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A Pharmacogenomic blog and you

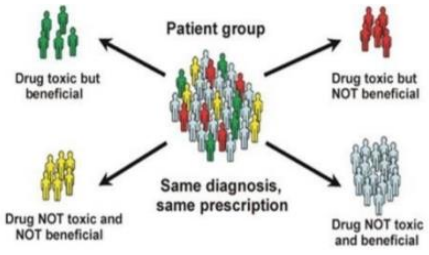
By Jordan Lee

Have you ever had a really bad migraine, like one where you just can't focus or do anything until you pop a few (maybe 4) tablets of your favourite "over-the-bar" painkillers and down a glass of water like there's no tomorrow? No? Well it looks like I'm part of that statistic. But what I can definitely say what statistic I'm not a part of is the one where I know the drug effects and what they are currently doing in and to my body while I chug down a glass of water and pop a handful of painkillers into my mouth just like right now.

Pharmacogenomics **1**. Although the word seems to be underlined in the trademark zig zaggy red line when typed on a word document, which is known to be an incorrect word while using Microsoft office, is anything but incorrect. The word pharmacogenomics is actually a combination of two words/fields combined. Pharmacy for the study/science of drugs and genomics, the study of genes and their functions. For the people good at maths, I've got a more fun way to break it down for you.

Pharmacy + Genetics = Pharmacogenomics

Now that we got the basic stuff out of the way, let's move on more to the slightly (but not a lot) advanced stuff. Pharmacogenomics as mentioned above is study of pharmacy and genomics together. What this combination of the two sciences can give us is a better understanding of how drugs affect an individual's system (how their metabolism affects the drugs), the side effects of the drug on the individual and also designing a dose that can be effective and not detrimental to an individual due to their genetic makeup and other factors such as age, weight, ethnicity and any immunocompromising factors.

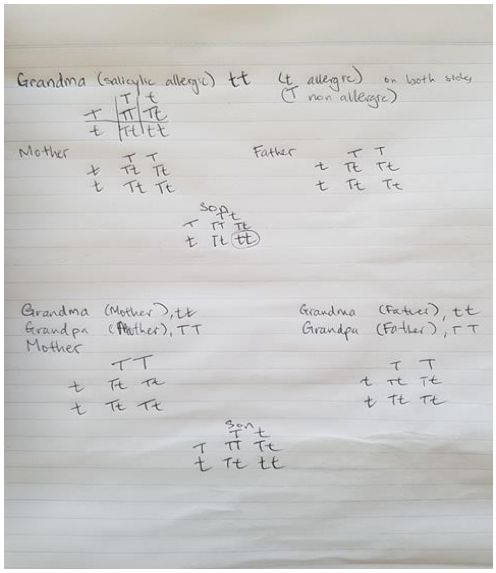


Now the thing with people using painkillers and other medications are a bit more complex than the idea of an individual not taking it or having a customised cocktail of pills catered to an individual's genetic makeup. One of the major challenges that the principles of pharmacogenomics faces is the one that a drug should not have any negative side effects on the person taking them. Unfortunately, everyone has a different genetic makeup. There is a minute chance that people will have identical DNA and genetic makeup (with twins not having identical DNA as well). Because of this problem, to have a combination of pills tailored to one person will be time-consuming and also not cost-efficient. Most of the drugs produced nowadays are aimed to have an effect on everyone but that doesn't always mean it'll have the desired effect on the person taking it.

Drugs being taken into the body are metabolised (broken down) by enzymes (biological chemicals in the body that help to facilitate this process). When drugs are broken down, they are then transported around the body to give off its effects but sometimes, they can give a negative side effect. These negative side effects from improper use or metabolising of drugs can result in hospitalisations as well as death which is why the subject of pharmacogenomics is an important one as instead of just understanding the pharmacology aspect of drugs being metabolised in someone's body, we have to also understand the perspectives of someone with genetic conditions and disorders when they properly can't metabolise a drug.

With that being said, let's delve into crash course 101 of genetics and drugs. I've currently been a part time barista while studying at university to make some extra cash. One of my old managers I used to work with had an interesting condition. During one of my shifts, he just got off sick leave after recovering from a jaw surgery of some kind (the matter wasn't important to what he got but the story is). He told me how he was allergic to aspirin and some form of salicylic acid which prevents him from taking any painkillers. As a result, the doctor had to put him under in some other way. I

asked him if any of his other family members or even any distant relatives had this condition to which he replied his grandmothers from both sides did but his parents didn't. This got me thinking in terms of punnet squares if his allergy was some kind of genetic trait being passed on. If anyone is unfamiliar with this topic, the punnet square method allows us to determine the genetic makeup of an individual from the traits passed from their previous family members like so.



It was through this event that I understood the importance of pharmacogenomics

Single gene therapy involves the genetic testing of one gene found inside a person. The million dollar question however is, how does it work? Pharmacogenomics like previously mentioned before has a process called single gene therapy. The million dollar question however is how

-How does it work?

2 Genes are known to be the basic unit of genetic materials. They are part of DNA which give information for the production of specific proteins to give specific functions. As known from basic biology, every individual has two copies of each gene; one from the father and one from the mother. With each specific protein, it can give advantages or disadvantages when it comes to ingesting drugs. Some proteins might have the ability to metabolise drugs faster, not able to metabolise the drug or even give a negative response to the body instead. Pharmacogenomic tests look for these genetic conditions in individuals to determine the correct dosage and drug that should be prescribed to a patient

-include examples of single gene therapy being used at the moment

2

DRUG	ASSOCIATED DISEASES/CONDITIONS	GENE(S) TESTED
Warfarin	Excessive clotting disorder	VKORC1 and CYP2C9
Thiopurines (azathioprine, mercaptopurine and thioguanine)	Autoimmune/childhood leukaemia	TPMT
Clopidogrel	Cardiovascular	CYP2C19
Irinotecan	Cancer	UGT1A1
Abacavir	HIV	HLA-B*5701
Carbamazepine, phenytoin	Epilepsy	HLA-B*1502
Some antidepressants, some antiepileptics, some anti-cancer drugs	Psychiatric, Epilepsy, Cancer	CYP2D6, CYP2C9, CYP2C19, DPYD

Examples of tests being carried prior to drug being prescribed

-influences on clinician's decision to use

-this way it is safe and the correct dosage/customisation of the pills/medications prescribed to a patient is adequate.

-I think this is fair and safe because.....

On the impact of society and further beyond

Through the practice and further research of pharmacogenomics, single gene therapy can heavily influence and positively affect the methodology of clinicians prescribing patients with drugs. Tests only need to be taken once as genetic material/makeup rarely change and if they do, not by a lot. Through increased practice of recording every patient's medical history, drugs can be prescribed to patients in a safe and controlled manner with very little risk ever developing inside the body as dosage will be controlled and calculated to specifically fit every individual. It can also make processing and prescribing medication to patients more quicker and efficient.

In my opinion, the topic of pharmacogenomics heavily biases the influences of a clinician's decision and thought process in what to prescribe a patient with which drugs. This is because through the process of the single gene therapy, clinicians can determine the correct type and amount of a drugs that should be prescribed to a patient in a safe and controlled situation.

What can benefit through future research of pharmacogenomics? Its use is currently quite limited, but new approaches are under study in clinical trials. In the future, pharmacogenomics will allow the development of tailored drugs to treat a wide range of health problems, including cardiovascular disease, Alzheimer disease, cancer, HIV/AIDS, and asthma. - **EDIT**

To anyone who's reading this blog, I heavily recommend to have a single gene therapy test. You only have to do it once and I can guarantee you won't regret it.

References (Note: edit and reference properly later)

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