По результатам исследования *in vitro* противотуберкулезной активности производного бензамида с помощью модифицированного метода пропорций в жидкой питательной среде Миддлбрук 7H9 с использованием автоматизированной системы BACTEC™ MGIT™ 960 (Becton Dickinson, USA) установлено, что производное бензамида полностью подавляет рост патогенного лекарственно-чувствительного референс-штамма *Mycobacterium tuberculosis H37Rv* и патогенного клинического штамма *Mycobacterium tuberculosis* с множественной лекарственной устойчивостью в концентрации 100 мкг/мл.

В эксперименте на 48 клинически здоровых мышах обоего пола линии СВА и на 48 клинически здоровых крысах обоего пола линии Вистар исследовали острую токсичность производного бенамида. Исследуемое соединение вводили внутрижелудочно в виде водной суспензии в дозах 100 мг/кг, 500 мг/кг и 2000 мг/кг живой массы. Продолжительность наблюдения за картиной интоксикации после введения составляла 14 дней. Во время эксперимента гибели животных не наблюдалось. Общее состояние всех животных было удовлетворительным. При макроскопическом исследовании внутренних органов не было выявлено отрицательное влияние. LD_{50} производного бензамида составляет более 2000 мг/кг, поэтому производное бензамида является практически нетоксичным соединением – относится к 5-му классу токсичности по модифицированной классификации Организации экономического содействия и развития (OECD) и согласно гармонизированной системе классификации опасности и маркировки химической продукции (GHS) относится к 5-му классу токсичности – то есть обладает относительно низкой острой токсичностью. LD_{50} производного бензамида значительно выше, чем LD_{50} препарата I ряда для лечения туберкулеза изониазида (LD_{50} изониазида составляет 170 мг/кг при внутрижелудочном введении мышам), что характеризует производное бензамида как менее токсичное соединение.

В эксперименте на 40 клинически здоровых крысах обоего пола линии Вистар исследовали подострую токсичность производного бензамида. Исследуемое соединение вводили внутрижелудочно в виде водной суспензии в дозах 10 мг/кг, 50 мг/кг и 100 мг/кг живой массы один раз в день на протяжении 28 дней. Во время эксперимента гибели животных не наблюдалось. Общее состояние всех животных было удовлетворительным. Клиническое состояние крыс опытных групп не отличалось от состояния крыс контрольных групп. В ходе осуществления макроскопического анализа стресс-компетентных органов (сердца, печени, легких, селезенки, желудка, почек и мозга) не было выявлено патологических изменений ни в одной из групп исследуемых животных.

Учитывая установленную в экспериментах *in vitro* противотуберкулезную активность и установленную в экспериментах *in vivo* безопасность 3-[4-(2-фторбензоил) пиперазин-1-карбонил]-N-[3-(трифторметил)фенил] бензамида − это новое синтезированное соединение можно считать перспективным для дальнейших исследований.

УДК 2

新型比率荧光探针的制备与应用

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Summary. *As a new type of nano-materials, metal nanoclusters have gained wide attention in chemistry, materials, biology and so on.In this project, the blue green fluorescent carbon nanomaterials with rich functional groups will be prepared by hydrothermal synthesis technology, using natural biomolecular bovine serum protein as precursor BSA@CDs. A new type of carbon nano coated silver nanoclustered composite was further prepared by using CDs as template CDs@AgNCs . The prepared CDs was used as template to further prepare a new carbon nanocoated silver nanocluster composite (CDs@AgNCs). The prepared new composite CDs@AgNCs*

has a double emission signal with good separation degree, it can realize the visual detection of dopamine and copper ions by the change of fluorescence signal ratio, effectively eliminating the interference of environmental factors.

At present, the aging population of our country is in a period of sustainable development, which is a huge demand for mobile medical services for chronic diseases and invisible diseases. The concept of mass medical treatment also changed from "never medical examination, serious medical treatment" to "prevention first, prevention combined". In addition, as a series of national policies and regulations guide, in recent years, the big health industry continues to rise, the development prospects of the medical examination industry is broad.

Dopamine is a neurotransmitter that plays an important role in human immunity and nervous system. Copper ions are widely involved in the regulation of many biological processes. Therefore, it is very important to monitor the content of dopamine and copper ions in biological liquids and cells in real time. The ratiometric fluorescent probe is a kind of fluorescent probe with multiple independent emission bands. It can expand the range of dynamic response by changing the intensity ratio of different peaks, and effectively reduce the interference of probe concentration and light source fluctuation to achieve more accurate analysis of target substances. For this project, a silver nanocluster composite modified by blue-green fluorescent carbon nanoparticles has a good separation degree of double emission signal. The detection of dopamine and copper ions is realized by the change of fluorescence signal ratio. And the real-time analysis and feedback are carried out through the matching test kit.

In this project, fluorescent carbon nanoparticles were prepared by hydrothermal synthesis of biomolecules such as glutathione as raw materials, and silver nanoclusters were further prepared by fluorescent carbon nanoparticles as templates. The prepared carbon nanoparticles modified silver nanocluster complex was used as a fluorescence ratio probe to detect dopamine and copper ions. It is divided into the following stages:

1. Preparation of blue-green fluorescent carbon nanoparticles.
2. Preparation of ratiometric fluorescent probes.
3. Characterization of synthetic ratiometric fluorescent probes.
4. Detection of important physiological markers such as dopamine and copper ions in test tubes.
5. Use of ratiometric fluorescent nanoprobes for identification and fluorescence imaging of dopamine and copper ion content in tumor cells.

1. This project has constructed, a novel dual-emission fluorescent nanocomposite. The composite consists of carbon nanoparticles with blue-green fluorescence and silver nanoclusters with red fluorescence, which is stable and can be preserved for a long time under various environmental conditions. The surface of the nanocomposite has abundant functional groups and good water solubility.

2. The main components of the nanoprobe are silver and carbon nanomaterials, which have low biological toxicity and good biocompatibility. With the use of detection kit, users can get accurate detection without leaving home, which has the big market application prospect.

3. The ratiometric fluorescent probe constructed by this project, it can detect and analyze dopamine content and copper ion content more accurately according to the change of peak intensity ratio of fluorescence signal belonging to silver nanoclusters and carbon nanoparticles. Compared with the traditional single signal fluorescence detection method, it can obtain better detection limit and anti-interference ability.

For the big data health industry, we processed the fluorescent probe packaging into a detection kit, which can accurately detect the concentration of copper ions in the human body when used with special reagents for detection. Especially for pesticide residues it has a strong pertinence. Before the user goes to bed, the body fluid is obtained through the test box, the preliminary analysis is carried out, and the test data are collected into the company's database for data evaluation. The detection box can detect the concentration of copper ion in human body, and can judge whether the index is normal or not, and then give feedback to the user. The matching test reagent is used with

the test box, can be replaced, can be purchased separately. Therefore, the test box has a long service life and saves environmental protection.

УДК 2

毛发宏扫描全息分析系统

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Summary. *The existing disease diagnosis techniques are more or less harmful to the human body, so a simple and non-invasive disease screening technology is urgently needed. This paper introduces a hair scanning technique for the diagnosis of diseases.*

Anatomically, human scalp hair is divided into thalamic layer, cortex and medulla. The medulla is located in the center of the cortical fibers and can be missing, broken or continuous. Existing studies have found that the thalamic layer and cortex of hair have different functions and functions. However, the hair medulla is simply considered to be an irregular gap with many holes in the center of the hair, and the research on the function and function of the medulla is not satisfactory. It can be used as a diagnostic tool to study whether changes in the medulla structure of hair are related to some diseases. Scanning hair samples can be used as a simple, cheap and non-invasive screening technique for the diagnosis of diseases, which has practical significance.Research progress of the project.

At present, the construction of hair scanning device, the collection and induction of hair data and the stitching of hair images have been completed. The specific contents of these three aspects of work will be introduced below.

The first is the construction of the hair scanning device, which includes four modules. The image acquisition module collects the microscopic image of the hair from the microscope by using a digital camera and saves the microscopic image; the transmission module, a mechanical device, is used to control the movement and straightening of the hair under the microscope, which is easy to focus and take a complete microscopic image of the hair. Include a hair tension unit (for straightening the hair, convenient for digital camera focus and microscopic image acquisition), a hair movement unit (for automatically moving the hair and taking continuous hair microscopic images), and a hardware control module for controlling the work of the transmission device and digital camera. The image analysis module is used to process and analyze the microscopic image of the hair collected by the image acquisition module, and obtain the data information such as the length of the hair pith, and obtain a complete microscopic image of a hair through the image mosaic technology.

Then there is the collection and induction of hair data. at present, 133 groups of hair images of cancer patients and 43 groups of healthy people have been collected, and the hair image data are numbered, and an information index table is established according to the number. record the age, disease, hair length and other basic information of the person to which the hair belongs.

The last part is the stitching work of the hair, which adopts the following stitching algorithm: first, the background of the hair is changed to white by logical operation, and the background of the hair image is separated; second, the pixel points of the hair image are searched, and the hair is fixed at the same horizontal line by clipping. Thirdly, the three-channel hair image channel is divided into three single-channel hair images. The three-channel R-MagneGMagneB three-channel image is weighted fused, and the three-channel image after fusion is fused to get the mosaic image.

To explore the feasibility of diagnosing immune diseases through hair: with the continuous development and progress of information technology, how to use these techniques to help patients or doctors make preliminary diagnosis quickly and efficiently has become a hot topic. This project provides a new method for disease screening and diagnosis by exploring the correlation between hair medulla structure and disease.