when combined with modern technology. For example, the Pluchea indica Less is an “herb used as traditional medicine for wound healing” (Buranasukhon, 2017), and its extract can be synthesized into nanoparticles. When the researchers applied the nanoparticles to the cells, they found that it “reduced the migration rate” of oral epithelial cells (Buranasukhon, 2017). The final results of the tests conducted mean that it could act as a substrate for another drug to aid in the healing process for the mouth. Because while it in itself can initiate a quicker healing process, the more appropriate use is as a delivery system for other medications (Buranasukhon, 2017). A good pairing for that delivery system would be the medication made from the Japanese herbal Kampo medications. When combined with rhubarb, they had great antibacterial effects when tested on P. gingivalis. The concoction was able to reduce the binding of the bacterium to oral epithelial cells by a whopping 83% (Liao, 2013). None of the extracts had any kind of cytotoxic effects on the inner mouth cells. The only other effect was that the cells “viability” went down a little bit (Liao, 2013). Low income areas and third world countries all suffer from a lack of access to proper dental care, but these treatments could help change that in the future.

Cancer

Diseases like cancer, resulting tumors have plagued human beings for the entirety of their existence. Thankfully, there has been some headway in the treatment of these ailments using traditional medicine from around the world. Scientists have always thought of folklore as something to be taken with a grain of salt since the story will change a little bit with each passing generation, but Chinese folklore presented an interesting query relating to the kiwifruit. The fruit was prescribed as a treatment for what current researchers think is cancer, based on the translations of ancient texts. Through the course of their tests, they found that the extract from the kiwifruit, combined with various other compounds, had toxic effects on living human oral tumor cell lines (Motohashi, 2002). When mixed with different aggregates, the mixture had fairly high anti-HIV activity (Motohashi, 2002). They never expected kiwifruit to have so many potential positive interactions. Chinese medicine seems to have many ways of dealing with cancer, from the kiwifruit to the Realgar-Indigo naturalis. The RIF had already been shown to be highly effective while treating human acute promyelocytic leukemia (Wang, 2007). The three main components to RIF are tetraarsenic, indirubin, and tanshinone IIA (TIA). The results of the study showed that TIA worked in cooperation to cause a disruption in the cellular reproduction cycle of acute promyelocytic leukemia cells (Wang, 2007). Another great stride forwards for traditional Chinese medicine in the treatment of cancer is the ancient herbal medicine called Yi Guan Jian. When modified using modern technology, it showed promising results when dealing with the Bel-7402 human hepatocarcinoma cells (Hu, 2011). When added to cultures of the Bel-7402 cells, it was able to cause programmed cell death. Combined with some other kind of cancer cell treatment and a delivery system, it could potentially be a useful weapon against such a rampant enemy. Cancer treatment is costly and most of the time people below a certain income level don't even have access to it, but if paired with the right introduction method this mix of traditional and modern medicine could fill that void.

Osteoporotic Medication

Traditional medicine can do more than kill bad cells that we don't want in our bodies. They can simply help to target other diseases for more acute treatment as well, like the root of the Salvia miltiorrhiza. The extract of this root has great anti-osteoporotic effects, but not enough to be considered as a treatment. The study does however, outline the fact that they felt they lacked funding, patients, treatment duration and more (Guo, 2014). The data they were able to gleam from their 36 trials was very promising. The basis of this statement being that more than 80% of the time they were able to get their desired results with very low toxicity to the patients (Guo, 2014). With more time and resources, maybe they could create a viable treatment using the root. Even in money saturated areas, bone diseases are hard to treat due to the fact that we still have so much research to do in that area as a whole. Brittle bones are often treated with a form of therapy, but ultimately still go on to cause great damage to the patients.

Kidneys

Another great function of ancient chinese medicine is to treat polycystic kidney disease. Through this study, they found that Ler Gong Teng can help restart the flow of calcium for the kidneys and counteract the effects of the disease (Leuenroth, 2006). They don't think it is quite there yet, but with more time and resources they could see it being a potential therapeutic strategy when treating autosomal dominant polycystic kidney disease. Sadly, there is no solid cure in sight though.

Parasites

The cures to known diseases don't only lie in ancient asian remedies; traditional egyptian medicine has the ability to cure ailments as well when combined with modern medicine. Now almost everyone has heard of tapeworms at some point in their lives, but it turns out ancient Egyptians had a pretty effective way of killing them in their early stages of development. The journal talks about how the researchers used alcoholic extracts of salvia, thyme and 2 pure compounds of thymol and menthol to treat the early stage tapeworms (Yones, 2011). They essentially took tapework embryos and injected them with the various compounds to see how they would react. They tested their theories side by side with the current medical intervention and found that the effects were essentially the same (Yones, 2011). The protoscolices (embryos) were all dead by 7th day and the results were well beyond what the scientists had hoped for when beginning the trials (Yones, 2011). Parasites run rampant in areas with no access to quality medical care, so any advancement towards their eradication is is favorable. The people most often affected are those who have no way of fighting back, so the cheaper and more effective the medicine, the better.

Negative effects

The purpose of this research paper is in no way meant to mislead and say that each traditional herbal medicine has the potential to cure disease. There was a time where germander was marketed in France as a weight loss supplement due to its previous use as a choleretic and antiseptic (Fau, 1997). As a result, the researchers had a massive outbreak of hepatitis with some cases ending with cirrhosis and were eventually forced to ban the substance all together. This is what happens when the government doesn’t keep track of what is being used by the general public. In a 1997 study, it was found that germander causes cell death when used on rat liver cells within an astonishing 2 hours (Fau, 1997). There may be a way to redirect the results of cellular death towards cells we want to die with scientists can warp the chemical compound a bit and provide a more direct deliver system for the extract.

Conclusion

There have been many contributions to the medical field based on traditional medicine. Each of these journals shows that conventional and ancient medicine have been a veritable garden of Eden ripe for the picking when it comes to knowledge. For hundreds and hundreds of years, it was written off as useless and only used by people with no “real” medical knowledge. That refusal to accept that knowledge is hidden in every corner of the world has set the human race back hundreds of years medically. Imagine if we had been studying traditional medicine alongside scientific medicine since the beginning. There would have cures for diseases that we can’t even begin to comprehend at this moment in time. We need more research funding and resources allocated to the combining to the old and the new, otherwise we will never reach our full potential as a race. The next steps for the research would be to combine it and create cost efficient alternatives to what we have in the system currently. Not to replace what we already have, but to allow more people access to life changing medical care. I plan to do even more research and find more studies that can all be woven together into a more clear tapestry. If even 1 or 2 studies line up in a way that could further the field of medicine in this direction, I will be absolutely elated.

Contribution

Legislation and Corporate Influence

My contribution relates directly to the wellbeing of all humanity. I want to detail a way to combine techniques of applying the extracts of traditional medicine to different methods of introduction. Throughout this portion, I will be discussing how it is possible to not only lower the cost of drugs but possible combination methods between delivery systems and traditional medicine extracts. There are a few ways that medication could be made cheaper within the borders of the United States that may apply to other countries. It seems that scientists have laid the groundwork for me to theorize approaches ranging from nanocapsules too the generic pill form for introducing the extracts I have found in my line of research.

The National Coalition on Health Care (NCHC) is one of the many advocates for helping the people of the nation get "transparency, competition and value in prescription drugs" (NCHC). The main mission statement of the NCHC is "to bring together key stakeholders in order to achieve an affordable, high-value health care system for patients and consumers, for employers and other payers, and for taxpayers" (NCHC). They ensure that brand name manufacturers can't prevent "generic competitors" (NCHC) from obtaining samples, help "reduce the backlog of generic drug applications at the Food and Drug Administration" (NCHC) and even try to give incentives for companies to create "medicines for true rare diseases" (NCHC). The United States has a big issue when it comes to the prices of medications. According to a quicktake on drug prices by Bloomberg, "In the U.S., patients directly pay about <u>14 percent</u> of prescription medicine costs out of their own pockets." (Drug Prices, Robert

Langreth). Just like most people think, my research showed that all the intermediaries like insurance and health providers prevent patients from actually knowing the price of their medicine. There are so many markups that occur from the time it is synthesized in the lab, to when it hits the shelves.

An editorial for the New York Times discusses how cities used algorithms to decide what clinics, hospitals and EMS agencies got certain life saving drugs. The article references US Code Section 1498, which "acts as a sort of eminent domain for patented inventions, allowing the government to circumvent patent protections as long as the patent holder is fairly compensated" (Editorial Board). As a result the government has the ability to gain control of an invention without the creator's consent, and in addition to this, any medication that has been made or could be produced. However, the only question is, why would the companies ever give up medication for free when they can make profit off them. The companies in charge "argue that high drug prices and strong patent protections are essential to spurring innovation..." (Editorial Board). These strong prices are depriving people of medicine they need though. These companies want to expand their profit margins more than they want too actually initiate positive change in the world. The medications that are high priced are usually the ones that have the most profound effects. From chemotherapy too simple epi-pens, the price gouging that companies are allowed to make hurt us all. Chemotherapy costs roughly "$40,102 for first-line mesothelioma treatment" (The cost of mesothelioma treatment, Daniel King), and it wasn't until 2018 that a generic version of the epi-pen was cleared by the FDA. Until that generic alternative was approved, people had to ration food and other things that the rest of us would see as essential, just to have enough money left over for a simple medication costing almost $1000. In low income areas there are plenty of people who simply roll the dice and don't buy epi-pens, which becomes more understandable when you realize they have to choose between rent/food or the medication.

On the same note, NPR ran an article on the various ways that the feds could cut the price of life saving medications. I'm sure that other countries could benefit from their insight on how to get their citizens the medications they need for a price that they can afford. From allowing the feds to "negotiate drug prices" to simply "shedding light on who pays what for prescription drugs" (Kodjak). I feel like the most prominent of their potential solutions was to "take away incentives for doctors to administer high cost drugs" (Kodjak) since the physicians serve as the front line for all those in need of help. If they have any kind of voice whispering in their ear that isn't directly in the best interest of their constituents, it can be disastrous. That is how we have gotten entangled in the current opioid crisis that grips the nation. The more control and freedom EMS and doctors have when it comes to their patients, the better. Lobbying may be beneficial for companies, but it creates an odd reality where companies can pay to have their products moved in larger quantities. The thing about extracts is, nobody really "owns" and extract. You may be able to patent an extraction method, but nobody is out lobbying for natural extracts. In order for these extracts to be used as medication for those in need, they have to jump the hurdles of American capitalism. There is a lot of potential in the use of extracts, especially when it comes to neurological and cancer based disease. The only thing holding back this revolution is that the research is still in near infantile stages, so there is nothing to really show off to investors or corporations.

Each of the extracts I described in the first part of this project worked very well when applied in vitro to the various cell types and bacteria. But none of them had a method of introduction mentioned by the researchers, even though that's a crucial part of the medical process. In searching for various ways of introducing the potential medications I found, I came across a few different already researched methods, and some patents that I believe could move the medications to the targeted cells. In my opinion, there are methods that could could work if applied in either pill form or through injection. None of the introduction methods I've come across specify how the extracts can be ascribed to them, but I believe that simply based off of the makeup of the system, I should be able to decipher which will be the most viable way of bonding the molecular structures with the goal of creating a theoretical direction for the research to go in next.

What The Next Steps Should Be

The first method I wanted to address was the Osmotic Drug Delivery System (ODDS), created by Takeru Higuchi and Lawrence and Kans. This method was patented back in 1984, so one can only assume that it has been in use for a while now. They created the device for everything from "oral ingestion, implantation, rectal, vaginal or ocular insertion" (Higuchi). This device would really help out with some of the non-cell targeting extracts that I have researched because it is equipped with a quick release mechanism. This would allow it to disperse a medication at a highly increased rate; much faster than if it was simply put in pill form and put through the digestive process. I think that this method of introduction would pair well with the Jinfukang extract since it has so many potential ways to enter the body. Cancer can sprout up almost everywhere in the body due mainly to the fact that it is caused by a simple mutation, and since this delivery system can enter from so many different areas, it's ideal for a cancer treatment. There was never any cellular toxicity linked to the Chinese herb Jinfukang

and if they can find a way to directly apply the ODDS to a region with cancer, I think that it could revolutionize cancer treatment. Direct surgical implantation of the delivery system into the cancerous tumor means that there is the potential for the extract to have a direct effect and cause cellular apoptosis in the cancer cells.

The next potential introduction method I want to introduce you to are the "Bioadhesive Microspheres as a controlled drug delivery system" by Jaspreet, Kaustubh and Garg. If we were able to adhere the kiwifruit extract to a peptide or protein, we could attach it to a bioadhesive microsphere. The next step would be to have it stick directly to the lining of a cancerous tumor and have it release the protein/extract combo. The kiwifruit extract was shown to have no ill effects on non-cancerous cells so there would be no worrying about hurting viable cells.

The bioadhesive microspheres could also be applied directly to the bloodstreams and modified to have an extended release. If combined with other treatments for HIV, the kiwifruit could help to suppress the symptoms and, if given proper funding in order to conduct further research, be combined into a cure. The fact that the microspheres can adhere to cell walls means that it won't just be passed through the body and released through the urine like most medications that are currently on the market.

The Bioadhesive microspheres would also be highly useful for medications relating to neuro diseases. If cudraflavanone A were able to be attached to the microspheres, they could be modified and programmed to attach directly to the blood vessels in the brain. The cudraflavanone A would then release and assist in preventing of neuroinflammatory diseases. This medication would be essential to patients in the post-op phase of the brain surgery. After surgery, infection and disease are most likely to set into a surgical area right after surgery due to the incisions made. There is also the potential for contaminated materials to make their way into surgical area throughout a lengthy surgery. There is the potential to quell the swelling and neuroinflammation in ways that current methods simply can't achieve. Surgeons that are forced to work in less than sterile environments would really benefit from this. The patients would benefit from a more sterile surgical area and the proper therapy for inflammatory diseases that previously went untreated

During this research, I discovered that there remains a huge gap and almost all of the experiments that were conducted with the various extracts was done in-vitro, therefore it is impossible to tell if they work just as well in their natural environments. I believe the next step would be to recreate the biological environment that each extract would be targeting. If it was cancer, then maybe using the cancerous tissue of a live animal would be the best route. This would allow the extracts to work their effects in a live tissue environment, a key part in finding out if there are any side effects that could occur in the post op period. A lot of different theories have to be tested to see how these treatments affect tissue and the overall organism in the long run.

There is also the issue of actually binding the extracts to the delivery system. The type of delivery system coupled with the extract that's being introduced is what it all really comes down too. There is a single system I found that has the potential to be a viable introduction method for multiple extracts. The journal spoke of a great method of using nanoparticles and capsules made from alginate and chitosan to act as delivery systems for medicines. “The drug release profile showed a slow and sustained release at a neutral pH…” (Natrajan). The nanocapsules would be amazing when attempting regular, non targeted treatment. There are other methods that would be better for targeted cell therapies. This introduction method would best be used in tandem with the osteoporotic, diabetic neuropathy, and neurological therapies. The “nano capsules were hemocompatible, which suggests that they are a suitable carrier for further biomedical applications” (Natrajan). The various plant extracts would fit perfectly inside of a slow release nanocapsule that can be created to release at different rates. This means that the capsules could be used to create both fast acting and long term medications. The next steps would be to streamline the production process to make it cheaper. The method would need to be simplified the point that countries with limited resources could have access too it. If combined with an extract that, in itself had a positive therapeutic effect ranging from prevention to treatment of diabetic neuropathy, an extract like

Moving from in-vitro to in-vivo experimentation comes with its own set of difficulties, that are often unforeseen by the researchers. When using live patients, researchers run into a lot of problems, like having “many patient presentations complicated by multiple comorbidities and occurring in the context of chaotic and fragmented clinical environments…” (Holomboe). This can be that the person used in the in-vivo study failed to disclose, or if there is simply a negative reaction in the patient. A journal I read talks about all the potential factors that have to be considered when creating a live experiment, and the writer was able to split them up in to 3 simple categories that are fairly easy to follow.

The first of them would be the physician factors, which can include “expertise, self regulation, deliberate practice, instructional format, sleepiness and wellbeing” (Holomboe). When you boil it down to its essentials, it basically just asks if the person is fit enough to perform the research experiment. It can take a lot out of person to stand by a patient or analyze them for hours at a time while looking for miniscule changes in their condition. The researcher also has to be able to properly relay what is happening to the patient involved, because there are a lot of laws governing exactly how studies have to be performed and what the people involved can and can’t know.

The second factor set would be the patient factors, regarding the “acuity of the illness, spoken english proficiency, emotional volatility and their support structures” (Holomboe). This section really takes a look at the patient, not as a participant but as a person. The most important sections of patient factors, in my eyes, would be their support structures and acuity of illness. First one must ensure that the patient actually has the exact ailment you are looking to research and has no other potential mitigating factors which would cause issues like, but not restrained too, allergic reactions. Secondly is the support structure, a key component not only because the person is already sick and going through a lot, but on top of that there is the toll that treatment can take. I am sure that during the first trials of chemotherapy there were many dropouts and people that were on their “last leg”, emotionally speaking, by the end. The physical toll enacted upon the patients could never have been quantified during the in-vitro stages of that therapy. A support system may be the only thing holding a patient with the study all the way too the end to reap the potential rewards. In cases where the research study leads to a dead end or winds up having no effect at all, it can be a devastating loss for those involved.

The final factor to take into account would be that of the “practice”. These include the “appointment length, ambulatory or inpatient setting, common versus rare presentation and the staffing” (Holomboe) for the facility. Essentially one must properly plan for an event ahead of time. It’s imperative to have an adequate space along with people who can devote their time to the research and patient care. Most of these factors are addressed when the scientists are presenting their research before a board for approval. If a board greenlights an experiment with obvious fallacies then it could potentially be liable if anything heinous or unpredicted occurred. Ensuring the safety and privacy of all involved is one of the top priorities of these committees.

A simple complication I have been considering is whether or not the effects on the surrounding cellular structure could differ when in an active environment. There were several extracts I researched that stated how the surrounding cells that weren’t afflicted remained unaffected by the treatments. I believe that there is a potential for other outcomes to occur, especially when it comes to a live human being. Anything from the way that a specific person's DNA is sequenced to a disease they have unknowingly contracted could cause mass cell death. If there was a disease that caused the surrounding healthy cells to mimic the target cells in any way, there is the potential that any kind of intervention could affect them as well. We have no way of controlling where the interventions spread to or how they interact with their environments.

Another amazing discovery I made through the hours of research was about the synthesis of silver nanoparticles. I always assumed that there was some kind of manmade catalyst that had to be involved, thus making the process more expensive as a whole. It was quite a suprise when I found a journal that outlined with process and study on the creation of silver nanoparticles using Elettaria cardamomom (cardamom) as the base. They found that after synthesis, the SNPs (silver nanoparticles) had a much larger purpose than to simply act as an antibacterial with the potential to help in the fight against antibiotic resistant strains. In a stunning turn of events, it turns out that "the applications include… food and water storage as well as waste or irrigated water treatment, cleaning utensils and used as disinfectant when added to soap and water" (Zaid). This research would cause a dramatic increase in the quality of life for so many citizens around the world with low income households able to buy this single product. Maintaining an antimicrobial environment in an otherwise unclean setting such as small villages where access to clean drinking water is lacking. I would also love to further my research in hopes of seeing if the BCSNPs (biosynthesis cardamom silver nanoparticles) could be put in the water with the same effect. If it could be modified to do so, there is the potential to treat well water with it and create clean water sources for small communities. Cardamom is a fairly abundant herb, so as long as the production of the nanoparticles can be made affordable, the antibacterial effects could become a part of one's household knowledge.

Also, I would be interested in seeing the silver nanoparticle synthesis done with other extracts to see if it can be used with more precisely targeted treatments. The creation of nanocapsules is a complicated one, but when boiled down to the essentials, it's a little bit simpler. Especially when you make the outer shell and inner nanoparticles at the same time; the hypothesis that the researchers acted upon was that "a free-radical photochemical initiator, which is used to promote the polymerization within the bilayer, would also facilitate the growth of nanoparticles in the aqueous core" (Shmakov). In more layman's terms, it causes a shell to form while simultaneously causing the innards to convert into a sort of filling, thus bypassing a whole part of the medical research process.

One of the biggest selling points for this method is its controlled permeability. This means that the delivery system could be programmed to attack a certain kind of cell within a region. For example, a cancer tumor would be highly susceptible to the extract from the kiwifruit, or the Jinfukang. Kiwifruit extract was effective when it came to fighting the spread of cancerous tumors, with the added effect of anti HIV activity. To be a bit more precise, “The kiwifruit gold extracts has also tumor selective, cytotoxic activity and antimicrobial activity, which can be distinct from anti-HIV activity” (Motohashi). The Jinfukang is known to attack a certain kind of cancer cell that is commonly found in the tumors. The combination of the delivery system and the potent remedy presents a possible big step in the field of tumor suppression.

A great drug introduction system for both tumors and neuro issues would be novel ultrasound-sensitive nanocapsules. These are small nanoparticle transports that break apart when hit with ultrasound waves. This could cause highly controlled dispersal of a medicine within a certain region. This would also be an amazing method to have available during prenatal care. As a result, babies could be afforded life saving medicine directly via the mother with no/minimum invasive surgery. The study by Mahalakshmi and Raichur yielded perfect results due to the fact that “when the loaded nanocapsules were sonicated, the presence of nanoparticles in the shell structure led to a rupturing of the shell into smaller fragments thus releasing the FITC-dextran.” (Mahalakshmi). This method would be a great step forward if it were more widely used. Imagine not having to wait to see if a medication actually got where it needed to go and did what it needed to do. All you would have to do is ingest or inject the medicine, and hover ultrasonic waves right over the area being treated. There would be no waste of medicine and I theorize that treatment time could even be redcuuced.

There is actually a specific extract, that when placed in nanocapsules, would be a perfect fit for the ultrasonic release. “Borneol is widely used in traditional Chinese medicine to facilitate the distribution of central nervous system (CNS) drugs in brain due to its ability to open blood–brain barrier” (Yu). The study performed by Yu and their colleagues proves that Borneol has the ability to open the blood brain barrier, which indicates that if it is paired with another extract like cudraflavanone A, it could turn the medical world upside down. Cudraflavanone A could be combined with Resiniferatoxin, an extract that showed promise in treating “patients suffering from painful diabetic neuropathy” (Appendino, 1997). A fast acting ultrasonically operated anti neuroinflammatory drug that bypasses the blood brain barrier is only a few steps away. If I am right, the potential to create a brand new and viable medicine is right in front of us. All we have to do is realize as a species that natural extracts are worth our time and money.

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