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POLARIZATION PROPERTIES OF TISSUES OF SOME ENDOCRINE GLANDS

Key words: *thyroid gland, suprarenal gland, prostate gland, laser polarimetry.*

Abstract. *The polarization properties of the tissue of the endocrine glands based on histological section were studied in the paper. An investigation by means of the method of laser polarimetry of the thyroid, suprarenal and prostate tissue demonstrated the polarization properties of the glands of intact rats in health.*

Introduction

For the last decade topicality of the use of laser polarimetry method has grown to determine properties of BT as exactly they allow to find out the spatially updiffused properties of an object, define the presence of dissipation areas distribution and get local high-frequency information. Interesting are possibilities of the use of laser polarimetry methods to determine the properties of glandular tissue, namely tissues of the thyroid and suprarenal glands. In the process of development of diagnostic methods, it has been found that the peculiarity of biological tissue structure is a double-base amorphously crystalline structure[1]. The use of lasers in biomedical optics stipulated the development of a number of researches – laser polarimetry of the biological tissues, which is based on the statistical analysis of polarizing-inhomogeneous objective fields [3,7]. Radiation field dispersed by biological tissue, becomes the carrier of information about their properties. This information is found to be contained in photometric, spectral, polarization and correlation characteristics of light vibrations [5].

However,the questions of the use of laser polarimetry methods remain little studied to examine the properties of glandular tissue, such as some endocrine glands which is topical for differential diagnostics of their pathological processes [6].

Objectives of the research

To study polarizing properties of optically thin sections of the thyroid and suprarenal glands tissues of intact rats.

Materials and methods

Researches were conducted on 20 white mature rats-males with initial body weight 100-150 grammes. For the study of structural organization of BT thyroid, suprarenal and prostate glands they were deleted and fixed in a 10% solution of neutral formalin with the triple change of fixing, dehydrated in the alcohols of growing concentration, whereupon inundated in paraffin blocks. Microsections of 5-6 мкм thickness were made and studied in a lightoptic microscope BIOLAMAS of P-12. For research of polarization properties and estimation of diagnostic possibilities of statistical analysis of fabrics images of glands achroos microsections (20 preparations) of physiologically normal glands of intact animals, which were made by means of cryostat were investigated. Polarization images of the thyroid, adrenal and prostate tissues were received by microobjective lens, projected in the plane of photosensitive ground (800x600 pixel) of CCD-camera, which provided the range of measuring structural elements of the biological tissues for such sizes: 2-2000 mkm. Examination of polarization images of gland tissues are presented by an optical chart (fig. 1). Illumination was conducted by the parallel ($\varnothing = 10^4$ мкm) bunch of He-Ne laser (λ= 0.6328 мкm, W = 5.0 мВт). Polarization illuminator consists of quater wave plates 3; 5 and polarizer 4, that provides forming of laser bunch with an arbitrary azimuth $0^0<\alpha_0<180^0$ or ellipticity $0^0<\beta_0<90^0$ of polarization.

Results of the research and discussion

Polarization images are presented on (fig. 2) optically thin microsections of the thyroid glands in health (coefficient of weakening, $\tau \leq 0,1$ geometrical thickness 40 λm) for axial (0–0) and crossed (0–90) polyarizer 4 and analyzer 9.

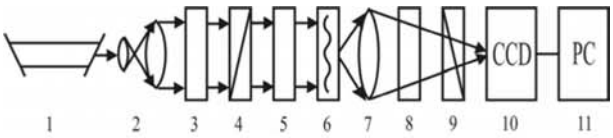

Fig. 1. Optical chart of polarization images examination of microsections of the thyroid and suprarenal gland tissues

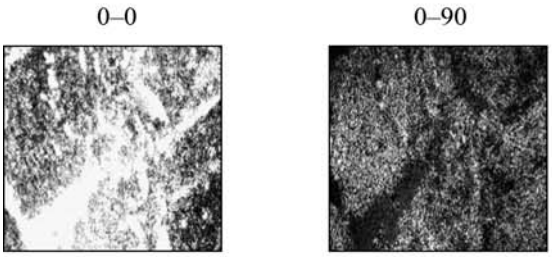

Fig. 2. Polarization images of optically thin sections of the thyroid gland, obtained for axial (0–0) and crossed (0–90) polyarizer and analyzer

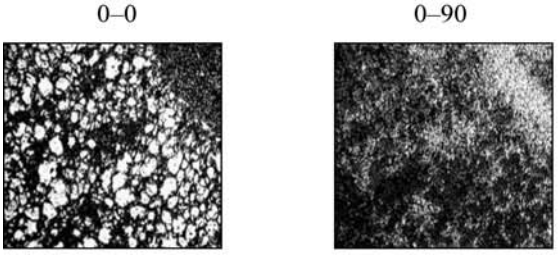

Fig. 3. Polarization images of optically thin sections of the glomerular zone tissue of the adrenal gland, obtained for axial (0–0) and crossed (0–90) polyarizer and analyzer

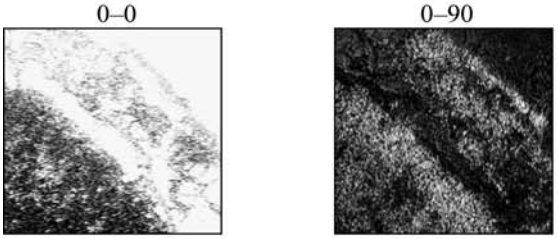

Fig. 4. Polarization images of optically thin sections tissues of the fasciculate zone of the adrenal cortex, obtained for axial (0–0) and crossed (0–90) polyarizer and analyzer

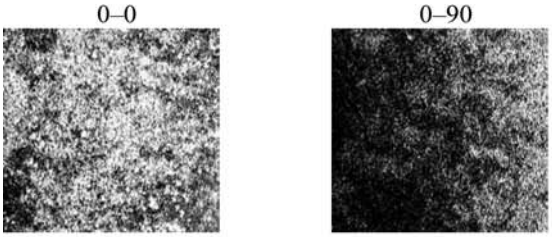

Fig. 5. Polarization images of optically thin sections tissues of the reticular zone of the adrenal cortex, obtained for axial (0–0) and crossed (0–90) polyarizer and analyzer

The statistical moments of the first *M*, second σ, third *A* and fourth *E* orders of their values, which were calculated by finding an average on every pixel of recording CCD – camera were used as a basic

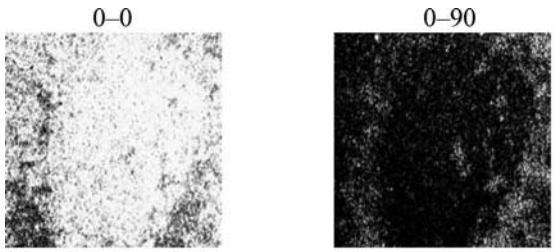

Fig. 6. Polarization images of optically thin sections of the adrenal medulla, obtained for axial (0–0) and crossed (0–90) polyarizer and analyzer

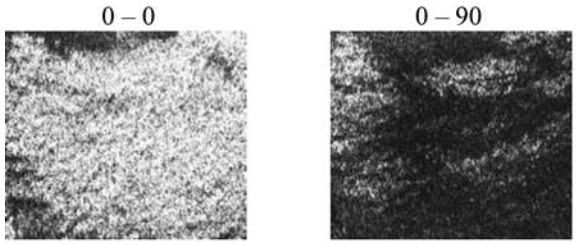

Fig. 7. Polarization images of optically-thin layers of tissue of the prostate gland got for axial (0–0) and crossed (0–90) polyarizer and analyzer

analytical instrument to evaluate aggregation of casual values characterizing the image of a biological object (intensities) and its optical geometrical structure (directions of orientations of protein fibrils c and index of double refraction of their matter Δn).

Polarization images are presented on (fig. 3, 4, 5, 6) of optically thin microsections of the cortical and medullar tissues of the adrenal gland in health (coefficient of weakening, geometrical thickness 40 λm) got for axial (0 – 0) and crossed (0 – 90) polyarizer 4 and analyzer 9.

Images of optically-thin (a coefficient of weakening is $\tau \le 0.1$, is a geometrical thickness 40) microsections of fabric is the prostate tissue got for axial (0-0) and crossed (0-90) polyarizer 4 and analyzer 9 are presented in fig. 7.

The findings obtained demonstrate the tendency of growth of statistical moments values of distributing orientations of the endocrine organs. The statistical moments of the third (A_p) and fourth (E_p) order grow most quickly.

Statistical approach in the analysis of polarization images was found to detect considerable diagnostic sensitiveness of the moments of higher distribution orders of image intensity of optically thin microsections of the thyroid, suprarenal and prostate glands [4].

Consequently, the results obtained correlate with the previous information of statistical investigations of polarization properties of other biological tissues [2,5].

Conclusion

Carried out polarization investigations of biological tissues in intact animals allowed to

determine the parameters of the norm of polarization properties of the thyroid, suprarenal glands and prostate tissues in rats.

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ПОЛЯРИЗАЦИОННЫЕ СВОЙСТВА ТКАНЕЙ НЕКОТОРЫХ ЭНДОКРИННЫХ ОРГАНОВ

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Резюме. В работе показаны поляризационные свойства тканей желез щитовидной, надпочечниковой и предстательной на основе гистологических срезов. Исследования методом лазерной поляриметрии тканей эндокринных желез интактных крыс показали их поляризационные свойства в норме.

Ключевые слова: щитовидная железа, надпочечниковая железа, предстательная железа, лазерная поляриметрия.

ПОЛЯРИЗАЦІЙНІ ВЛАСТИВОСТІ ТКАНИН ДЕЯКИХ ЕНДОКРИННИХ ОРГАНІВ

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Резюме. У роботі показані поляризаційні властивості тканин залоз щитоподібної, надниркової та передміхурової залоз на основі гістологічних зрізів. Дослідження методом лазерної поляриметрії тканин ендокринних залоз інтактних щурів показали їх поляризаційні властивості в нормі.

Ключові слова: щитоподібна залоза, надниркова залоза, передміхурова залоза, лазерна поляриметрія.

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