MARUKYOU BIO FOODS Co.

Nano247

Nrf2 activator using chondroitin sulfate oligosaccharides

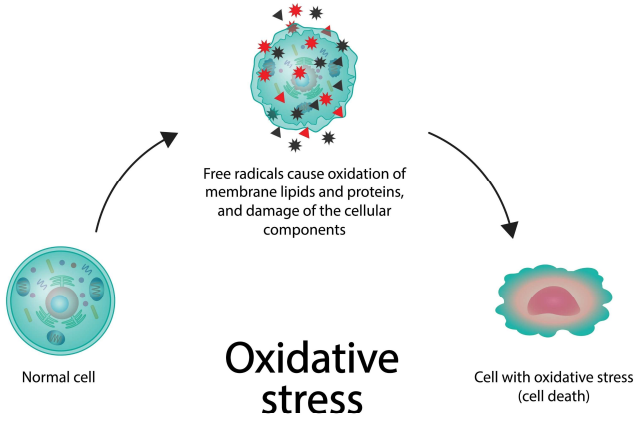
Patent pending

What is Nrf2?

Nrf2 is a cell-protective protein that is activated when cells are exposed to oxidative stress, such as free radicals, in order to protect themselves and reduce damage.

The body is made up of individual cells, so if one of these small cells is repeatedly injured and dies, eventually the function of a single tissue will become impaired, leading to premature aging and death.

For example, thinning hair is a good example. When one small cell is repeatedly damaged and dies, it will eventually appear as thinning hair over a wide area.

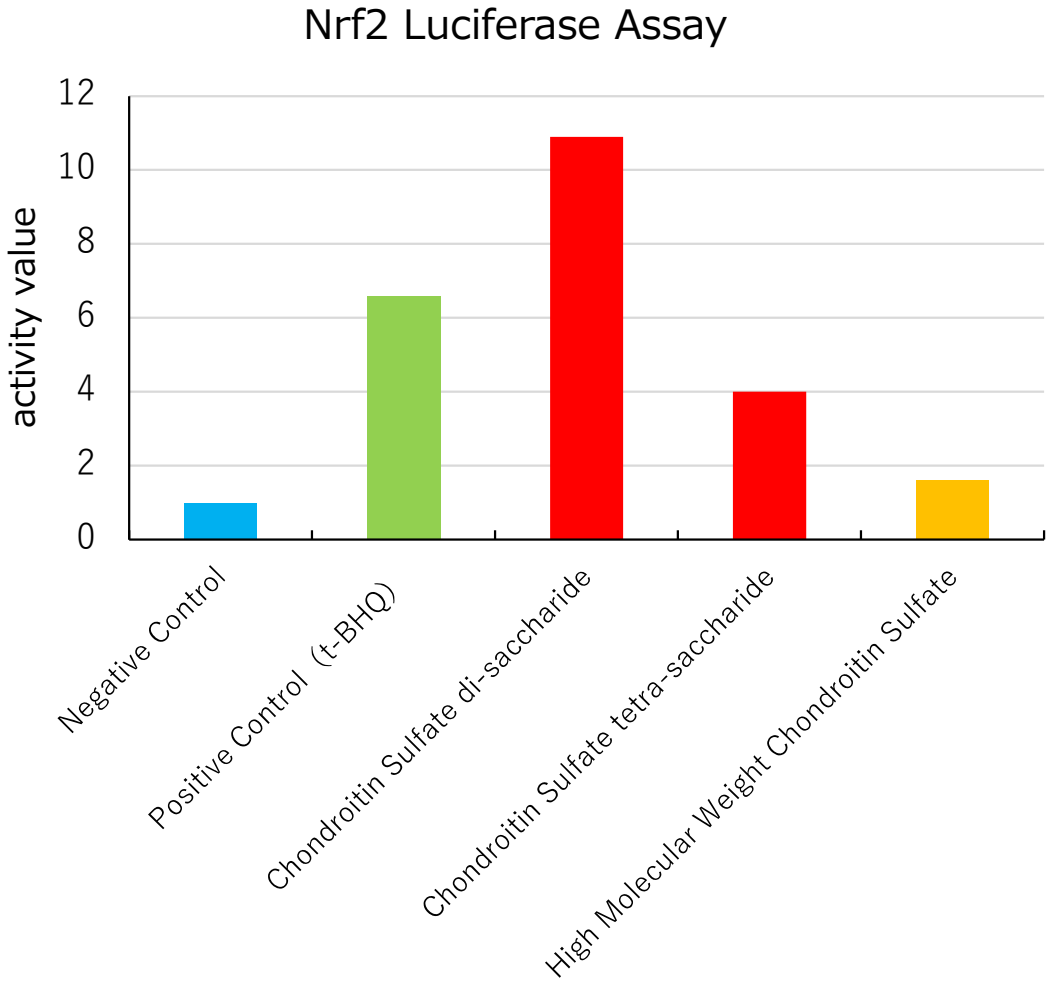


Protecting each individual cell and keeping the tissue healthy is very important for maintaining a youthful appearance and good health.

1. Reporter assay

Reporter assay for testing the activation of the transcription factor Nrf2

A reporter assay is a method for evaluating the ability of a target gene to be activated by introducing a reporter gene into the genes of cultured cells, attaching a substance that emits light when activated, culturing the cells with the test substance added, and measuring the light emission intensity.



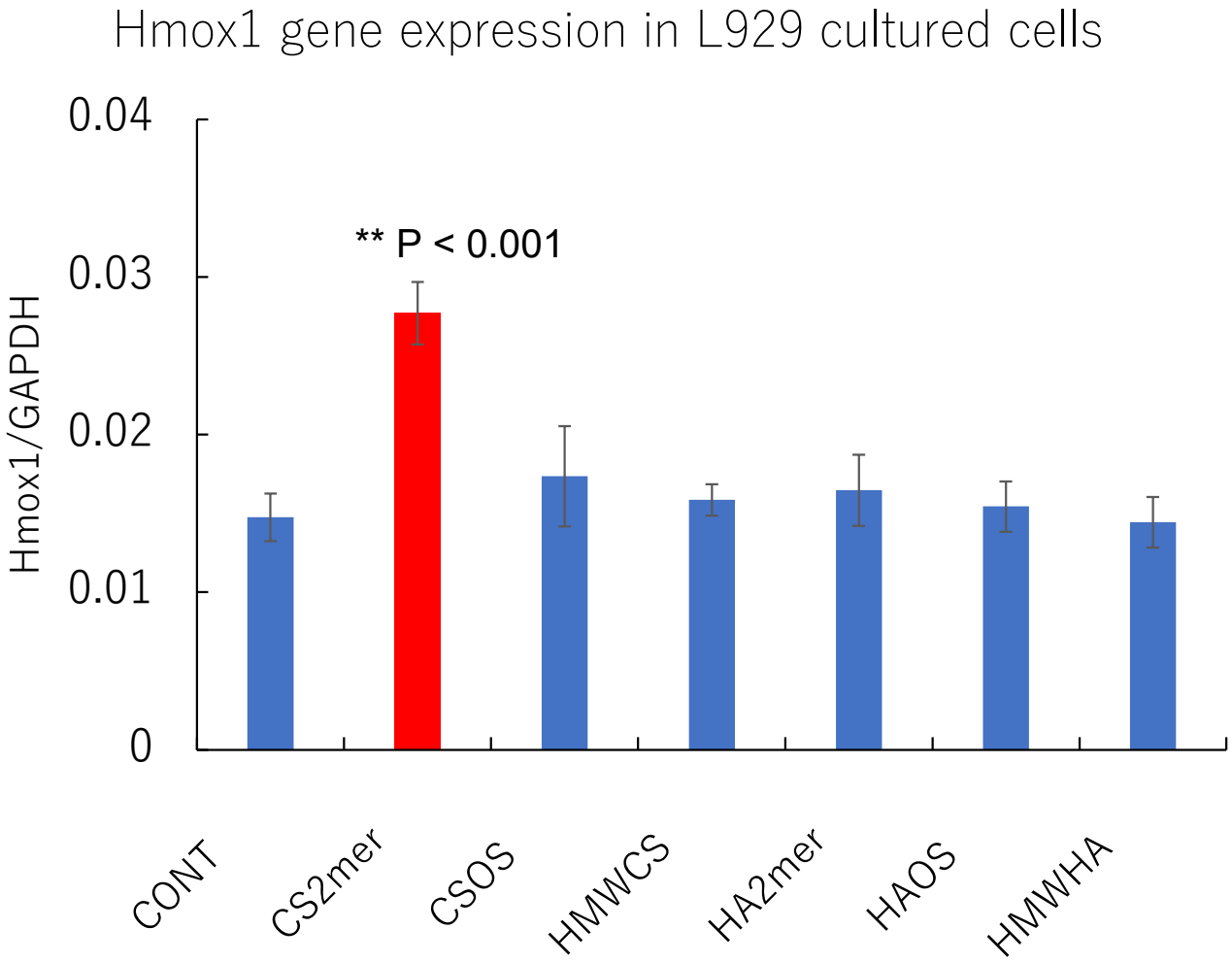
As a result of measuring the ability to activate transcription factor Nrf2, chondroitin sulfate oligosaccharides (disaccharides and tetrasaccharides) strongly activated Nrf2.

On the other hand, high-molecular-weight chondroitin sulfate had no effect.

2. Research using cultured cells

Activation of the transcription factor Nrf2

Normally, Nrf2 forms a complex with a protein called Keap1 and is inactive. However, when the cell is damaged by free radicals or other factors (oxidative stress, etc.), Nrf2 is activated and moves into the nucleus, where it binds to antioxidant response elements in the genes to rapidly increase the production of proteins that protect the cell by expressing various cell-protective genes and protecting the cell from damage. If this function is weak, the damaged cell will die.



The graph shows the amount of expression of the gene (Hmox-1) that produces HO-1 (heme oxygenase 1), a typical antioxidant protein.
Chondroitin sulfate oligosaccharides (disaccharides) strongly increased the expression of Homx-1, but high-molecular-weight chondroitin sulfate, hyaluronic acid oligosaccharides (disaccharides, Mix), and high-molecular-weight hyaluronic acid had no effect.

Conclusion

Chondroitin sulfate oligosaccharides

activate Nrf2, which in turn promotes the expression of antioxidant response genes to protect cells.

References (example)

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Sec. Cellular Biochemistry
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Nrf2 activation as target to implement therapeutic treatments

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A chronic increase of oxidative stress is typical of serious pathologies such as myocardial infarction, stroke, chronic limb ischemia, chronic obstructive pulmonary disease (COPD), type II-diabetes, age-related macular degeneration leads to an epic increase of morbidity and mortality in all countries of the world. The initial inflammation followed by an excessive release of reactive oxygen species (ROS) implies a diffused cellular injury that needs to be corrected by an inducible expression of the innate detoxifying and antioxidant system. The transcription factor Nrf2, when properly activated, is able to restore a redox homeostasis and possibly improve human health.

Keywords: oxidative stress, antioxidants, pathologies, calorie restriction, ozone

References (example)

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Heme oxygenase-1, oxidation, inflammation, and atherosclerosis

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Atherosclerosis is an inflammatory process of the vascular wall characterized by the infiltration of lipids and inflammatory cells. Oxidative modifications of infiltrating low-density lipoproteins and induction of oxidative stress play a major role in lipid retention in the vascular wall, uptake by macrophages and generation of foam cells, a hallmark of this disorder. The vasculature has a plethora of protective resources against oxidation and inflammation, many of them regulated by the Nrf2 transcription factor. Heme oxygenase-1 (HO-1) is a Nrf2-regulated gene that plays a critical role in the prevention of vascular inflammation. It is the inducible isoform of HO, responsible for the oxidative cleavage of heme groups leading to the generation of biliverdin, carbon monoxide, and release of ferrous iron. HO-1 has important antioxidant, antiinflammatory, antiapoptotic, antiproliferative, and immunomodulatory effects in vascular cells, most of which play a significant role in the protection against atherogenesis. HO-1 may also be an important feature in macrophage differentiation and polarization to certain subtypes. The biological effects of HO-1 are largely attributable to its enzymatic activity, which can be conceived as a system with three arms of action, corresponding to its three enzymatic byproducts. HO-1 mediated vascular protection may be due

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