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The GH-Method

Viscoelastic Medicine theory (VMT #401): Influences of intermittent fasting on both body weight and glucoses using both statistics method and viscoplastic energy model of GH-Method: math-physical medicine (No. 1003)

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Abstract

Over a time span of 2,056 days (5.63 years) from May 1, 2018, to December 17, 2023, the author has practised intermittent fasting (IF) for 800 days, amounting to 39% of the total time period. This study builds on his previous findings of an approximate 2% to 4% reduction in his daily average glucose (eAG) and no significant weight loss resulting from his IF practice. However, in this research, he expanded his data collection, focusing on three glucose components, eAG, fasting morning glucose (FPG), and post-meal glucose (PPG), and applied the space-domain viscoplastic medicine theory (SD-VMT) energy model to explore the interconnectivity between his body weight (BW) and these three-glucose metrics.

In summary, this study's conclusions are twofold:

First, using simple statistical analysis, it showed four different notable reductions due to his IF efforts:

-BW reduced by 0.5%;

-eAG reduced by 5%;

-FPG reduced by 2%;

-PPG reduced by 7%.

The most significant reduction of 7% was observed in his post-meal glucose, which is directly impacted by his intermittent fasting effort, making logical sense. The smallest reduction of 0.5% was in his weight, consistent with his previous research findings.

Second, using the SD-VMT energy model, the energy results are: -FPG: 37%; - eAG: 32%; -PPG: 31%.

The higher contribution of energy from FPG and body weight is due to the strong relationship between obesity and the main cause of diabetes, insulin resistance. Besides, the choice of 90 mg/dL as FPG's normalization factor contributes to higher energy levels compared to eAG and PPG, which use the conventional 120 mg/dL as their normalization factors. It should be noted that, clinically, the normal range for measured fasting morning glucose, is generally between 70 to 99 mg/dL (85 mg/dL being the middle value). FPG above this range or 99 mg/dL may indicate pre-diabetes or diabetes.

The energy between body weight and PPG being the smallest one (31%) is resulted from weight mainly depending on food quantity (portion) while PPG mainly depends on food quality (carbs/sugar). Exercise serves as the secondary infill factor for both post-meal glucose and body weight.

Additionally, most dynamic energies (91%) were concentrated in the early period of 2019-2021.

Key message:
Intermittent fasting practice has the most significant and direct impact on post-meal glucose control, followed by daily average glucose and fasting morning glucose. However, the weight reduction resulting from intermittent fasting practice is not obvious.

Keywords: Viscoelastic; Viscoplastic; Diabetes; Glucose; Biomarkers; Insulin; Hyperglycemia

Abbreviations: CGM: continuous glucose monitoring; eAG: estimated average glucose; T2D: type 2 diabetes; PPG: postprandial plasma glucose; FPG: fasting plasma glucose; SD: space-domain; VMT: viscoelastic medicine theory; FFT: Fast Fourier Transform

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1. INTRODUCTION

Over a time span of 2,056 days (5.63 years) from May 1, 2018, to December 17, 2023, the author has practised intermittent fasting (IF) for 800 days, amounting to 39% of the total time period. This study builds on his previous findings of an approximate 2% to 4% reduction in his daily average glucose (eAG) and no significant weight loss resulting from his IF practice. However, in this research, he expanded his data collection, focusing on three glucose components, eAG, fasting morning glucose (FPG), and post-meal glucose (PPG), and applied the space-domain viscoplastic medicine theory (SD-VMT) energy model to explore the interconnectivity between his body weight (BW) and these three glucose metrics.

1.1 Biomedical information:

The following sections contain excerpts and concise information drawn from multiple medical articles, which have been meticulously reviewed by the author of this paper. The author has adopted this approach as an alternative to including a conventional reference list at the end of this document, with the intention of optimizing his valuable research time. It is essential to clarify that these sections do not constitute part of the author's original contribution but have been included to aid the author in his future reviews and offer valuable insights to other readers with an interest in these subjects.

Pathophysiological explanations and statistical data regarding the relationship between intermittent fasting (IF) and body weight, daily averaged glucose, fasting morning glucose, and post-meal glucose:

Intermittent fasting (IF) has garnered significant attention for its potential health benefits, especially in the context of weight management and blood glucose control. Here is an overview of its pathophysiological explanations and some statistical data regarding its influence on both body weight and various glucose parameters:

Body Weight: Pathophysiology: IF leads to a caloric deficit, which induces weight loss. This is achieved through alternating periods of fasting and eating, which may enhance metabolic switching and fat oxidation while reducing fat storage.

Statistical Data: Studies have shown varied results. A systematic review and meta-analysis of 40 studies published in 2020 in the journal "Cell Metabolism" found that intermittent fasting was effective in reducing body weight, with an average weight loss of 1-8% over periods ranging from 3-24 weeks. (The Author's Note: The duration of 3-24 weeks might be considered brief, potentially resulting in a lack of sustained effects from Intermittent Fasting).

Daily Averaged Glucose: Pathophysiology: IF can influence insulin sensitivity and beta-cell responsiveness, which can lead to more stable glucose levels throughout the day.

Statistical Data: A 2018 study in "The Journal of Nutritional Biochemistry" observed that IF participants had a significant reduction in the daily average glucose level, indicating improved glycemic control.

Fasting Morning Glucose: Pathophysiology: During fasting periods, decreased insulin secretion and increased glucagon levels promote glycogenolysis and gluconeogenesis, leading to a temporary increase in fasting glucose levels. However, prolonged IF can enhance insulin sensitivity, reducing fasting glucose levels.

Statistical Data: A study in "Obesity" (2019) showed that IF could reduce fasting glucose by 3-6% over a period of 8-12 weeks. (The author's Note: His data over 5.6 years had shown 2% of FPG reduction).

Post-Meal Glucose: Pathophysiology: IF can improve postprandial glucose control, likely due to improved insulin sensitivity and more efficient glucose uptake by muscles and other tissues.

Statistical Data: Research published in "Diabetes Care" in 2017 indicated a reduction in post-meal glucose spikes in individuals practising IF, compared to those on regular diets.

It is important to note that individual responses to IF can vary widely based on factors like age, sex, initial body weight, and underlying health conditions. Additionally, most of the research in this area is still emerging, and the long-term effects of IF are not fully understood.

1.2 MPM Background:

To learn more about his developed GH-Method: math-physical medicine (MPM) methodology, readers can read the following three papers selected from his published 760+ papers.

The first paper, No. 386 (Reference 1) describes his MPM methodology in a general conceptual format. The second paper, No. 387 (Reference 2) outlines the history of his personalized diabetes research, various application tools, and the differences between the biochemical medicine (BCM) approach versus the MPM approach. The third paper, No. 397 (Reference 3) depicts a general flow diagram containing ~10 key MPM research methods and different tools.

The author's diabetes history:

The author has been a severe T2D patient since 1995. He weighed 220 lb. (100 kg) at that time. By 2010, he still weighed 198 lb. with an average daily glucose of 250 mg/dL (HbA1C at 10%). During that year, his triglycerides reached 1161 (high risk for CVD and stroke) and his albumin-creatinine ratio (ACR) at 116 (high risk for chronic kidney disease). He also suffered from five cardiac episodes within a decade. In 2010, three independent physicians warned him regarding the need for kidney dialysis treatment and the future high risk of dying from his severe diabetic complications.

In 2010, he decided to self-study endocrinology with an emphasis on diabetes and food nutrition. He spent the entire year of 2014 developing a metabolism index (MI) mathematical model. During 2015 and 2016, he developed four mathematical prediction models related to diabetes conditions: weight, PPG, fasting plasma glucose (FPG), and HbA1C (A1C). Through using his developed mathematical metabolism index (MI) model and the other four glucose prediction tools, by the end of 2016, his weight was reduced from 220 lbs. (100 kg) to 176 lbs. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), average finger-piercing glucose from 250 mg/dL to 120 mg/dL, and A1C from 10% to ~6.5%. One of his major accomplishments is that he no longer takes any diabetes-related medications since 12/8/2015.

In 2017, he achieved excellent results on all fronts, especially his glucose control. However, during the pre-COVID period, including both 2018 and 2019, he travelled to ~50 international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to his diabetes control caused by stress, dining out frequently, post-meal exercise disruption, and jet lag, along with the overall negative metabolic impact from the irregular life patterns; therefore, his glucose control was somewhat affected during the two-year travelling period of 2018-2019.

He started his COVID-19 self-quarantined life on 1/19/2020. By 10/16/2022, his weight was further reduced to ~164 lbs. (BMI 24.22) and his A1C was at 6.0% without any medication intervention or insulin injection. In fact, with the special COVID-19 quarantine lifestyle since early 2020, not only has he written and published ~500 new research articles in various medical and engineering journals, but he has also achieved his best health conditions for the past 27 years. These achievements have resulted from his non-travelling, low-stress, and regular daily life routines. Of course, his in-depth knowledge of chronic diseases, sufficient practical lifestyle management experiences, and his own developed high-tech tools have also contributed to his excellent health improvements.

On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device on his upper arm and checked his glucose measurements every 5 minutes for a total of 288 times each day. Furthermore, he extracted the 5-minute intervals from every 15-minute interval for a total of 96 glucose data each day stored in his computer software.

Through the author's medical research work over 40,000 hours and read over 4,000 published medical papers online in the past 13 years, he discovered and became convinced that good life habits of not smoking, moderate or no alcohol intake, avoiding illicit drugs; along with eating the right food with well-balanced nutrition, persistent exercise, having a sufficient and good quality of sleep, reducing all kinds of unnecessary stress, maintaining a regular daily life routine contribute to the risk reduction of having many diseases, including CVD, stroke, kidney problems, micro blood vessels issues, peripheral nervous system problems, and even cancers and dementia. In addition, a long-term healthy lifestyle can even "repair" some damaged internal organs, with different required time lengths depending on the particular organ's cell lifespan. For example, he has "self-repaired" about 35% of his damaged pancreatic beta cells during the past 10 years.

Energy theory:

The human body and organs have around 37 trillion live cells which are composed of different organic cells that require energy infusion from glucose carried by red blood cells; and energy consumption from labor-work or exercise. When the residual energy (resulting from the plastic glucose scenario) is stored inside our bodies, it will cause different degrees of damage or influence to many of our internal organs.

According to physics, energies associated with the glucose waves are proportional to the square of the glucose amplitude. The residual energies from elevated glucose are circulating inside the body via blood vessels which then impact all of the internal organs to cause different degrees of damage or influence, e.g., diabetic complications. Elevated glucose (hyperglycemia) causes damage to the structural integrity of blood vessels. When it combines with both hypertension (rupture of arteries) and hyperlipidemia (blockage of arteries), CVD or Stroke happens. Similarly, many other deadly diseases could result from these excessive energies which would finally shorten our lifespan. For example, the combination of hyperglycemia and hypertension would cause micro-blood vessel leakage in kidney systems which is one of the major causes of CKD.

The author then applied Fast Fourier Transform (FFT) operations to convert the input wave from a time domain into a frequency domain. The y-axis amplitude values in the frequency domain indicate the proportional energy levels associated with each different frequency component of input occurrence. Both output symptom value (i.e., strain amplitude in the time domain) and output symptom fluctuation rate (i.e. the strain rate and strain frequency) influence the energy level (i.e. the Y-amplitude in the frequency domain).

Currently, many people live a sedentary lifestyle and lack sufficient exercise to burn off the energy influx which causes them to become overweight or obese. Being overweight and having obesity leads to a variety of chronic diseases, particularly diabetes. In addition, many types of processed food add unnecessary ingredients and harmful chemicals that are toxic to the bodies, which lead to the development of many other deadly diseases, such as cancers. For example, ~85% of worldwide diabetes patients are overweight, and ~75% of patients with cardiac illnesses or surgeries have diabetes conditions.

In engineering analysis, when the load is applied to the structure, it bends or twists, i.e. deform; however, when the load is removed, it will either be restored to its original shape (i.e, elastic case) or remain in a deformed shape (i.e. plastic case). In a biomedical system, the glucose level will increase after eating carbohydrates or sugar from food; therefore, carbohydrates and sugar function as the energy supply. After having labour work or exercise, the glucose level will decrease. As a result, the exercise burns off the energy, which is similar to load removal in the engineering case. In the biomedical case, both processes of energy influx and energy dissipation take some time which is not as simple and quick as the structural load removal in the engineering case. Therefore, the age difference and 3 input behaviours are "dynamic" in nature, i.e. time-dependent. This time-dependent nature leads to a "viscoelastic or viscoplastic" situation. For the author's case, it is "viscoplastic" since most of his biomarkers have continuously improved during the past 13-year time window.

Time-dependent output strain and stress of (viscous input*output rate):

Hooke's law of linear elasticity is expressed as:

Strain (ε: epsilon) = Stress (σ: sigma) / Young's modulus (E)

For biomedical glucose application, his developed linear elastic glucose theory (LEGT) is expressed as:

PPG (strain) = carbs/sugar (stress) * GH.p-Modulus (a positive number) + post-meal walking k-steps * GH.w-Modulus (a negative number)

where GH.p-Modulus is the reciprocal of Young's modulus E.

However, in viscoelasticity or viscoplasticity theory, the stress is expressed as:

Stress = viscosity factor (η: eta) * strain rate (dε/dt)

where strain is expressed as Greek epsilon or ε.

In this article, in order to construct an "ellipse-like" diagram in a stress-strain space domain (e.g., "hysteresis loop") covering both the positive side and negative side of space, he has modified the definition of strain as follows:

Strain = (body weight at a certain specific time instant)

He also calculates his strain rate using the following formula:

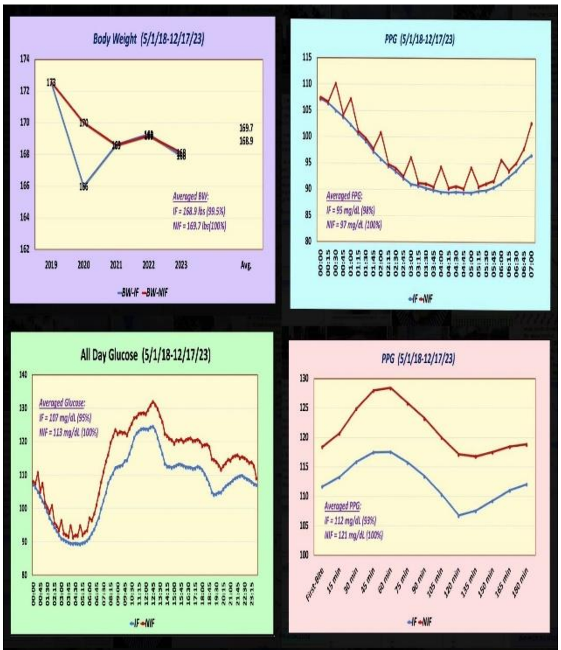
Strain rate = (body weight at next time instant) - (body weight at present time instant)

The risk probability % of developing into CVD, CKD, and Cancer is calculated based on his developed metabolism index model (MI) in 2014. His MI value is calculated using inputs of 4 chronic conditions, i.e. weight, glucose, blood pressure, and lipids; and 6 lifestyle details, i.e. diet, drinking water, exercise, sleep, stress, and daily routines. These 10 metabolism categories further contain ~500 elements with millions of input data collected and processed since 2010. For individual deadly disease risk probability %, his mathematical model contains certain specific weighting factors for simulating certain risk percentages associated with different deadly diseases, such as metabolic disorder-induced CVD, stroke, kidney failure, cancers, dementia; artery damage in heart and brain, micro-vessel damage in kidney, and immunity-related infectious diseases, such as COVID death.

Some of the explored deadly diseases and longevity characteristics using the viscoplastic medicine theory (VMT) include stress relaxation, creep, hysteresis loop, and material stiffness, damping effect based on time-dependent stress and strain which are different from his previous research findings using linear elastic glucose theory (LEGT) and nonlinear plastic glucose theory (NPGT).

2. RESULTS

Figure 1 shows inputs, data table, and SD-VMT energy output diagram.



IF					/ 120	/ 90	/ 120	Rate	Strain	Strs 1	Strs 2	Strs 3	Hgt 1	Hgt 2	Hgt 3	Area 1	Area 2	Area 3	Time
12/18/23	BW-IF	eAG	FPG	PPG	eAG	FPG	PPG	BW-IF	BW-IF	eAG	FPG	PPG	eAG	FPG	PPG	eAG	FPG	PPG	Zone
2019	173	131	115	136	1.09	1.27	1.14	0.00	172.6	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	Y19-Y21
2020	166	108	96	104	0.90	1.06	0.87	-6.58	166.0	-5.91	-6.99	-5.70	-2.96	-3.49	-2.85	19	23	19	91%
2021	169	110	98	111	0.91	1.09	0.92	2.62	168.6	2.40	2.85	2.42	-1.76	-2.07	-1.64	-5	-5	-4	Y22-Y23
2022	169	105	92	109	0.87	1.02	0.91	0.67	169.3	0.59	0.68	0.61	1.49	1.77	1.51	1	1	1	9%
2023	168	105	94	105	0.88	1.04	0.88	-1.35	167.9	-1.19	-1.41	-1.19	-0.30	-0.36	-0.29	0	0	0	
Avg	169	112	99	113	0.93	1.10	0.94	-0.93	168.9	-0.82	-0.97	-0.77	-0.71	-0.83	-0.65	16	19	16	
Correl.	100%	82%	80%	93%										SD-E:	51	32%	37%	31%	

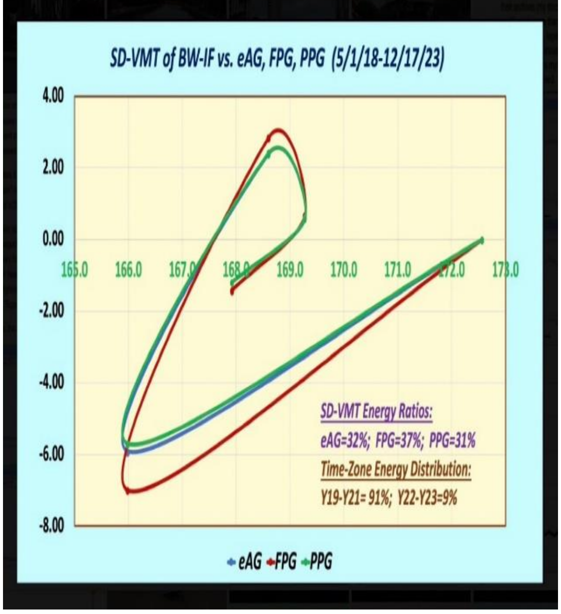


Figure 1: Inputs, data table, and SD-VMT energy output diagram.

3. CONCLUSION

In summary, this study's conclusions are twofold:

First, using simple statistical analysis, it showed four different notable reductions due to his IF efforts:

-BW reduced by 0.5%;

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Key message:

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4. REFERENCES

For editing purposes, the majority of the references in this paper, which are self-references, have been removed from this article. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclairemd.com.

For reading more of the author's published VGT or FD analysis results on medical applications, please locate them through platforms for scientific research publications, such as ResearchGate, Google Scholar, etc.

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Viscoelastic and Viscoplastic Glucose Theory Application in Medicine

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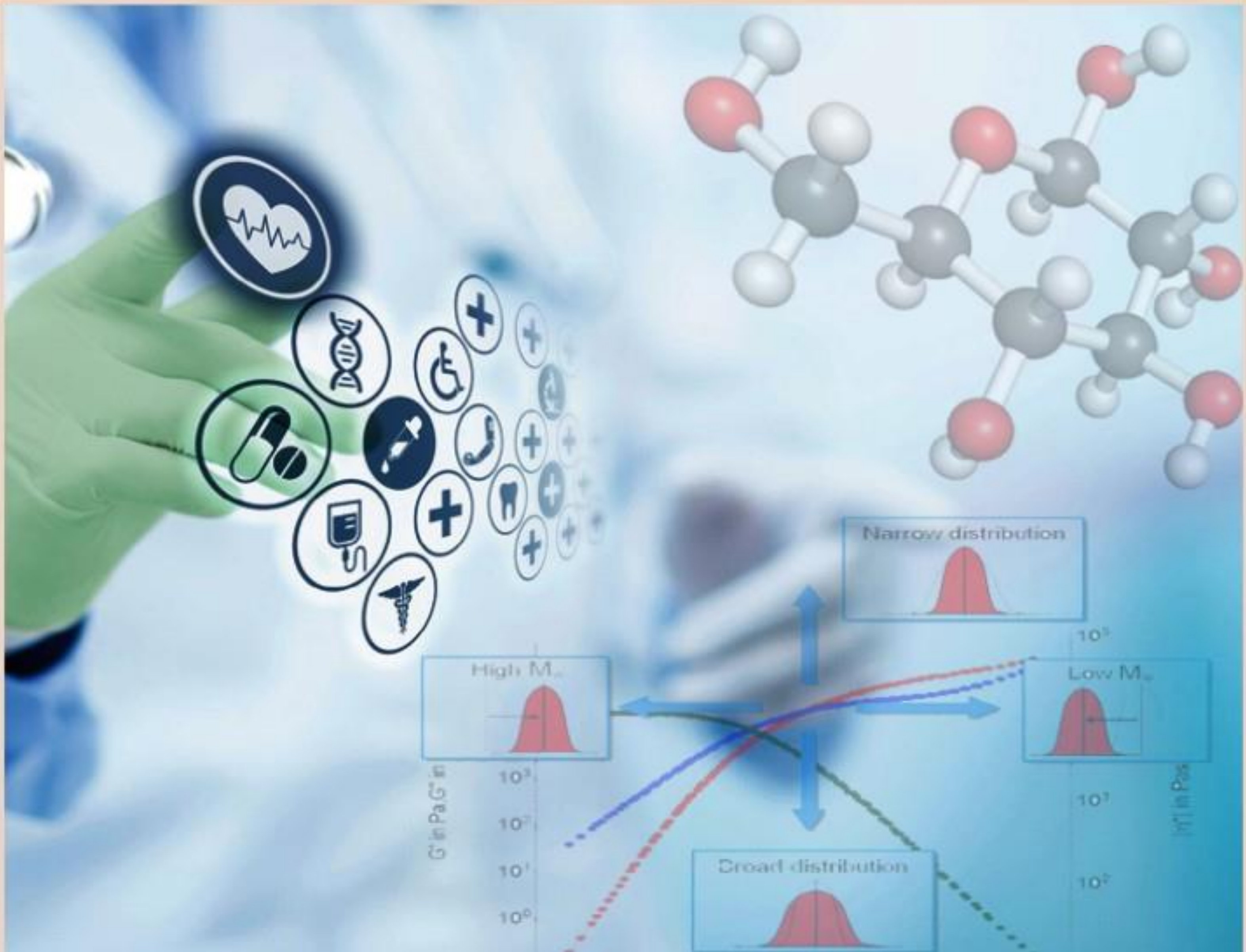

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