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SUMMARY OF DATA ON TRANSCELLULAR TRANSPORT PROTEINS INVOLVED IN MEDICAL PRACTICE

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The authors of the presented article address the problem of transcellular transport proteins used in medical practice. Passive transport-facilitated diffusion is mediated by permeating membrane proteins with specific characteristics.

In the process of transmembrane transport, permeating molecules bind to an active site of the transporter on one side of the membrane. In this way a permeant-transporter complex is formed that crosses the bilayer, dissociating themselves on the other side of the membrane, with the purpose to release the molecule transported.

Facilitated diffusion occurs depending on concentration transported molecule according to kinetics similar to the Michaelis-Menten relationship for enzymatic reactions with a single substrate. This implies that the rate of transport reaches a maximum value when it becomes independent of substrate concentration.

Key words: protein, transcellular transport, membrane, diffusion, transport rate

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A common feature among facilitated diffusion and enzymatic reactions is represented by specific inhibitors. This can be a competitive or non-competitive process with similar molecules, as for example in the case of heavy metal ions.

According to theoretical models such transport carriers perform a rotational motion in the lipid bilayer, thus allowing molecules to pass from one side of the membrane to the another. Another type of diffusion is mediated by channel proteins. These proteins are transmembrane proteins that are characterised by a canal bordered by hydrophilic amino acids that form the membrane pores.

Such proteins are called ion channels, through which ions diffuse according to their concentration gradient direction and membrane potential. There are several types if ion channel proteins, depending on how their opening occurs, representing a cellular response to mechanical stimuli. The ion channel protein channels may be voltage-dependent channels, which open and close dependent on the membrane potential, or are activated by intracellular mediators, such as GTP binding proteins, or extracellular ligands such as neurotransmitters.

An alternative model is one in which the transporter undergoes a conformational change after binding the molecule to be transported. As a result of this conformational change, the transporter forms a channel through which molecules can pass the membrane. Such a conformational change could direct hydrophilic amino acids towards the interior of the molecule, thus creating the channel through which hydrophilic molecules can pass through. This process is well known for water transport channels, involving aquaporins

With the studies undertaken in the area, 13 types of aquaporin have been identified in human cell membranes. It is believed that aquaporins form part of a family of major intrinsic membrane proteins that carry water in and out of the cell, therebypreventing the passage of ions and various substances.

Peter Agre received the Nobel Prize in 2003 for on the identification and characterization of aquaporins. In 1986 Professor Dr. Gheorghe Benga at the University of Medicine and Pharmacy Iuliu Hatieganu in Cluj-Napoca, was the first to discover the existence of an aquaporins in erythrocyte membrane, now known to be AQP1.

AQP1 is also expressed in the apical and basolateral membrane of epithelial cells of the proximal tubules convoluted, the loop of Henle

and utensils rectum. AQP2 occurs in intracellular membranes of the collecting duct of the kidney. the activity of AQP2 is controlled by vasopressin, while mutations in the AQP2 gene have been shown to cause diabetes insipidus.

Types 3 and 4 aquaporins are involved in water reabsorption from the renal collecting ducts, medullary portion. The types 3, 7, 9 and 10 are aquagliceroporins or channels involved in the transport of water and glycerol. In spite of various studies, the physiological and pathological role of aquaporins as carriers of glycerol is still not fully understood.

Aquaporins 7 to 9 (AQP7, AQP9) are channels for glycerol in adipocytes and hepatocytes. They maintain the balance between the release of glycerol in adipocytes and its uptake in hepatocytes. It should be noted that adipocytes are the major source of glycerol, which is actually the substrate for hepatic gluconeogenesis.

As application in medical practice, we present here some data on the determination of anti-aquaporin 4 antibody in relation to a disease called neuromyelitis optical (NMO), or Devie syndrome. Neuromyelitis optical defines an inflammatory disorder caused by an autoimmune response.

Neuromyelitis optics is characterized by production of optic neuritis bilateral, which may be followed within a few days or weeks of a transverse myelitis.

There has been a long dispute as to whether neuromyelitis optics is a subtype of multiple sclerosis, defined as a primary demyelinating disease, or a distinct disorder.

Recent studies identified a specific IgG autoantibody NMO for neuromyelitis optics. It was found exclusively in serum of patients with neuromyelitis optics. Target antigen is the protein aquaporin water channel 4 (AQP 4) expressed in the astrocytes.

For diagnosis and treatment of neuromyelitis optics specific determination of anti-AQP 4 is indispensable.

Subsequent investigations showed that adjacent lesions in the CNS can be severe and necrotizing. It was also observed that changes in cerebrospinal fluid may be variable, and in some cases consists of polymorphonuclear pleocytosis and an increase in protein content.

The titer of anti-AQP antibodies 4 is dosed in venous blood, using vacutainer without anticoagulant, with / without separator gel, serum separated by centrifugation; working with fresh serum; if this is not possible, the serum is stored at 2-8 ° C, -20 ° C or -70 ° C.

Indirect immunofluorescence is used for analyse. Using modern laboratory techniques, it has been observed that anti-AQP4 antibodies shows the sensitivity and specificity for optical neuromyelitis 91% and 100%.

Compliance investigation results, increased titers of autoantibodies associated with blindness and brain damage extended evidenced by MRI.

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К ПРОБЛЕМЕ ЧРЕЗКЛЕТОЧНЫХ ТРАНСПОРТНЫХ БЕЛКОВ, ПРИМЕНЯЕМЫХ В МЕДИЦИНСКОЙ ПРАКТИКЕ

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Авторы представленной статьи обращаются к проблеме чрезклеточных транспортных белков, применяемых в медицинской практике. Пассивная диффузия, облегчающая транспорт, опосредуется проникающими через мембрану белками со специфическими характеристиками.

В процессе трансмембранного транспорта проникающие молекулы связываются с активным центром переносчика на одной стороне мембраны. Таким образом образуется комплекс пермеант-переносчик, который пересекает бислой, диссоциируя на другой стороне мембраны с целью высвобождения транспортируемой молекулы. Облегченная диффузия происходит в зависимости от концентрации переносимой молекулы в соответствии с кинетикой, аналогичной соотношению Михаэлиса – Ментена для ферментативных реакций с одним суб-

стратом. Это означает, что скорость транспорта достигает максимального значения, когда она перестает зависеть от концентрации субстрата.

Ключевые слова: белок, чрезклеточный транспорт, мембрана, диффузия, скорость транспорта

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МЕДИЦИНАЛЫҚ ТӘЖІРИБЕСІНДЕ ҚОЛДАНЫЛҒАН СЫРТҚА ЖАСАЛҒАН КӨЛІК ПРОТЕИНДЕРІ

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Ұсынылған мақаланың авторлары медициналық практикада қолданылатын жасушалық көлік ақуыздарының проблемасын шешеді. Тасымалдауды жеңілдететін пассивті диффузия мембранаға енетін спецификалық сипаттамалары бар ақуыздар арқылы жүзеге асырылады.

Трансмембраналық тасымалдау процесінде еніп жатқан молекулалар мембрананың бір жағында тасымалдаушының белсенді центрімен байланысады. Осылайша, тасымалданған молекуланы босату үшін қабықтың екінші жағында диссоциацияланып, екі қабатты кесіп өтетін өткізгіш-тасымалдаушы кешен түзіледі. Жеңілдетілген диффузия бір субстратпен ферментативті реакциялар үшін Михаэлис-Ментен қатынасына ұқсас кинетикаға сәйкес берілген молекуланың концентрациясына байланысты жүреді. Бұл тасымалдау жылдамдығы субстрат концентрациясына тәуелді болуды тоқтатқанда максималды мәнге жететіндігін білдіреді.

Кілт сөздер: ақуыз, жасушалық тасымалдау, мембрана, диффузия, тасымалдау жылдамдығы