

Cholesterol

Cholesterol is an amphipathic compound. That means it has both polar and non-polar parts. The polar part is represented by a hydroxyl group, which makes the molecule soluble in water. The non-polar part is formed by the steroid nucleus and hydrocarbon chain. These parts are fat soluble. However, cholesterol is not soluble enough to exist alone in blood, therefore it is bound to lipoproteins.

Source of Cholesterol

We accept cholesterol exogenously from food (mainly animal - meat, dairy products, liver, cereals...) and it is also produced endogenously.^[1]

Cholesterol Synthesis

Endogenous synthesis occurs mainly in the liver (10%), as well as in the intestines (15%), adrenal and genital organs.

- acetyl-CoA reacts with acetoacetyl-CoA, with HMG-CoA-synthase as the catalyzer, to form 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA),
- HMG-CoA is reduced to mevalonate by HMG-CoA-reductase (This reaction is irreversible),
- In the presence of ATP and after loss of 1 CO₂ molecule mevalonate is converted into isopentenyl pyrophosphate,
- Isopentenyl pyrophosphate is converted into squalene,
- Squalene is converted to cholesterol via lanosterol^[2]

 For more information see *Cholesterol synthesis regulation*.

Functions in cells

Cholesterol forms part of cell membranes (approximately every two phospholipid molecules account for one cholesterol molecule^[3]). It stabilizes their structure by binding to hydroxyl groups with their polar parts of phospholipids and sphingolipids, and binding the steroid part of cholesterol with chains of fatty acids. It ensures the permeability of membranes (especially for small molecules) by increasing the packing of phospholipids, and also prevent membrane crystallization. It is also part of the membranes of intracellular organelles (mitochondria, endoplasmic reticulum). Participates in intercellular communication (intracellular transport, transmission of nerve impulses, cellular signals)^[4].

Transformation of cholesterol

Used for the synthesis of steroid hormones (glucocorticoids, mineralocorticoids, sex hormones)^[5], vitamin D and bile acids.

Bile acids

They are synthesized from cholesterol in the liver. Course of synthesis: hydroxylation in several places of the molecule, loss of double bond in the steroid bulk, shortening of 3 hydrocarbons and replacing it with the carboxyl group. This produces primary bile acids: cholic acid and chenodeoxycholic acid. The synthesis of bile acids is subject to the regulation of cholesterol and cholic acid. Bile acids are conjugated in hepatocytes with glycine or taurine to form bile salts.^[6]

Vitamin D

Cholesterol is a precursor for the synthesis of vitamin D. Vitamin D is also present directly in the diet. Inhibition of cholesterol synthesis can cause vitamin D deficiency. Cholesterol is often found in the diet together with vitamin D, therefore a low cholesterol diet can lead to hypovitaminosis^[7].

Links

Related articles

- Lipoproteins
- Cardiovascular disease risk factors

External links

- Cholesterol and health (<http://www.cholesterol-and-health.com>)
- The Medical biochemistry (<http://themedicalbiochemistrypage.org/cholesterol.html>)

References

1. VOKURKA, Martin – HUGO, Jan, et al. *Velký lékařský slovník*. 9. edition. Praha : Maxdorf, 2009. 1159 pp. ISBN 978-80-7345-202-5.
2. IU School of Medicine. *Biosynthesis of Cholesterol* [online]. ©2010. The last revision 2010-03-24, [cit. 2010-04-18]. <<http://themedicalbiochemistrypage.org/cholesterol.html>>.
3. ROBERTSON, JC – HAZEL, JR. Cholesterol content of trout plasma membranes varies with acclimation temperature. *AJP – Regulatory, Integrative and Comparative Physiology* [online]. 1995, vol. 269, p. R1113-R1119, Available from <<https://www.physiology.org/doi/abs/10.1152/ajpregu.1995.269.5.r1113?cookieSet=1>>. ISSN 1522-1490.
4. MASTERJOHN, Chris. *Synthesis of Steroid Hormones From Cholesterol* [online]. ©2005-06. [cit. 2010-04-18]. <<http://www.cholesterol-and-health.com/Cholesterol-Cell-Membrane.html>>.
5. MASTERJOHN, Chris. *Synthesis of Steroid Hormones From Cholesterol* [online]. ©2005-09-02. The last revision 2008-10-09, [cit. 2010-04-18]. <<http://www.cholesterol-and-health.com/Steroid-Hormones.html>>.
6. MASTERJOHN, Chris. *Cholesterol Is a Precursor to Bile Acids* [online]. ©2005-09-02. The last revision 2008-10-09, [cit. 2010-04-18]. <<http://www.cholesterol-and-health.com/Bile-Acids.html>>.
7. MASTERJOHN, Chris. *Foods High in Vitamin D Are High in Cholesterol* [online]. ©2005-05-25. The last revision 2008-10-09, [cit. 2010-04-18]. <<http://www.cholesterol-and-health.com/Vitamin-D.html>>.

Used literature

- Wikipedie: Otevřená encyklopedie. *Cholesterol* [online]. ©2010. The last revision 10.4.2010, [cit. 18.4.2010]. <<https://cs.wikipedia.org/w/index.php?title=Cholesterol&oldid=5203759>>.
- Wikipedia, The Free Encyclopedia. *Cholesterol* [online]. ©2010. The last revision 16.04.2010, [cit. 18.4.2010]. <<https://en.wikipedia.org/w/index.php?title=Cholesterol&oldid=356367934>>.