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此次检索竞赛特别侧重于 IEEE Xplore 中收录的的生物医学工程技术文献。所有题目答案均来自于 IEEE Xplore 平台的 IEEE 旗舰杂志—— IEEE Spectrum 中的文章。

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2020 IEEE *Xplore* Challenge for Researchers in Asia

The questions below are based on research available via the IEEE *Xplore* digital library. IEEE *Xplore* provides access to more than five-million full-text documents from some of the world's most highly-cited publications in a wide range of technologies including electrical engineering, computing, telecommunications, and many other new and emerging fields of study.

This search competition and the questions below specifically focus on biomedical technologies found in IEEE *Xplore* and articles from IEEE *Spectrum*, one of nearly 200 leading publications available via your institution's subscription in the IEEE *Xplore* Digital Library.

Please search for the correct answers to these questions from articles found in IEEE *Spectrum*.

1．康奈尔大学的迈克尔·舒勒（Michael Shuler）的小组在一个封闭循环的单芯片上建立了一个微生理系统，该系统包含三种类型的类器官，肝脏，骨髓和结肠肿瘤。研究人员用它来研究抗癌药物的代谢。第一个用以研究药物之间的相互作用的该系统在何时建立? (如需提示请见英文版)

A. 1970 年代晚期

B. 1980 年代晚期

C. 1990 年代晚期

D. 2000 年代早期

Michael Shuler's group at Cornell University built a micro-physiological system that contains three types of organoids—liver, bone marrow, and a tumor of the colon-on a single chip with closed circulation. Researchers used it to examine the metabolism of a decades-old anticancer drug. When was the first organ-on-a-chip system created to study the interaction of drugs?

Tip: In the global search box on the IEEE *Xplore* home page, type in the author name “Yu Shrike Zhang” and click “Search”. Find the article titled “A medical mini-me one day your doctor could prescribe drugs based on now a biochip version of you reacts”. Read the seventh paragraph to find the year.

A. In the late 1970s

B. In the late 1980s

C. In the late 1990s

D. In the early 2000s

2．在新泽西州霍博肯的 Autonomous Healthcare 公司中，研究人员正在为 ICU 设计和构建首批 AI 系统。这些技术旨在提供监控和细致入微的护理，就好像专家每秒都在患者床旁仔细校准治疗。这样的系统可以减轻重症监护病房中工作人员的负担。更重要的是，如果该技术帮助患者早日离开 ICU，则可以降低医疗保健的费用。人类医生通常既没有时间也没有工具来理解迅速积累的数据，但是 AI 系统可以。它还可以根据数据采取措施，例如调整关键 ICU 任务中涉及的机器。研究人员设计的 AI 系统首先专注于管理患者的哪里? (如需提示请见英文版)

A. 血液和换气

B. 换气和体液

C. 呼吸系统和心跳

D. 血压和呼吸系统

At Autonomous Healthcare, based in Hoboken, NJ, researchers are designing and building some of the first AI systems for ICUs. These technologies are intended to provide vigilant and nuanced care, as if an expert were at the patient's bedside every second, carefully calibrating treatment. Such systems could relieve the burden on the overtaxed staff in critical-care units. A human doctor typically has neither the time nor the tools to make sense of the rapidly accumulating data. But an AI system does. It could also take actions based on the data, such as adjusting the machines involved in crucial ICU tasks. At Autonomous Healthcare, what AI system and function are researchers focusing on first to help patients?

Tip: On the IEEE *Xplore* home page, click on the advanced search button. Then type in the article named “AI in the ICU” and click on “Search”. Click on the article to read the full text. Read the sixth paragraph to find the answer.

A. Circulation and blood

B. Ventilation and fluids

C. Respiratory system and heartbeats

D. Respiratory system and blood pressure

3．在生命科学中，仅 DNA 测序每年就产生数百万 gigabytes 的数据。研究人员预测，十年之内，我们将被 400 亿 GB 的基因组数据所淹没。随着数据存储需求的激增，传统的大容量存储密度也开始接近极限。超过硬盘驱动器极限，温度波动会导致磁极性翻转，从而破坏磁盘上保存的数据。那么硬盘驱动器的存储密度极限值是多少呢？(如需提示请见英文版)

A. 每平方英寸 1,000GB – 1TB

B. 每平方英寸 1TB – 2TB

C. 每平方英寸 1,000GB – 2,000GB

D. 每平方英寸 2,000GB – 2TB

In the life sciences, DNA sequencing alone generates millions of gigabytes of data per year. Researchers predict that within a decade we will be swamped with 40 billion GB of genomic data. As data storage needs surge, traditional mass-storage technologies are starting to approach their limits. Past that limit point, temperature fluctuations can induce the

magnetically charged material of the disk to flip, corrupting the data it holds. What is the limit point？

Tip: On the IEEE *Xplore* home page, click on the “Advanced Search” button. Type in the keyword “exabytes” and click on the search button. Filter by “Magazines” and click “Apply”. In the search results on the left, filter by single year and type in “2018”. Look for the article with the word “Exabytes” in the title and click on the article link to read paragraph four.

A. 1,000 GB – 1 terabyte — per square inch

B. 1 terabyte – 2 terabyte — per square inch

C. 1,000 GB – 2,000 GB — per square inch

D. 2,000 GB – 2 terabyte — per square inch

4．五十多年来，得克萨斯心脏研究所（THI）的心脏外科医师和生物医学工程师一直在寻求一种可以完全替代天然心脏的人造心脏，这个梦想可能在一头母牛体内实现。该实验向母牛体内植入了人造心脏，使其生命得到延续。这颗人造心脏是由哪个公司制造的呢？(如需提示请见英文版)

A. SynCardia

B. AbioCor

C. Bivacor

D. LVAD

For more than 50 years, cardiac surgeons and biomedical engineers at the Texas Heart Institute) have been working to develop an artificial heart that can fully replace natural ones. In April 2019, the possible culmination of that long quest was inside a shaggy brown cow throughout the trial, and the calf stayed healthy and energetic. What is the name of the company that made this artificial heart?

Tip: On the IEEE *Xplore* home page, click on the “Advanced Search” button. Type in the keyword “Maglev Heart” and click on the search button. Read the article titled “The Maglev Heart” to find the company that developed this artificial heart.

A. SynCardia

B. AbioCor

C. Bivacor

D. LVAD

5．如果咳血，并且胸部扫描显示肺部有可疑的肿块，外科医生会对肿块取样，并通过显微镜观察以发现这些细胞是否具有肺癌征兆。需要在肿瘤扩散和生长之前就开始治疗，但是医生也可能会出现误诊。人工智能（AI）系统通过大量的机器学习训练，可以提供更准确的诊断。病理学家 Andrew H. Beck 宣称“病理学将成为 AI 真正改变医学的第一个医学技术领域”。同时他还运营了一家成立了三年的初创公司。Andrew H. Beck 说这家公司的系统能提高诊断的准确性和治疗效果。这家公司的名字是什么？(如需提示请见英文版)

A. Philips

B. IBM

C. PathAI

D. Leica Biosystems

Imagine you're coughing up blood, and a chest scan reveals a suspicious mass in your lungs. A surgeon removes a small cylindrical sample from the potential tumor, and the pathologist sees that the cells have the telltale signs of lung cancer through a microscope. You start treatment before the tumor spreads and grows. But pathologists can also make a misdiagnosis and an artificially intelligent pathologist will likely provide more accurate diagnoses than human pathologists. Andrew H. Beck, a pathologist who runs a three-year-old startup, says his tools will bring real improvements in the accuracy of diagnoses and the efficacy of treatment. What is the name of his startup company?

Tip: On the IEEE *Xplore* home page, click on the “Advanced search” button. In the first text box type in “Pathology”, select “Or” and then type in “Andrew H. Beck” in the second text box. Click on “Search” and filter by “Magazines”. Click “Apply”. In the search results on the left, filter by single year and type in “2018”. Click on the article titled “This is how a pathologist could save your life”. Read the article to determine the startup company name.

A. Philips

B. IBM

C. PathAI

D. Leica Biosystems

6．让神经元和电子设备之间的互通一直以来都很困难。现在，工程师们认为形状记忆材料（shape-memory materials）可以做得更好，因为可以对形状记忆材料进行编程，以使其缠绕在血管周围并像藤蔓一样攀爬神经。来自清华大学和浙江大学的一组工程师正探索一种对神经损伤更小，更易于植入的电极。该团队建造了一个由形状记忆聚合物制成的基底，并在其上用黄金沉积图案以传导神经信号。他们建造的这个基底有多厚？(如需提示请见英文版)

A. 10μm

B. 100μm

C. 1mm

D. 100mm

Getting neurons to communicate with electronics has always been hard-hard on the neurons. Engineers now think shape-memory materials could do the job much better because they can be programmed to snake around blood vessels and climb nerves like a vine. A group of engineers from Tsinghua University and Zhejiang University are seeking a less-damaging, easier-to-implant electrode for nerves. They constructed a substrate from a shape-memory polymer and deposited a pattern of gold onto it to conduct nerve signals. How thick was the substrate they constructed？

Tip: On the IEEE *Xplore* home page, click on “Advanced search”. Type in the keyword “Shape-shifting electrodes”. Click on the article titled, “Shape-shifting electrodes for the brain: Materials that have memory could make medical implants easier to place” written by Samuel K. Moore and read the 11th paragraph for the answer.

A. 10μm

B. 100μm

C. 1mm

D. 100mm

7．在全球范围内，肺炎（pneumonia）和其他肺部疾病（lung ailments）的是儿童死亡的重要原因，超过了其他任何因素。约翰斯·霍普金斯大学的工程师、医生和公共卫生专家合作成立

了一个项目。他们共同发明了一种设备，该设备使用数字声音传感和有源降噪技术，并使用人工智能帮助卫生工作者进行准确的肺炎诊断。他们希望这一智能听诊器（smart stethoscope）能在世界各地使用，以预防儿童肺炎。2015 年在 5 岁前死于肺炎的儿童占比是多少？(如需提示请见英文版)

A. 6.1%

B. 8.6%

C. 15.5%

D. 24.9%

Worldwide, more children die of pneumonia and other lung ailments than from any other cause. A project was established with a collaboration among engineers, doctors, and public health experts at Johns Hopkins University. Together, they invented a device that uses digital sensing technology for sound capture, active acoustics for noise cancellation, and artificial intelligence (AI) to help health workers make accurate pneumonia diagnoses. They hope that the smart stethoscope will be deployed around the world to prevent children from dying of pneumonia. In 2015, how many children died of pneumonia under the age of 5?

Tip: On the IEEE *Xplore* home page, click on “Advanced search”. Type in the phrase “The Stethoscope Gets Smart”. Click on the article titled, “The Stethoscope Gets Smart: Engineers from Johns Hopkins are giving the humble stethoscope an AI upgrade” and scroll down to find Figure 2 for the number.

A. 6.1%

B. 8.6%

C. 15.5%

D. 24.9%

8．一般来说，通过指纹、牙科记录，或 DNA 进行身份识别可能要花费数小时甚至数天。而虹膜的结构（如指纹的结构）对于每个人都是唯一的，并且在一生中不会发生变化。传统观点认为，虹膜在死亡后仅几分钟就开始衰减。但一系列研究发现这是错误的，虹膜扫描几乎可以立即进行识别。这一发现具有重要而积极的意义：虹膜识别可能成为法医检查人员进行

尸体身份验证的有力新选择。如果尸体进行低温保存，多长时间内仍然可以进行虹膜识别？(如需提示请见英文版)

A. 21 天

B. 6 个月

C. 12 个月

D. 5 年

Iris recognition could become a powerful new option for forensic examiners when they need to verify the identity of a corpse. How long will the irises remain identifiable after death if cadavers are kept cool?

Tip: On the IEEE *Xplore* home page, click on the drop down menu to the left of the global search box and select “Author”. Type in the last name Maciejewicz and click on the search button. Filter by “Magazines” and click “Apply”. Click on the article titled, “The Eyes have it: New iris-recognition techniques can tell whether an Eye is healthy, diseased—or dead” and read the tenth paragraph.

A. Up to 21 days

B. About 6 months

C. 12 months

D. 5 years

9．卢旺达（Rrwanda）被称为千山之国，从穆汉加（Muhanga）小镇到甚至更小的小镇基纳齐（Kinazi）驱车要花费一个多小时。但是装载鲜血的无人机能在很短时间内完成运送。无人机由位于加利福尼亚的 Zipline 公司运营，该公司致力于为基础设施较差的地区提供医疗用品。无人机到达接收地点后，下降，在腹部打开一组门，并伞降到地面一个小包装，眨眼即可完成。当工作人员在半小时前通过 WhatsApp 订购了这批血液，在他们越过医院停车场来领取包裹时，无人驾驶飞机立即开始爬升并消失在山上。下单之后，医院工作人员会收到自动短信提醒，告诉他们要派人到外面等待。医院工作人员大概什么时候会收到短信提醒？(如需提示请见英文版)

A. 无人机到达医院之后

B. 无人机到达前 60 秒

C. 无人机到达前 5 分钟

D. 在无人机起飞前

Rwanda is known as the land of a thousand hills, and driving a car from the small town of Kinazi takes over an hour. But a blood-carrying drone can make the trip in a very short time. The drone is operated by Zipline, a California-based company focused on delivering medical supplies in areas with poor infrastructure. The fixed-wing drone materializes and drops a small package that parachutes to the ground. A staff member crosses the hospital parking lot to pick up the package–a shipment of blood ordered by WhatsApp–a half hour earlier. The hospital staff members will get an automatic text alert telling them to send someone outside to await the delivery in advance. When will the hospital staff receive the text alert ?

Tip: On the IEEE X*plore* home page, click on “Advanced search”. Type in the keyword “Zipline” Click on the article titled, “The blood is here: Zipline's medical delivery drones are changing the game in Rwanda” and read the 14th paragraph to find the amount of time.

A. After the drone arrives at the hospital

B. 60 seconds before the drone arrives

C. About 5 minutes before the drone arrives

D. Before the drone takes off

10．根据世界卫生组织的调查，在发展中国家至少有十分之一的药品质量不合格。即使是在发达国家市场，也存在着大量的劣质甚至假冒药物。凯斯西储大学、佛罗里达大学和伦敦国王学院的科研工作者发现可以利用核四极矩共振（nuclear quadrupole resonance，NQR）对药品进行品质鉴定，这种无需损坏药品的方法利用原子核（atomic nuclei）在不同频率下的化学响应导致的能量跃迁所产生的光谱来进行比对认证。请问在此方法

中，科研工作者是采取对哪两种化学物质进行核四极矩共振，其相应的频率又是多少？(如需提示请见英文版)

A. N-15 @ 0.1 – 5MHz, Cl-35 @ 20-40MHz

B. N-14/15 @ 0.1-5MHz, Cl-35 @ 2-40MHz

C. N-14 @ 0.1 – 5MHz, Cl-35/37 @ 20-40MHz

D. N-13 @ 1- 5MHz, Cl-35/37 @ 20-40MHz

According to the World Health Organization, one out of ten medicines sold in developing countries should be considered “substandard”. A similar situation exists in developed countries with fake drugs in the markets. Researchers at Case Western Reserve University, University of Florida, and King’s College London are looking into ways to verify the pharmaceutical ingredients using nuclear quadrupole resonance (NQR). Energy transitions within the atomic nuclei of the chemical responding at different frequencies will result in different spectrums, providing a unique fingerprint for the compound. What are the two most commonly used chemicals in this resonance, and their respective responding frequencies?

Tip: On the IEEE *Xplore* home page, click on “Advanced search”. Type in the keyword “Counterfeit drugs”. Filter by ‘Magazines” and click “Apply”. Click on the article titled, “Countering counterfeit drugs: A technique used for detecting explosives can also verify the integrity of medicines” and read the 14th and 15th paragraphs for the frequencies.

A. N-15 @ 0.1 – 5MHz, Cl-35 @ 20-40MHz

B. N-14/15 @ 0.1-5MHz, Cl-35 @ 2-40MHz

C. N-14 @ 0.1 – 5MHz, Cl-35/37 @ 20-40MHz

D. N-13 @ 1- 5MHz, Cl-35/37 @ 20-40MHz