

# Functional Medicine Systems Model & the "Order of Things"

The interaction between an individual's genome, epigenome, and exposome is at the core of what determines our health.

The **genome** is our complete set of DNA, containing all of the information needed to build and maintain the human organism.

The **epigenome** consists of chemicals that modify the genome in a way that tells it what to do, where to do it, and when to do it. These modifications do not change the underlying genes, but they can be passed on to future generations.

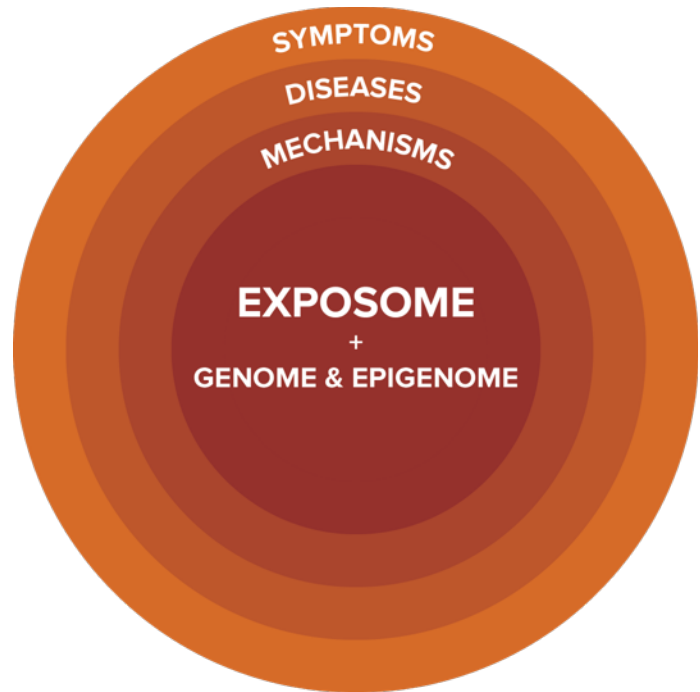
The **exposome** represents the sum total of all non-genetic exposures an individual experiences from the moment of conception through the end of his or her life.

It includes the food we eat, the water we drink, the air we breathe, the chemicals we're exposed to, the social connections we have, and the environment we live in.

To use an analogy, the genome is like a piano, the epigenome is like the sheet music, and the exposome is what determines how the music is written and performed. The quality of the piano will certainly affect the sound that it produces. But the finest piano in the world will still sound terrible if the sheet music and performance are terrible. Likewise, a virtuoso pianist performing a Mozart piece will not be at her best playing a poor-quality piano.

In the same way, genetics do play an important role in human health and disease. However, we now know that the exposome (and its influence on the epigenome) is far more significant in most cases. In fact, it is responsible for more than 90 percent of human disease. That is why the exposome is at the core of the functional medicine systems model and should always be the first thing addressed regardless of the patient's complaint.

The modern diet, lifestyle, and environment affect the expression of our genes and lead to **pathology**, which in turn cause **disease** and **symptoms** in the patient. In conventional medicine, the focus is often on diseases and the symptoms; it works "from the outside in." In functional



medicine, we work “from the inside out.” We pay less attention to the symptoms and more attention to the pathology that produces those symptoms.

My experience is that virtually all symptoms and diseases are caused by the following eight dysfunctional mechanisms:

1. **GI issues.** Includes SIBO; infections; low stomach acid, bile, and enzyme production; intestinal permeability; and food intolerances.
2. **Nutrient imbalance.** Includes deficiency of nutrients like B12, iron, folate, magnesium, zinc, EPA/DHA, and fat-soluble vitamins (most common) and excess of nutrients like iron (less common).
3. **HPA axis dysregulation.** Includes regulating the communication between the hypothalamus, pituitary, and adrenal glands and balancing the production of hormones associated with those glands (e.g., DHEA, cortisol).
4. **Toxic burden.** Includes exposure to chemicals (e.g., BPA, phthalates, etc.), heavy metals (e.g., mercury, arsenic), and mold toxins (e.g., tricothecenes, aflatoxin, ochratoxin), or impaired detoxification capacity due to nutrient deficiency, GI issues, or other causes.
5. **Chronic infections.** Includes “stealth” infections by tick-borne organisms (e.g., Borrelia, Babesia, Bartonella, Erlichia), intracellular bacteria (e.g., Mycoplasma, Chlamydia), viruses (e.g., HHV-6, HPV), and dental bacteria.
6. **Hormone imbalance.** Includes hormones associated with metabolism (e.g., insulin, leptin), thyroid, and gonads (e.g., estrogen, progesterone, testosterone).
7. **Immune dysregulation.** Includes autoimmunity, underactive immune function, and chronic, systemic inflammation.
8. **Cellular dysfunction.** Oxidative damage and impaired methylation, energy production, and mitochondrial function.

These pathologies (and the exposome–gene interactions that lead to them) are at the root of all chronic diseases and their symptoms, from obesity to Hashimoto’s thyroiditis to asthma to autism spectrum disorders. For this reason, they should be the focus of the functional medicine encounter after diet, lifestyle, and environmental exposures have been addressed.

But in what order should they be addressed? Here is what I’ve found to be most effective:

- As mentioned above, diet, lifestyle, and environmental exposure must always come first because these are the primary drivers of more than 90 percent of chronic disease.
- Next, I focus on **nutrient imbalances, GI issues, and the HPA axis.** There are two reasons for this. First, these pathologies are often at the root of (or at least strongly influence) other pathologies like hormone imbalance, immune dysregulation, and cellular dysfunction. Second, even if other pathologies are present, fixing GI issues, restoring nutrient balance, and addressing the HPA axis will lead to significant clinical improvement. This is important for patient compliance and paving the way for a successful treatment.
- Next, I will address **cellular dysfunction, toxic burden, hormone imbalance, immune dysregulation, and chronic infections.** The specific order in which I address each of these depends upon the patient and his or her presentation. If signs and symptoms of chronic

infection, toxic burden, and cellular dysfunction are present, I focus on those first because they are more proximal than hormone imbalance and immune dysregulation.

- Finally, once all pathologies have been resolved, if signs and symptoms of disease are still present that require attention, I may address them directly. For example, dyslipidemia is typically caused by poor thyroid function, insulin or leptin resistance, intestinal permeability, or chronic infections. If none of those conditions is present, and the patient still has dyslipidemia, I would suspect genetics as the cause and use natural therapies to improve lipid metabolism.