

тенциала. Поэтому перспективой дальнейших исследований является более углубленное изучение иммунопатогенеза коморбидности псориатической болезни, что даст возможность выявить новые мишени терапии данного дерматоза.

Summary

THE ROLE OF PPAR IN THE PATHOGENESIS OF PSORIASIS AND OBESITY

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Key words: psoriasis, obesity, pathogenesis, systemic inflammation.

Psoriasis is one of the most common chronic recurrent multifactorial diseases of the skin with a predominance of genetic predisposition. The disease is characterized by hyperproliferation of epidermal cells, impairment of the keratinisation against the background of inflammatory reactions in the dermal layer, the nails, joints and scalp involvement. According to the results of clinical and epidemiological research, about 3-4% of the population of our planet has psoriasis, regardless of sex, age and ethnic group, while the share of this pathology in the overall structure of skin diseases reaches from 1% - to 40%, according to some reports. However, despite the wide prevalence of psoriasis and a huge number of works on this issue, there is still no shared view on the pathogenesis of this dermatosis. The data presented by many clinical studies show that there has been a recent increase in cases of comorbidity of psoriasis and obesity, leading to severe, atypical, disabling and resistant to the treatment forms of dermatosis. All this considerably impairs the quality of life of patients with psoriasis, reduces their working capacity and social activity that lays emphasis on not only the medical but also the social significance of the problem. Immunological disorders and genetic defects have been proven as the causes of psoriasis and abdominal obesity. The distinctive feature of the pathogenesis in the patients having comorbidity of psoriasis and obesity, in contrast to the patients without excessive body weight, is a statistically significant increase in hyperleptinemia and in systemic cytokine proinflammatory potential. Therefore, the vision for the future research is in-depth study of the pathogenesis of comorbid disease in patients with psoriasis that will contribute to reveal new targets for the treatment of this dermatosis.

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GENERAL BIOLOGICAL PATTERNS OF THE STRUCTURE OF HUMAN MAJOR AND MINOR LACRIMAL GLANDS AND UNDER-RESEARCHED ASPECTS OF THEIR MORPHOLOGY

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The article discusses the fundamental and modern data on the structure and functions of human large and small lacrimal glands. The palpebral lobe of the human lacrimal gland consists of numerous fairly large lobules, which are almost of identical structure. Each lobule has several axial excretory intralobular ducts. Their branches along the whole length are surrounded by secretory epithelial components in the form of terminal sections and the corresponding finest terminal lacrimal ducts that are grouped into the grape-bunch structural elements. Blood supply to the capillary network of the lacrimal gland and its alveoli is carried out by several arterioles that run through very large interstitial spaces rich in fatty tissue. Each arteriole supplies several adjacent lobules. The network of capillaries can be described as integral and is not divided into segments that would correspond to sublobular units. Blood capillaries are located in the spaces between several adjacent terminal portions. Thus, the fact of close syntopic similarity of the intralobular excretory ducts and postcapillary venules has been confirmed. The article poses the appropriateness of more detailed morphological studying of anatomical and topographic characteristics of the lacrimal glands. It has been found out the lack of information on the cellular composition of the wall of the excretory ducts of the lacrimal gland, both in humans and in laboratory rats, in order to compare their morphology and the quality of the secretion they produce. It would be interesting to compare the morphology of the human lacrimal glands and the Gardner gland in rats to identify general biological characteristics of the structure and functioning.

Key words: lacrimal gland, excretory duct, hemomicrocirculatory bed, stereomorphological analysis.

The human lacrimal apparatus is known to include the lacrimal gland, consisting of two lobes, the orbital and palpebral ones, and a number of accessory tiny lacrimal glands scattered through the upper fornix of lacrimal sac. According to A. Hemm, D. Cormac, the lacrimal fluid is produced by the lacrimal glands of various localization and size, and, according to their data, minor (accessorial)

lacrimal glands are scattered along both fornices of conjunctiva, but are more numerous in the anterior fornix of conjunctive than in posterior one. These are the so-called Krause glands. Similar in their structure and secretion, the minor glands were found in the lacrimal caruncle, where they are even tinier in size compared to the minor conjunctival lacrimal glands of the fornices [5; 13; 25].

It is interesting to note that in humans, the palpebral conjunctiva is rich in fine glands of diverse function and structure. For instance, the secretory parts of long, vertically localized complex sebaceous glands, called meibomian glands, are immersed in the tarsal plate. They open their orifices in the back of the free edge of the eyelid. In the area of the hair follicles of the eyelids, there are the sebaceous glands of Zeis, and between the follicles, there are Molle's sweat glands.

The minor lacrimal (accessorial) glands secrete a small amount of secretion a day, but it is sufficient to wet the surface of the eye, to prevent the development of the «dry eye symptom», leading to loss of vision. In special cases, the large amount of tears can be produced by a major lacrimal gland, which is located in the upper-outer corner of the orbit. It is known to be divided into two parts, often called lobes, by the lateral edge of the muscle that lifts the eyelid. As it has been already mentioned, there are orbital and superficial palpebral lobes, each of which has an individual connective tissue capsule [5]. Both lacrimal glands develop from the conjunctiva and belong to complex tubular-alveolar serous glands, secreting a slightly alkaline secret, rich in various salts and a bactericidal enzyme, lysozyme. Their secretion is released through dozens of ducts, pouring it along the upper fornix [6].

The so-called tear film that covers the eye is known to have three layers: a thin mucin layer that contacts the cornea. The mucin of this layer is a carbohydrate that is secreted by the conjunctival goblet cells, Henle's crypts, Manz glands. The aqueous layer (it is the largest in terms of volume) is the secretion of the accessorial glands of Krause and Wolfring. The lipid layer is the outermost layer. Lipids are secreted by meibomian glands, glands of Zeiss and Mollet.

Human lacrimal organs, both in the major lacrimal glands (palpebral and orbital lobes) and in minor ones (glands of the conjunctiva of the upper and lower eyelids, glands of the lacrimal caruncle) can be divided into tear-secretory and tear-excretory portions.

The palpebral part of the human lacrimal gland can be seen with eversion of the upper eyelid when an eyeball sharply moves downwards and inwards. In this case, this part of the glands appears as a slightly uneven yellowish structure protruding above the eyeball from the outside, under the conjunctiva of the upper fornix. It is a complex tubular-alveolar gland. It is a complex tubular-alveolar gland. There exists a conception that most of the ducts exiting from the orbital lobe reach their end points through the palpebral lobe. Excretory ducts of the orbital part of the gland run between the lobes of the palpebral part and, together with its ducts (total number about 15-20), open the tiniest orifices into the outer half of the upper conjunctival fornix [2;20]. These descriptions do not provide a clear answer about the topography of the excretory ducts of the

orbital and palpebral lobes, each of which has its own capsule and location.

According to the research of Yu. P. Kostilenko [3], the lacrimal glands of a newborn have much in common by their structure with the structure of palatine salivary glands in rats. According to his data, each segment of the lacrimal gland of human newborns and palatine glands of rats is polymeric and formed by sublobular units, adenomeres [1;16]. The structure of the segments is characterized by a radial type of symmetry. The intralobular duct is located in the centre of the lobules. The author called it the "central glandular tube." In his opinion, they are the first link in the system of saliva collectors. The adenomere of the human lacrimal glands, in comparison with the palatine glands of rats, is more complicated, "because it has additional epithelial components that directly flow into the central glandular tubes". However, the author does not provide a description of these additional components.

According to A. V. Piliuhin (2014), the palpebral lobe of the lacrimal gland in human adults is a space-occupying mass of complex three-dimensional structure. It is represented by numerous individual glands consisting of terminal ends and excretory ducts of different calibre and spatial directions. Such aggregates of the epithelial components of the palpebral lobe are similar in volume and shape to the lobules of the palatine, as well as human labial salivary glands [14;15]. Inside the individual gland (lobules) its epithelial components (terminal ends and excretory ducts) are closely adjacent to each other. On the histological slides, as a rule, narrow interstitial spaces between them are visible. According to the author, when investigating a series of thin paraffin sections of the palpebral lobe of the human lacrimal gland, there is a well-developed fatty tissue quite well seen along the periphery of the lobules and between them. Fatty fibres are well known as a depot of water and an energy source, as well as a shock-absorber [7]. Inside individual slices on histological specimens, the terminal ends and excretory ducts, at first sight, seem to be randomly arranged, and since they are very closely grouped, they therefore look deformed. The lumens in the cavities of the end sections are poorly identified or can be invisible by the microscopy [8]. Moreover, the lumens of many ducts within the lobules are very narrow, slit-like, and sometimes in sections as well as the lumens of the acini are not seen at all. This is especially true for the lumen of the ducts, directly adjacent to the terminal ends. When the lumens of the end sections are visualized, they are scanty, often are of an irregular shape that complicates their measuring and obtaining morphometric information. The transition of the terminal part to the lacrimal ductule that is well-marked in other glands, for example, in the salivary gland, is not detected. The terminal ends on the sections, as a rule, do not end in a regular round

shape with end extensions.

In their studies, these authors assume that the palpebral component of the lacrimal gland is a polymeric organ with its own specific syntopic relationships in three-dimensional space [9]. Moreover, each of the two lobes of the lacrimal gland has its own location and the true individual connective tissue capsule. Therefore, the same criteria as applying for investigating the human salivary glands were used as they correspond to the concept of a structural and functional unit. In their opinion, a lobule of the lacrimal gland can be considered as a structural and functional unit that is divided into several cluster-like aggregates, including the lacrimal ducts of the smallest internal diameter and their terminal extensions (acini). In the palpebral lobe, the cavity of the terminal portion of the lacrimal gland is connected with the cavity of only one lacrimal tube adjacent to it. The smallest lacrimal ducts, merging, form ducts of ever larger diameter, but localized within the lobule. Here they are arranged radially from the axial intralobular duct. Such ducts are able to integrate a number of alveolar-tubular clusters, resembling a typical adenomere; large ducts of the lacrimal gland lobes are outside of the lobules. Due to this structure, only relatively large lumens of the ducts and their walls (the epithelial zone) located in the close proximity to the tectorial epithelium of the conjunctiva can be seen on some histological slides, whereas on the other slides the small calibre ducts up to their sac-like extensions forming clusters can be seen in the thickness of the conjunctiva.

Since there are no ducts corresponding to the insertion ducts of the salivary glands in the lacrimal glands, there is no obvious visible border between them and the terminal end that seems the terminal ends of the lacrimal glands (palpebral lobes) do not have a separate connecting segment with a system of excretory ducts. Therefore, it is more correct to name them as alveoli. It is known that the intralobular ducts are lined with a cubic epithelium with a narrow lumen. The wall of their terminal ends is formed by two layers of specialized cells, secretory glandulocytes and myoepithelium.

Thus, the analysis of the relevant literature allows us to conclude that the palpebral lobe of the human lacrimal gland consists of numerous, relatively large segments, which are of almost identical structure. Each lobule has several axial excretory intralobular ducts. Their branching along the whole length are surrounded by secretory epithelial components in the form of terminal ends and the corresponding smallest terminal lacrimal ducts that form the structural elements in the shape of bunch of grapes [10].

According to the literature, the blood to the capillary network of lobules in the lacrimal gland and its alveoli is supplied by several arterioles, which pass through very large interstitial spaces rich in adipose tissue. Each such arteriole supplies

several adjacent lobules. Precapillary arterioles extend directly from the blood alveoli of the lobules. The network of capillaries is a whole structure and is not divided into blocks that would correspond to sublobular units. Blood capillaries are located in spaces between several adjacent terminal sections [22].

Thus, the fact of close syntopic similarity of the intralobular excretory ducts and postcapillary venules has been confirmed. It is known that these capacitive vessels and their wall are characterized by increased hydraulic conductivity. This is due to the fact that the wall of postcapillary venules is formed by fenestrated endothelium. Experimental data suggest that through the paths of the preferred blood flow, blood from the pre-capillaries can enter the capacitive vessels, which become distended with blood and then dilated. At the same time, the hydrostatic pressure of the blood increases and the filtering ability of the endothelial wall in postcapillary venules increases. In other words, such a syntopic unity of the excretory ducts and veins is far from being deliberate; it often determines their interaction by filtering fluid from the interstitium through the intercellular spaces of the duct wall in both directions [4;24].

Considering the much similarity in the blood supply at the microcirculatory level, in the structure of the glandular epithelium of both lobes of the lacrimal glands, the unified processes of their functioning, as well as in the biosynthetic activity of the secretory glandulocytes and filtration capacity, we can suggest the dual nature of the functioning of these glands and that it can be implemented at the sublobular unit, an adenomere. Since similar principles and approaches were used to identify the elementary structures of the lacrimal gland, therefore, the aggregate of terminal extensions and their corresponding ducts, which converge into one duct, performing the collecting function were assigned to the elementary level of organization of the lacrimal gland structure. Such a duct, according to a number of researchers, is described as an intralobular duct that extensively branches in the lobules of the lacrimal gland. In the lobule there are several centrally located in relation to the surrounding tubulo-alveolar elementary units of the intralobular ducts [22].

At the same time, having analyzed the literature data, it should be noted that the structure of the human lacrimal glands and laboratory rats have much in common. This is fair to the structure of their epithelial secretory components, the mechanisms of secretion and excretion, as well as the biochemical composition of the secretion (tears).

In humans, the largest share of tear secretion (up to 98%) is water; the rest is made of inorganic substances (sodium chloride, sodium and magnesium carbonate, as well as calcium sulphate and calcium phosphate), proteins and carbohydrates. Under the normal conditions, 0.5-1

ml of tears is secreted during a day. A. Fleming was one of the first who found lysozyme, an enzyme having bactericidal properties, in the tear fluid. It acts on bacteria, splitting their cell walls. In addition, the tears fluid contains other enzymes providing bactericidal effect. Tear contains about 1.5% of sodium chloride, some amount of albumin and mucus. The chemical composition of tears is similar to the composition of blood plasma, but unlike it, the concentration of potassium and chlorine in the tear fluid is higher, but the organic acids are less.

Among the numerous proteins produced by the lacrimal glands of an adult individual, lactoferrin, lipocalin and lysozyme are found in the highest concentration in the tear fluid. Amylases, peroxidase, plasminogen activator, prolactin, epidermal growth factor, transforming growth factor beta (TGF-beta), endothelin-1, retinol are found in lower concentrations. Lactoferrin, lipocalin, peroxidase and lysozyme protect the cornea against viral and bacterial infections; retinol, growth factors and endothelin-1 play an important role in the normal functioning and healing of the cornea [21].

The tears are considered as carrying less information compared with a drop of blood: their chemical composition, depending on the state of the body, is constantly changing. Tears as well as blood plasma and oral fluid are one of the clinically important functional and diagnostic secretions of the human body. It is well known that tears are physiological: there is a lacrimal reflex, when tears are produced for moistening and cleansing the eyes, or as an emotional response. Moreover, tears can differ by their composition depending on the character of emotions. R. Fisher once wondered whether tears of sorrow differed from tears of joy. To clear it up, she began to investigate the tears under the microscope. Fisher studied 100 different samples of tear fluid and concluded that basal tears (those that lubricate the surface of the eyeball) are very different from tears that come out when cutting the onion; while tears of laugh have nothing in common with tears of sadness. In her opinion, like a drop of sea water, a tear by itself carries a whole microcosm of human experiences. Fisher noted: "There are many criteria for distinguishing tears: chemical composition, viscosity, medium, rate of vaporization, freezing, etc."

The results of her study were confirmed by Joseph Stromberg from Smithsonian College. According to his data, there are also three main types of tear fluid: the basal, reflex, and emotional types that contain various organic substances, oils, antibodies, and enzymes suspended in tears. It has been shown that various types of tears have their own molecular structure. Emotional tears contain protein hormones, including leucine-enkephalin, a neurotransmitter, which is a natural anaesthetic, and is usually released during stress. The lacrimal fluid studied under a microscope when cooled has a crystalline structure and can take various forms.

Even emotional tears of the same chemical composition can look completely different.

These researchers have studied the so-called "basal tears, tears of the meeting after parting, tears of the beginning and completion of secretion, tears of relief, tears of hope, tears of delight from the event being experienced, tears of memories." It has been established that at the moment of pain, grief and despair the tears become dense and very salty, i. e. heavy. These tears contain chemical elements, which are usually released during the stress, nervous overstrain. In the tears of people who are seriously ill, protein can be found. It is an interesting fact that a tear contains psychotropic substances that reduce anxiety and tension, bringing relief to a crying individual. A few years ago London firm "Studio Weave" launched the production of exotic salt, which has some components of tears. In addition to sodium and chlorine, the product contains a certain amount of hormonal substances that are not and cannot be in regular salt. One percent of salts and hormones, isolated from 1 ml of tear fluid can be enriched to 10 kg of table salt. As a result, a bioactive additive with hormonal correcting function has been obtained [11;23].

As it has been already mentioned, in health, a small amount of tear (0.4–1 ml per day) produced by conjunctival accessory lacrimal glands is needed for wetting the human eyeball. The major lacrimal gland starts acting only in special cases: when particles from the environment enter the eye, in cases of contact with irritating gases, blinding light, enhanced drying, irritation of the mucous membrane of the mouth or nose, severe pain and emotional conditions.

The tear coming from the lacrimal glands, due to the blinking movements of the eyelids and the forces of capillary tension, is evenly distributed over the surface of the eyeball. A narrow strip of tear between the posterior edge of the eyelid and the eyeball is called the rivas lacrimalis. A tear is collected in the depression of the conjunctival cavity at the inner corner of the palpebral fissure, the lacrimal lake. From here it is discharged into the nasal cavity through the lacrimal ways, which include the lacrimal punctures, the lacrimal canaliculi, and the nasolacrimal canal. The lacrimal punctures (one in each eyelid) are placed on the tops of the elevations, known as the lacrimal papillae, at the medial corner of the palpebral fissure along the posterior edge of the intermarginal space. They are turned to the eyeball, tightly adjoining to it in the region of the lacrimal lake. Tears drain into the lacrimal canals, which have vertical and horizontal genu. The length of the tubules is 8-10 mm. The lacrimal punctures and tubules are lined with a stratified pavement non-keratinizing epithelium, and the lacrimal sac and the nasal duct are covered with two layers of cylindrical epithelium containing, as it has been already mentioned, goblet cells. The horizontal parts of the

tubules run behind the internal adhesions of the eyelids and drain into the lacrimal sac on its lateral side. The lacrimal sac is a cylindrical cavity closed from above; it is 10-12 mm long with a diameter of 3-4 mm. It is placed in the lacrimal fossa. This is bone depression at the junction of the frontal process of the maxilla with the lacrimal bone in bordered anteriorly by the lacrimal anterior crest, belonging to the frontal process of the maxilla, and by the posterior lacrimal crest of the lacrimal bone posteriorly. Inferiorly, the fovea passes into the nasolacrimal canal. The lacrimal sac is walled up in a triangular space formed by the fascia. The anterior wall of this fascial bed is formed by a broad lamina of the inner ligament of the eyelids, its anterior portion and the deep fascia of the circular muscle of the eyelids, the posterior is formed by the torsoorbital fascia and the posterior ligament of the internal ligament, and the inner periosteum of the lacrimal fossa [18].

These morphological characteristics are taken into account during surgical interventions on the lacrimal sac. The lacrimal sac descends into the nasal duct opening under the inferior nasal concha. Its length exceeds the length of the bone canal and ranges from 14 to 20 mm, width is 2-2.5 mm. The mucous membrane of the sac and duct is lined with a cylindrical epithelium, which contains goblet cells producing mucus. The submucosal layer is rich in adenoid tissue. The outer layers are made of dense fibrous tissue containing elastic fibers. The lower sections of the anterior wall of the sac are poor in elastic fabric. Along the lacrimal tubules, lacrimal sac and nasolacrimal ducts, there are bends, contractions and valvular folds. They are permanent at the orifices of the canaliculi, at the site where the sac transits into the nasolacrimal canal, at the exit of the nasolacrimal canal that explains the frequent localization of strictures and obliterations in the indicated places.

These morphological characteristics of the lacrimation apparatus considerably determine its mechanisms. A number of factors are considered to be important in the tear-draining mechanism. The main one is the suction capacity of the tubules, the walls of which have muscle fibers. Moreover, the siphon action of the tear-draining system, the pressure on the tear by the closed eyelids with a closed conjunctival cavity, capillary forces, the suction action of nasal breathing are important as well [17;19].

As we can conclude, a part of the lacrimal apparatus providing tear drainage is well described. At the same time, the mechanism of tear-draining from the human large and small lacrimal glands according to the system of the excretory ducts, unlike the tearing mechanisms, care from being completely described. Moreover, there are little data on the structure of the wall and the three-dimensional structure the excretory ducts. Microanatomical relationships between the orbital and palpebral ducts (lobes) with each other are not

clear. Information on the number and localization of the small lacrimal glands in the conjunctiva of the eyelids is still contradictory.

Conclusion

Having analyzed the available literature resources we can conclude that the structure of the excretory ducts of the orbital lobe of the human lacrimal gland, unlike its palpebral lobe, from their terminal extensions to the orifices in the conjunctival epithelium, has not been completely studied yet. There is no data on their morphometry (lumen diameter, outer diameter, wall thickness), as well as changes in the lumen of the ducts along their extension. There are also no data on the syntopic relationship between the ducts and the hemomicrocirculatory segments in the lobule of the human orbital lacrimal gland. Moreover, the cellular composition of the wall of the lacrimal duct, both in humans and in laboratory rats is requiring further in-depth study.

It is appropriate to compare the morphology of the human lacrimal glands and lacrimal gland in rats in order to identify general biological structural and functional characteristics, especially taking into account that the secret of the lacrimal gland in rats is mixed with tears, and with age, the lacrimal glands can undergo changes in their structure called "lacrimation".

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Реферат

ОБЩЕБИОЛОГИЧЕСКИЕ ЗАКОНОМЕРНОСТИ СТРОЕНИЯ БОЛЬШИХ И МАЛЫХ СЛЕЗНЫХ ЖЕЛЕЗ ЧЕЛОВЕКА И МАЛОИЗУЧЕННЫЕ АСПЕКТЫ ИХ МОРФОЛОГИИ

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Ключевые слова: слезная железа, выводной проток, гемомикроциркуляторное русло, стереоморфологический анализ.

В статье рассмотрены фундаментальные и современные данные о структуре и функции больших и малых слезных желез человека. Пальпебральная доля слезной железы человека состоит из многочисленных достаточно крупных долек, которые имеют практически идентичный принцип устройства. Каждая долька имеет несколько осевых выводных внутридольковых протоков. Их разветвления на всем протяжении окружены секреторными эпителиальными компонентами в виде концевых отделов и соответствующих им мельчайших терминальных слезных протоков, образующих в совокупности структурные элементы гроздевидной формы. Доставка крови к капиллярной сети долек слезной железы и ее альвеол осуществляется несколькими артериолами, которые проходят в очень крупных интерстициальных промежутках богатых жировой тканью. Каждая такая артериола кровоснабжает несколько смежных долек. От нее берут свое начало прекапиллярные артериолы, непосредственно питающие кровью альвеолы дольки. Сеть капилляров едина и не разделяется на блоки, которые соответствовали бы субдольковым единицам. Кровеносные капилляры располагаются в пространствах между несколькими смежными концевыми отделами. Таким образом, подтверждается факт тесного синтопического соответствия внутридольковых выводных протоков и посткапиллярных венул. Доказана необходимость в проведении более детальных морфологических исследований, анатомо-топографических особенностей слезных желез. Требуется дальнейшее изучение клеточного состава стенки выводных протоков слезной железы, как у человека, так и у лабораторной крысы с целью сравнения их морфологии и качества вырабатываемого ими секрета. Интересным было бы сравнить морфологию слезных желез человека и гардеровой железы крысы с целью выявления общебиологических черт строения и функции.

Реферат

ЗАГАЛЬНОБІОЛОГІЧНІ ЗАКОНОМІРНОСТІ БУДОВИ ВЕЛИКИХ І МАЛИХ СЛЬОЗОВИХ ЗАЛОЗ ЛЮДИНИ І МАЛОВИВЧЕНІ АСПЕКТИ ЇХ МОРФОЛОГІЇ

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Ключові слова: слъзозва заліза, вивідний проток, гемомікроциркуляторне русло, стереоморфологічний аналіз.

У статті розглянуті фундаментальні та сучасні дані про структуру та функції великих і малих слъзових залоз людини. Пальпебральна частка слъзової залози людини складається з численних досить великих часточок, які мають практично ідентичний принцип улаштування. Кожна часточка має кілька осевих вивідних внутрішньодолькових протоків. Їх розгалуження на всьому протязі оточені секреторними епітеліальними компонентами у вигляді кінцевих відділів і відповідних їм найдрібніших терминальних слъзових протоків, що утворюють в сукупності структурні елементи гроноподібної форми. Доставка крові до капілярної мережі часточок слъзової залози і її альвеол здійснюється декількома артеріолами, які проходять в дуже великих інтерстиціальних проміжках, багатих на жирову тканину. Кожна така артеріола кровопостачає кілька суміжних часточок. Від неї беруть свій початок прекапілярні артеріоли, що безпосередньо живлять кров'ю альвеоли часточки. Мережа капілярів едина і не поділяється на блоки, які відповідали б субдольковим одиницям. Кровеносні капіляри розташовуються в просторах між декількома суміжними кінцевими відділами. Таким чином, підтверджується факт тісної синтопічної відповідності внутрішньодолькових вивідних протоків і посткапілярних венул. Доведена необхідність в проведенні більш детальних морфологічних досліджень, анатомо-топографічних особливостей слъзових залоз. Потрібне подальше вивчення клітинного складу стінки вивідних протоків слъзової залози, як у людини, так і у лабораторних щурів з метою порівняння їх морфології і якості секрету, що ними виробляється. Цікавим було б порівняти морфологію слъзових залоз людини і гардерової залози щура з метою виявлення загальнобіологічних рис будови і функції.