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Intersection of Chemistry & Technology to rewrite human Biological narrative for restoring Health

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Time is right now to re-invent how we measure, analyse & interpret chemical reactions at molecular level using technology to eradicate chronic diseases

Our Biology is unique, as distinctive as our fingerprint & at any given point in time, this hotbed of biochemical activities process tens of thousands of biological functions. At core, a lot of these biological functions, such as the immune system, mitochondrial functions etc are regulated by the microbiome. This makes science behind human health so complex & fascinating!

Every Story we create, creates us

The starting point of our life is DNA which we inherit from our parents. DNA makes us who we are. It is a static vocabulary of the genetic alphabets for our biological narrative. Each of our cells has a nucleus which contains DNA molecules organised into genes that is home to standard operating instructions for functioning of cells. But this individual genetic code is static throughout life. Some DNA does mutate during cell division & other processes, however in-built cellular machinery tries to repair these mutations to bring DNA back into its original state. The mutations that survive (usually <10%), result in genetic disorders.

DNA does not matter, it is not our destiny. For instance, if we were to sequence DNA of liver, lungs, brain & heart, DNA of these tissues are the same. DNA has potential to be any one of those organs but it does not tell you which one it is & what function it performs. It is no brainer that each of these organs perform vastly different functions which differentiate them. It is not the DNA, but the expression of genes through the DNA that define their functions & role in our health.

However, in the modern day world, people are grappling with chronic diseases which have no association with their genetic code.

Our daily actions impacts our genes expression & state of our health

The actual biological storyline- work your cells perform to extract & generate energy, repair, divide, fight etc is defined by how these genetic alphabets or genes are expressed based on what we decide to do everyday.

The things we do such as food we eat, the activities we do, specifically functions performed by trillions of micro-organisms living at different sites inside our body give rise to different external triggers which result in secretion of various metabolites into the system.

When these external triggers activate, DNA molecules are copied into RNA molecules. These RNA molecules translate the DNA sequence into proteins that perform, inhibit or activate various actions or functions.

Microbiome is doing most of the talking

Things get interesting here. Human gene expression, constituting 25000 genes, accounts for only 1% of total gene expression inside the body. 99% of gene expression, covering 2 to 20 million genes, belong to trillions of microbes living inside of us.

For instance, when we have gut microbial dysbiosis, expression of certain genes of gut microbes that code for protein that triggers chronic inflammation & signals pro-inflammatory activities are increased.

Rather than collecting & analysing information about static DNA, the focus has to be expressed RNA of genes that triggers activities via encoding of certain proteins.

Unlocking molecular storylines

Thousands of research studies & clinical evidence have now found that the majority of these external triggers arise from production of harmful byproducts a.k.a metabolites which results from microbiome performing suboptimal functions. These metabolites are biochemical signals that activates immune system response leading to systemic inflammation

Inflammasomes, the immune system sensors, determine the nature of the immune system's inflammatory response & activates certain enzymes that upregulates secretion of pro-inflammatory molecules such as cytokines, TNF-Alpha & more. It is these molecules that trigger the onset & progression of chronic disease conditions.

However, these pre-symptomatic molecular signatures are completely invisible & cannot be identified & measured using traditional clinical tests. We wait for these molecules to translocate in blood streams & symptoms to arise & then we adopt the modern medicine driven Pharmaceutical strategies to suppress those symptoms.

There is a need for a paradigm shift from reactive & symptom care to preventative approach so that these molecules are eliminated before the symptoms arise & disease does not even occur.

Chemistry & Technology to decode molecular mechanisms underlying chronic diseases

Our biology is nothing but a bundle of chemicals & chemical reactions. It does not have eyes or ears rather it responds to chemical sensing & signals. Since 99% of the genes expressed inside our body belong to microbes & at any point in time, these microorganisms encode for 1-1.5 million genes, a lot of these chemical messaging & signalling is performed by these microorganisms.

The interactions of these microorganisms living in our gut & mouth with human tissue, their translocation to blood stream & organs & with thousands of food substrates are independent risk factors for a number of systemic & chronic diseases.

The best case scenario is the food we eat. Our body's ability to metabolise molecules & substrates in food is limited epigenetically. A lot of these foods are synthesised by our microorganisms. With every meal, there are floods of chemicals that hit our colon where 40 trillion microbes are expressing 1 million genes & performing upwards of 50,000 biological functions. It is these huge sacks of chemical interactions that program our biology for either health or disease.

It is virtually impossible for human beings- the healthcare practitioners, doctors, nutritionists etc. to decipher these biochemical reactions & trillions of datasets. This is the reason why measuring biology at molecular level has never been a topic of interest.

Thankfully time is on our side now. We now have all science & technology tools at our disposal to understand these molecular mechanisms at play.

We now can marry biology, chemistry & technology to actually decode if an individual's body is producing proinflammatory molecules which have not been able to reflect in any plasma level investigations till date.

When it comes to human health, there are three exponential technologies at play-

-**Next Generation Sequencing**: Using human & microbial gene expression sequencing to digitise the human body at molecular & cellular level. This translates into 130 million bytes of molecular data for an individual. Combining these molecular data sets with data points & scientific evidence from existing scientific literature, customer phenotype & data points from clinical studies makes a massive warehouse of molecular datasets at our disposal.

-**Cloud Computing** to process these huge molecular data points coming from multiple sources

-**Artificial Intelligenc**e: Building & training machine learning models for human biology to make sense of these huge datasets to decode what is happening inside the body at mechanistic level & determine pre-symptomatic/Asymptomatic molecular signatures that are predictive of range of chronic diseases & cancer.

These exponential technologies can provide huge & massive petabytes of molecular data points & indications for biotechnology companies to

- Suggest precise interventions via molecules in foods & supplements

- Develop small molecule drugs/novel biologics that can inhibit the molecules involved in a disease

-Replace specific microbial activities causing disease with novel immune & phage therapies.

The time is right now to re-invent how we measure, analyse & interpret these chemical reactions at molecular level using technology to eradicate the epidemic of chronic diseases.

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