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MODERN BIOLOGY AND CELL COMMUNICATION

Everything starts with a signal

What do GLP-1, metabolism, and biological age have in common? At first glance, they seem like different areas within health. Yet modern biology increasingly describes the body as a network of 37 trillion communicating cells.

What we often think of as separate health domains are, in reality, expressions of the same biological network. More and more researchers believe that the key to understanding this network lies in something fundamental: **cellular signaling**.

Biology always starts with a signal

In this article, we explore research on **cellular signaling and biological age**.

Our aim is simple: to offer a clearer understanding of how the body works — and how insights into cellular signaling may help guide us toward **a long, healthy, and joyful life.**

Why This Matters

The body is not passive. It is constantly working to **protect, repair and adapt throughout life –** managing stress, repairing damage, and maintaining balance, often without us noticing.

So how does the body actually coordinate all this?
The answer begins at the cellular level.

The body speaks a biological language

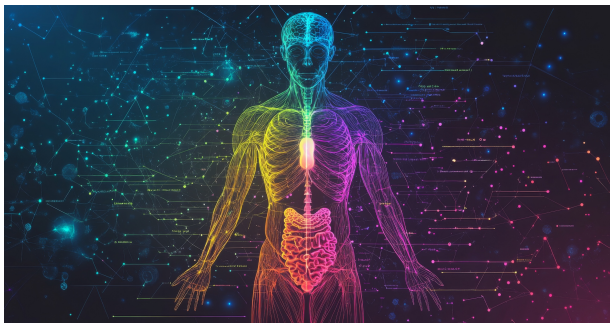
The human body consists of approximately **37 trillion cells**. Every second, these cells send signals to one other and coordinate processes such as:

- **metabolism**
- **protection against stress**
- **repair**
- ***adaptation to the environment***

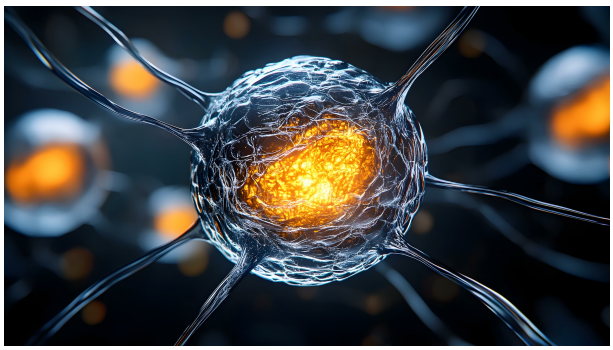
This continuous dialogue between cells allows the body to function as a unified system.

When signallng works, cells cooperate - and the body can maintain **biological balance over time**. Today, researchers are increasingly focusing on **cellular signaling** in relation to **metabolic health and biological aging**.

”You could almost say that the body speaks a biological language.”



"*Clearly, biology is showing something important: cellular signaling is important to biological age*"



A new biological perspective

Interest in **cellular signaling** has grown rapidly in recent years.

A clear example is GLP-1, a signaling molecule that helps cells communicate about energy, satiety, and metabolism. Many areas of research are now shifting focus toward how **cellular signals influence body functions over time.**

Increasingly, the body is no longer described as a collection of organs, but as a **network of communicating cells.**

But how did our own journey into this research actually begin?

How Our Journey Began

For many of you who have followed us for a long time, much of this is well known. But as research on **metabolic health and biological age** is discussed more than ever, we want to briefly return to the beginning.

To the question that first inspired our work. And to the **research** that later became part of **CN24**. For new customers and representatives, this is an introduction. For some of you, it is perhaps more of **a reminder of why the journey began.**

The Discovery

More than twenty years ago, everything started with a remarkable discovery.

Our mentor, and neuroscientist, demonstrated something once thought impossible:
human brain cells can regenerate throughout life.

The discovery changed how scientists and the world view the brain. It showed that the body is not simply breaking down over time. Instead, it continuously attempts to **protect, repair and adapt.**

And it raised a new question.
What helps cells function well over time?

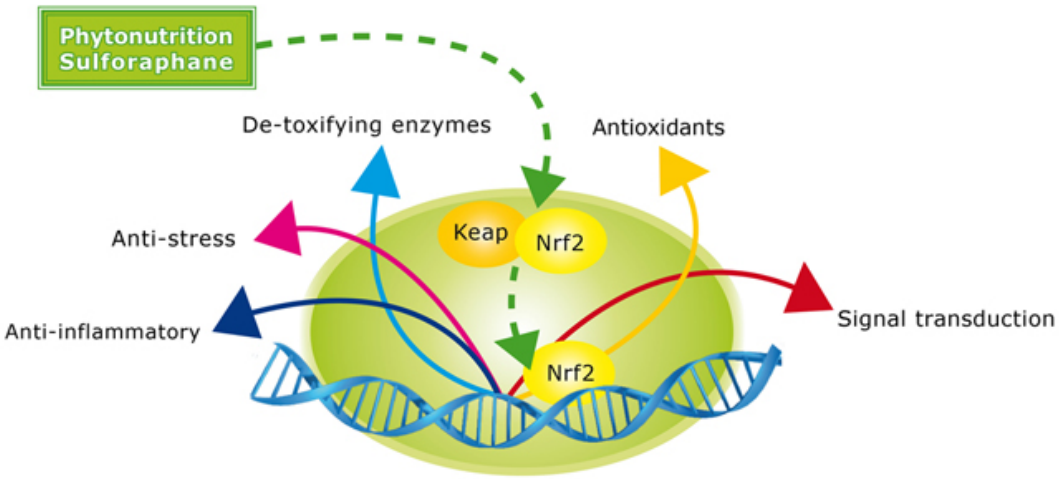
The Cell's Defense System

Research began to focus on the cell's natural defense systems — particularly the **Nrf2 signaling pathway**.

This system regulates genes that help cells:
• respond to oxidative stress
• support detoxification processes
• strengthen cellular protection

At the same time, researchers discovered that certain molecules from nature can act as **biological signals** — substances that cells can recognize and respond to.

One of the most studied is **sulforaphane**, found in broccoli and other cruciferous plants. Research suggests that sulforaphane can influence signaling pathways linked to **cell protection, metabolism, and biological aging**.



When Research Met Nature

At this intersection — where cellular signaling and natural compounds meet – our own journey took a new direction.

Our mentor and his research team contributed scientific insights into cellular signaling.

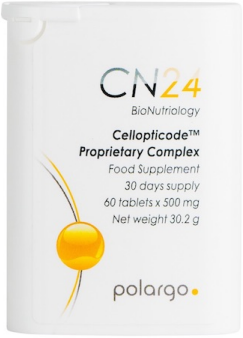
We contributed with something complementary: our knowledge of **bioactive compounds from nature** and how to formulate them in a usable way.

Together we began exploring how these natural molecules could be integrated into a **stable and biologically active formulation**.

This collaboration became part of the foundation for **CN24.**

The biological challenge

Sulforaphane is a powerful natural substance, but it is also highly unstable and volatile. To function biologically, it must reach the cells in its active form.



Through our joint work, a formulation was developed where sulforaphane could be:
• stabilized
• encapsulated in a protective structure
• preserved in a ***biologically active*** **signaling** form.

A Signal the Cell Understands

Cells communicate through signals – a kind of biological language.
For a signal to matter, it must be r**ecognized and interpreted**. Some signals are already ”known” to the cell – meaning the response is built into its regulatory systems. Sulforaphane is one such signal.

When recognized, it can interact with systems linked to:

- metabolism
- energy balance
- inflammation
- biological aging

These are part of the same biological network that research increasingly links to the body's hormonal signals for energy regulation, for example **GLP-1-related systems**.

Long, Healthy and Joyful

Modern biology is revealing something important:
Cellular signaling influences biological age and how the body functions over time.
Longevity does not begin in the future. What we do today influences how our cells communicate and function tomorrow.

Thank you for sharing our passion.

Making Connections • Making Sense • Making Winners™

Scientific Insight

Over the past two decades, research on **cellular signaling pathways** has expanded rapidly. Particular attention has been given to the interaction between the cell's own defense systems and **bioactive compounds found in plants**.

One of the most studied molecules in this context is **sulforaphane**. Research suggests that sulforaphane can influence cellular signaling pathways involved in **stress responses, metabolism, and biological aging**.

A key element of this research involves **Nrf2 signaling**, a regulatory system that controls genes responsible for antioxidant defense, detoxification processes, and cellular adaptation.

Several studies also suggest that the activity of certain cellular defense systems may change with age.

Three examples from published research illustrate these relationships.
(Published in scientific journals and available via PubMed.)

1. The cell's defense system
Studies show that **Nrf2 signaling** plays a central role in regulating antioxidant defenses and protecting cells from oxidative stress.
"Sulforaphane Prevents Age-Associated Cardiac and Muscular Dysfunction Through Nrf2 Signaling"

2. Barrier functions
Research indicates that the Nrf2 system helps maintain the integrity of epithelial barriers, including the intestinal lining.
"A Protective Role of the NRF2-Keap1 Pathway in Maintaining Intestinal Barrier Function"

3. Bioactive plant compounds
Sulforaphane is a bioactive plant compound that activates Nrf2 signaling and enhances cell ular defense mechanisms. In addition, it alters the gut microbiome and metabolome, partic ularly in older organisms, restoring microbial composition and metabolic profiles toward a more youthful state, which may contribute to its anti-aging effects.
"Multi-Omic Analysis Reveals Effects of Sulforaphane on the Microbiome and Metabolome"

This growing body of research helps deepen our understanding of how **cells protect themselves, adapt and cooperate over time** - processes that are central to the discussions of ***biological aging and longevity***.