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The GH-Method

Viscoelastic Medicine Theory (VMT #403): Inter-connectivity of walking steps on body weight, systolic blood pressure, Alzheimer's disease risks, and overall metabolism index using reversed viscoplastic energy model of GH-Method: Math-Physical Medicine (No. 1005)

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Abstract

Inspired by two NIH articles (PubMed) referenced in the Introduction Section, the author utilized his personal data collected over a 12-year span (from 1/1/2012 to 12/19/2023) to investigate the relationships between his daily walking exercise and four specific health outcomes, body weight (BW), systolic blood pressure (SBP), Alzheimer's disease risk (AD), and metabolism index (MI).

Obesity is primarily influenced by excessive food intake, and secondarily by factors like poor diet quality, lack of exercise, insufficient sleep, digestive issues and constipation. Hypertension is tied to high stress, high sodium diets, inadequate exercise, diabetes, and obesity. Alzheimer's disease risk factors include obesity, diabetes, and hypertension, which can damage brain blood vessels and affect nutrient delivery, potentially leading to vascular dementia and the build-up of amyloid plaques in the brain. The author's developed MI model, comprising about 500 elements, integrates four medical conditions (obesity, diabetes, hypertension, dyslipidemia) and six lifestyle details (diet, hydration, exercise, sleep, stress, daily routines), making it a comprehensive assessment tool. The author has learned that a single health outcome can stem from various input factors, diseases can present diverse symptoms, and some symptoms may also be indicative of other illnesses.

This set of research utilized two papers (one "traditional" and the other "reversed") employing viscoplastic energy theory to study the interconnections between the author's walking steps and the aforementioned four health outcomes.

The second study (paper 1005) uses walking steps as the sole "strain or outcome" and those four diseases as the influential factors and then analyzes them together. It reverses the traditional input-output roles, often seen in engineering applications where stress and strain have fixed roles. Despite deviating from the standard viscoplastic theory in engineering, this approach (in paper 1005) seeks reasonable biomedical interpretations by exploring the direct effects of this "role-switching".

In summary, the four outcome reduction rates are:

-Weight: 11% over 12 years & 0.9% per year, with a strain's change rate of time at -0.01;

-SBP: 18% over 12 years & 1.5% per year, with a strain's change rate of time at -0.02;

-AD risk: 42% over 12 years & 3.5% per year, with a strain's change rate of time at -0.03;

-Metabolism: 45% over 12 years & 3.7% per year, with a strain's change rate of time at -0.01.

It also discovered four significant negative correlations, varying between -78% and -97%, linking exercise to four health outcomes. These negative correlations are strong and expected, as increased exercise usually leads to betterment in most health outcomes.

The second study (no. 1005) analyzed the SD-VMT energy ratios derived from the single strain of walking steps together with four health outcomes as stresses, finding the following energy ranking order: Body Weight (31%) > SBP (29%) > Metabolism Index (23%) > Alzheimer's Disease (18%).

This study revealed that outcomes more directly influenced by physical activity, such as BW and SBP, had higher energy percentages, reflecting a stronger correlation with walking. Conversely, complex outcomes like Alzheimer's risk and Metabolism Index, which involve many more other complex influences and issues, generated lower energy percentages from walking, indicating a weaker direct link with walking exercise.

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Key message:
Biomedical, such as pathological and physiological, understanding of these factors and outcomes are the most important foundations for understanding and interpreting these math-physical analysis data. On the other hand, those math-physical quantitative data also provide a deeper and clearer meaning of biomedical phenomena.

The second study(no.1005) performed one analysis with a single input of exercise versus four outcomes together. Due to interactions between exercises having identical change rates of time versus four different outcomes, their energy rankings order are reversed due to the different averaged amplitude of each outcome.

BW at 31% > SBP at 29% > MI at 23% > AD at 18%

This role-reversed and combined analysis has a single strain of walking steps with identical strain change rate of time versus four different outcomes. Therefore, the associated energies and their ranking merely identify the exercise's impact on each of these four outcomes.

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; MI: Metabolism Index; SBP: Systolic Blood Pressure

1. INTRODUCTION

Inspired by two NIH articles (PubMed) referenced in the Introduction Section, the author utilized his personal data collected over a 12-year span (from 1/1/2012 to 12/19/2023) to investigate the relationships between his daily walking exercise and four specific health outcomes, body weight (BW), systolic blood pressure (SBP), Alzheimer's disease risk (AD), and metabolism index (MI).

Obesity is primarily influenced by excessive food intake, and secondarily by factors like poor diet quality, lack of exercise, insufficient sleep, digestive issues and constipation. Hypertension is tied to high stress, high sodium diets, inadequate exercise, diabetes, and obesity. Alzheimer's disease risk factors include obesity, diabetes, and hypertension, which can damage brain blood vessels and affect nutrient delivery, potentially leading to vascular dementia and the build-up of amyloid plaques in the brain. The author's developed MI model, comprising about 500 elements, integrates four medical conditions (obesity, diabetes, hypertension, dyslipidemia) and six lifestyle details (diet, hydration, exercise, sleep, stress, daily routines), making it a comprehensive assessment tool. The author has learned that a single health outcome can stem from various input factors, diseases can present diverse symptoms, and some symptoms may also be indicative of other illnesses.

This set of research utilized two papers (one "traditional" and the other "reversed") employing viscoplastic energy theory to study the interconnections between the author's walking steps and the aforementioned four health outcomes.

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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.

Physiological explanations regarding relationships between exercise and systolic blood pressure, Alzheimer's disease, and overall metabolism:

Exercise has a multifaceted impact on health, affecting various aspects of physiology including systolic blood pressure, Alzheimer's disease, and overall metabolism.

Exercise and Systolic Blood Pressure:

Exercise, especially aerobic activities, helps to strengthen the heart, making it more efficient at pumping blood. This efficiency can lead to lower systolic blood pressure over time. Regular physical activity can reduce systolic blood pressure by an average of 5 to 7 mmHg, which is significant in reducing the risk of heart disease and stroke. (Note from the author: The author of this article has experienced a total of 18% SBP reduction over 12 years and an average of 1.5% SBP reduction each year).

Exercise and Alzheimer's Disease:

Exercise is believed to benefit brain health and can potentially lower the risk of Alzheimer's disease and other dementias. Physical activity can stimulate brain plasticity, improving cognitive functions and possibly reducing the accumulation of beta-amyloid plaques, a hallmark of Alzheimer's disease. Studies have shown that regular physical activity can reduce the risk of Alzheimer's and cognitive decline by up to 50%. (Note from the author: The author of this article has experienced a total of 42% AD risk reduction over 12 years and an average 3.5% AD risk reduction each year).

Exercise and Overall Metabolism:

Exercise increases metabolic rate, meaning the body burns more calories both during and after physical activity. It helps in regulating blood sugar levels by increasing insulin sensitivity, which is beneficial for metabolic health and can prevent or manage type 2 diabetes. Regular exercise also improves muscle strength and endurance, supports healthy body composition, and can enhance the immune system. (Note from the author: The author of this article has experienced a total of 45% metabolism reduction over 12 years and an average of 3.7% metabolism reduction each year).

It's important to note that the specific effects of exercise can vary based on factors like intensity, duration, and the individual's overall health status.

The normal range for both SBP and DBP:

The normal range for blood pressure readings, which include systolic blood pressure (SBP) and diastolic blood pressure (DBP), is typically as follows:

Systolic Blood Pressure (SBP): This is the higher number in a blood pressure reading. A normal SBP is generally considered to be between 90 and 120 millimetres of mercury (mm Hg).

Diastolic Blood Pressure (DBP): This is the lower number in a blood pressure reading. A normal DBP is usually between 60- and 80 mm Hg.

Two articles the author recently read:

1. Matthew Calamia et al. Pedometer-assessed steps per day as a predictor of cognitive performance in older adults. Neuropsychology. 2018.

2. Dena M Bravata et al. Using pedometers to increase physical activity and improve health: a systematic review. JAMA. 2007.

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 was 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 has no longer taken 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 checks 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 of over 40,000 hours and reading 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-length 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 glucoses 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., deforms; 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 data table, inputs, and SD-VMT energy output diagram.

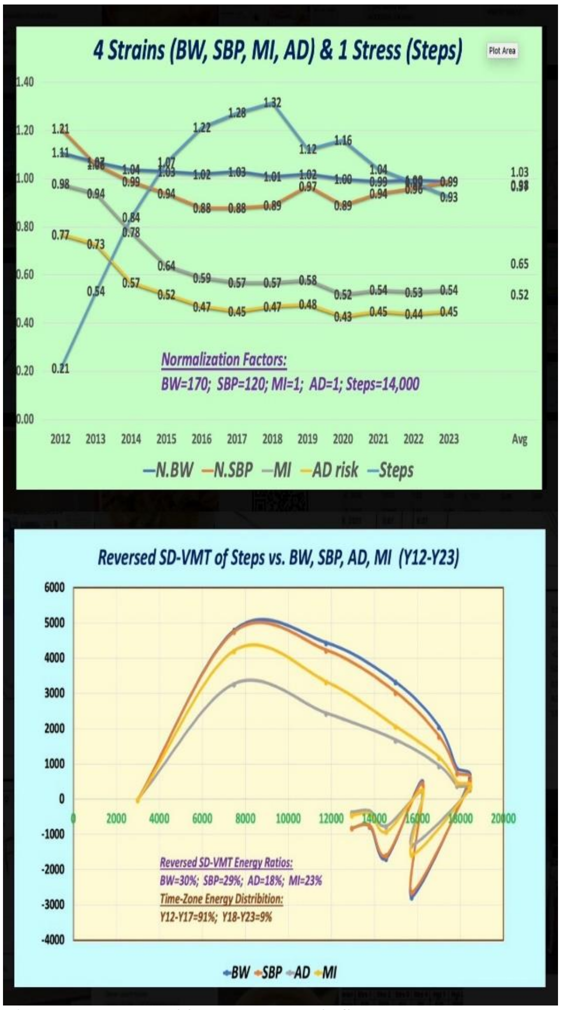

Figure 1: Data table, inputs, and SD-VMT energy output diagram.

3. CONCLUSION

In summary, the four outcome reduction rates are:

-Weight: 11% over 12 years & 0.9% per year, with a strain's change rate of time at -0.01;

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Biomedical, such as pathological and physiological, understanding of these factors and outcomes are the most important foundations for understanding and interpreting these math-physical analysis data. On the other hand, those math-physical quantitative data also provides deeper and clear meaning of biomedical phenomena.

The second study (no.1005) has performed one analysis with a single input of exercise versus four outcomes together. Due to interactions between exercise having identical change rate of time versus four different outcomes, their energy rankings order is reversed due to different averaged amplitude of each outcome.

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This role-reversed and combined analysis having single strain of walking steps with identical strain change rate of time versus four different outcomes. Therefore, the associated energies and their ranking merely identify the exercise's impact on each of these four outcomes.

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.

Readers may use this article as long as the work is properly cited, their use is educational and not for profit, and the author's original work is not altered.

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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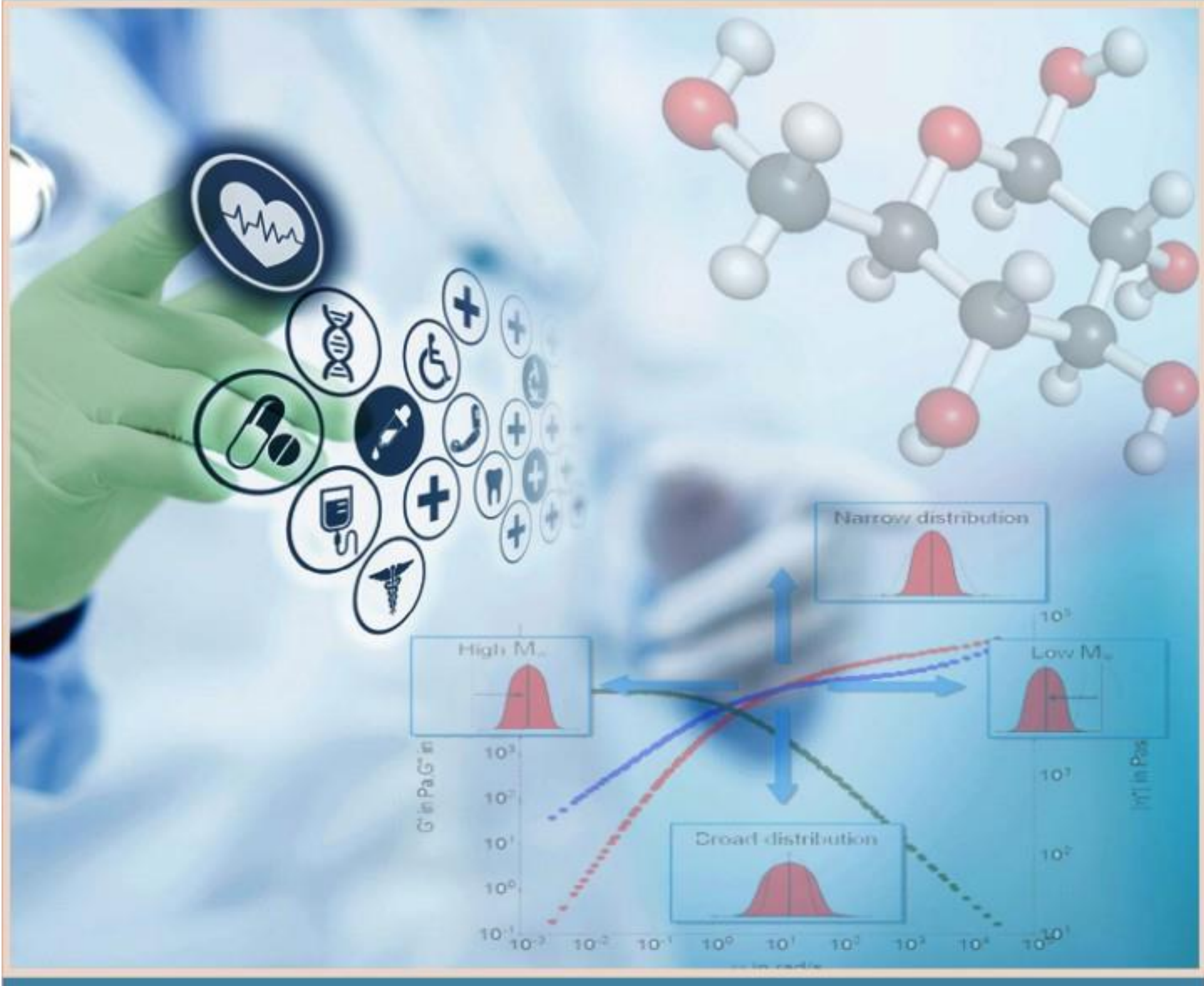

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