МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
БУКОВИНСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ

М А Т Е Р І А Л И

106-ї підсумкової науково-практичної конференції
з міжнародною участю
професорсько-викладацького колективу
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Матеріали підсумкової 106-ї науково-практичної конференції з міжнародною участю професорсько-викладацького колективу Буковинського державного медичного університету (м. Чернівці, 03, 05, 10 лютого 2025 р.) – Чернівці: Медуніверситет, 2025. – 450 с. іл.

У збірнику представлені матеріали 106-ї науково-практичної конференції з міжнародною участю професорсько-викладацького колективу Буковинського державного медичного університету (м. Чернівці, 03, 05, 10 лютого 2025 р.) зі стилістикою та орфографією у авторській редакції. Публікації присвячені актуальним проблемам фундаментальної, теоретичної та клінічної медицини.

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in resistance with increasing bacterial concentration for both species and characteristic changes within the 10–100 kHz frequency range. Time-dependent impedance differences were also observed. The semicircular shape of Nyquist plots at high frequencies indicated faradic electron transfer at the electrodes, while the low-frequency spectrum reflected diffusion processes of bacterial waste products to the electrode surface. The presence of live *E. coli* cells led to a decrease in impedance compared to dead cells, with $R_{s+}R_{ct}$values decreasing by approximately 50%.

Conclusions. The proposed method of selective detection of bacterial cells can be used to identify two types of bacteria *E. coli* and *S. aureus*, to qualitatively characterize the differences between dead and live cells and to estimate their concentration in samples with an unknown number of bacteria per unit volume.

Ivanchuk M.A.

MATHEMATICAL METHODS IN MEDICAL PREDICTION

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Introduction. Medical forecasting involves predicting the probability or course of a disease and its potential outcomes by understanding the patterns of pathological processes. This study explores various mathematical methods that can help build accurate prognostic models in medicine.

The aim of the study. The primary aim is to explore the use of mathematical methods in medical prediction.

Material and methods. The study involved analyzing research on mathematical methods for medical forecasting.

Results. Several mathematical methods are used in medical forecasting, each with unique strengths. Cluster analysis is an unsupervised learning method. Unlike supervised models, cluster analysis does not require predefined groupings. Instead, data is grouped into clusters based on inherent patterns (e.g., patients with or without a specific disease). Researchers can then analyze the characteristics of each cluster to understand why certain patients were grouped together and make conclusions based on these patterns.

Support vector machines are supervised models that classify data by identifying an optimal hyperplane to separate two data classes. Using known patient data, an SVM model is trained to classify new cases, making it suitable for tasks such as disease prediction.

A naive Bayesian classifier is a probabilistic classifier that uses Bayes' theorem to determine the probability that an observation belongs to one of the classes.That is, if, based on the values of the variables, it is possible to unambiguously determine to which class the observation belongs, the Bayesian classifier will report the probability of belonging to this class.

A Markov process is a stochastic process describing a sequence of possible events in which the probability of each event depends only on the state attained in the previous event.In medicine, Markov processes can be used to build epidemiological models and predict disease prevalence.

Conclusions. The above list of mathematical methods that can be used in medical forecasting is far from complete. The selection of the method for a specific task depends on the available medical data and the goal of the researcher.

Kulchynskyi V. V.

ADVANCED MATERIALS FOR FLEXIBLE WEARABLE SENSORS OF BODY AREA NETWORKS: PHYSICAL LIMITATIONS AND PROSPECTS

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Introduction. Personalized medicine and telemedicine involve the use of Body Area Networks (BANs) for real-time monitoring physiological parameters. The functionality of BANs is effective in case of using flexible wearable sensors. Designing of new advanced materials is the way to enhance the performance of these sensors.

The aim of the study. To review advanced materials current state used in flexible wearable sensors, the physical limitations they encounter and future prospects to overcome these challenges.

Material and methods. Combination of such properties of conductive polymersasgood electrical conductivity, mechanical flexibility, ease of processing and integrating with other substrates, makes them suitable for such medical applications, as sensors for different electrography techniques. Advantages of flexible sensors fabricated from graphene and carbon nanotubes (CNTs) are rapid response times and high signal-to-noise ratios. Enhanced sensor sensitivity due high surface area with other their electrical, thermal and mechanical properties makes them appropriate for biosensors. Metal nanowires, particularly silver and gold, provide excellent conductivity and flexibility, making them suitable for transparent and stretchable electronics. Their ability to form percolating networks allows for effective signal transmission, even when stretched. However, brittleness and susceptibility to oxidation are issues for long-term applications in wearable sensors.

Results. There are several physical limitations on the optimal performance of flexible wearable sensors. 1. Repeated bending and stretching: flexible sensors must withstand it without losing functionality. Designing substrates that maintain sensor integrity under significant deformation remains challenging. 2. Materials for wearable sensors that interface directly with the skin must be non-toxic, non-allergenic and capable of withstanding the harsh biological environment. Current materials often fail to meet these criteria over extended periods, leading to skin irritation and sensor degradation. 3. Such environmental factors as moisture, temperature fluctuations and electromagnetic interference are causes of unstable signals and reduced accuracy in physiological measurements of flexible wearable sensors due to sensitivity of most of advanced materials to these factors. 4. Current battery technologies may not provide the necessary energy density or flexibility, leading to limitations on continuous operation of wearable sensors.

Prospective directions overcoming the limitations of advanced materials for flexible wearable sensors requires innovative strategies and interdisciplinary collaboration. 1. The ways to achieve increasing of flexibility and improving of sensing capabilities are to research into new materials, such as stretchable ionic conductors and self-healing polymers and combination of different materials, such as polymers with graphene or CNTs, to obtain hybrid materials. Some new materials can overcome mechanical and biocompatibility limitations, providing greater durability and comfort for users. 2. Sensors with improved performance metrics can be created by integration of nanotechnology and microfabrication techniques. 3. Coating existing materials with protective layers could enhance their biocompatibility and environmental resilience. 4. Incorporating energy harvesting technologies, such as piezoelectric or thermoelectric materials, is the way to enable self-powered sensors with extended the operational life of wearable devices and enhanced user convenience.

Conclusions. The development of advanced materials for flexible wearable sensors of BANs presents both significant opportunities and challenges. While current materials like conductive polymers, graphene and metal nanowires demonstrate promising characteristics, their limitations in mechanical stability, biocompatibility and environmental sensitivity need to overcome. Future research directions focus on new materials, advanced fabrication techniques, protective coatings and energy harvesting solutions. The integration of these innovative materials will be critical in shaping the future of healthcare and personalized medicine.

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THE USE OF BONE PLATES IN TRAUMATOLOGY

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Introduction. Bone plates are essential tools for stabilizing fractures, especially in complex or unstable cases. They offer structural support and help maintain proper alignment, thereby aiding the healing process. This study explores the applications, benefits and potential complications associated with bone plates in trauma surgery.