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此次檢索競賽特別側重於IEEE *Xplore* 中所收錄的的生物醫學技術以及IEEE *Spectrum* 的文章，這些文章是貴校/貴單位享有使用權限的 200 多種文獻的一部分。

以下題目以IEEE *Xplore* 上可查詢到的研究結果為基礎出題，請依提示作答。

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. 康乃爾大學的 Michael Shuler 團隊在一個封閉循環的晶片上建立了一個微生理系統，該系統包含肝臟、骨髓和結腸腫瘤等三種類型的類器官。研究人員用它來研究抗癌藥物的代謝機制。第一個用以研究藥物之間的相互作用的晶片器官系統在何時建立？

提示 : 請至 IEEE Xplore 搜尋作者名稱”Yu Shrike Zhang”，從檢索結果找出文獻“A medical mini-me one day your doctor could prescribe drugs based on now a biochip version of you reacts”，答案就在文章第七段中。

A. 1970 年代末期

B. 1980 年代末期

C. 1990 年代末期

D. 2000 年代初期

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. 在紐澤西州霍博肯的 Autonomous Healthcare 公司，研究人員正在為加護病房設計和構建首批 AI 系統。這些技術旨在提供高度警戒和細緻入微的護理，如同專家時時刻刻都在患者床旁仔細調校治療方式。這樣的系統可以減輕加護病房人力超負荷的問題。更重要的是，如果該技術能協助患者加速轉出加護病房，則可以降低醫療保健的費用。醫生通常既沒有時間也沒有工具來理解迅速積累的數據，但是 AI 系統可以。它還可以根據數據採取措施，例如調整加護病房中的關鍵儀器。在Autonomous Healthcare，研究人員設計的 AI 系統首先著重於管理患者的部分為何？
提示 : 請至 IEEE Xplore 搜尋文獻名稱 “AI in the ICU” ，答案就在文章第六段中。

A. 血液和換氣

B. 換氣和體液

C. 呼吸系統和心跳

D. 血壓和呼吸系統

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. 在生命科學領域，僅 DNA 定序每年就產生數百萬 GB 的數據。研究人員預測，十年之內，我們將被 400 億 GB 的基因組數據所淹沒。隨著數據存儲需求的激增，傳統的大量儲存技術也開始接近儲存密度極限。超過儲存密度極限時，溫度的波動會導致硬碟的磁性材料翻轉(flip)，從而破壞硬碟 上所儲存的數據。試問該極限值為何？

提示：請至 IEEE Xplore 之Advanced Search 進階檢索，輸入關鍵字“exabytes”點選Search，篩選文獻類型 Magazines點選Apply，在左側出版年份 single year 輸入”2018” ，檢索結果中點選附有“Exabytes”標題的文章，答案就在第四段中。

A. **每平方英吋** 1,000GB – 1TB

B. **每平方英吋** 1TB – 2TB

C. **每平方英吋** 1,000GB – 2,000GB

D. **每平方英吋** 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. 五十多年來，德州心臟研究所（THI）的心臟外科醫師和生物醫學工程師一直在尋求一種可以完全替代天然心臟的人造心臟，在 2019 年 4 月，這項長期計畫的最終成果在一頭棕毛母牛體內實現，該實驗在母牛體內植入了人造心臟，使其生命得到延續。請問這顆人造心臟是由哪個公司製造的呢？

提示：請至 IEEE Xplore 之Advanced Search 進階檢索，輸入關鍵字“Maglev Heart”點選Search，答案就在檢索結果標題為“The Maglev Heart”的文章中。

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.

E. SynCardia

F. AbioCor

G. Bivacor

H. LVAD

5. 當病患出現咳血症狀，且透過胸部掃描發現肺部有可疑的腫塊，醫生將從疑似惡性腫瘤部分取出一部分組織進行切片檢查。若經病理學家確認這些細胞具有肺癌的明顯徵兆，病患將需要在腫 瘤擴散和生長之前及早開始治療。然而專家也可能會出現誤診。而人工智慧（AI）系統透過大量的 機器學習訓練將有機會提供更準確的診斷。病理學家兼創投公司創始人Andrew H. Beck 宣稱病理學將成為第一個受惠於 AI 的醫學技術領域，而該公司開發的系統能提高診斷的準確性和治療效果。請問這家新創公司的名字是什麼？
提示 : 請至 IEEE Xplore 之Advanced Search 進階檢索，在第一個欄位輸入關鍵字 “Pathology”，選擇 “OR” 接續在第二個欄位輸入 “Andrew H. Beck” 點選Search，篩選選文獻類型 Magazines 點選Apply，左方出版年份single year 輸入” 2018” ，答案在檢索結果標題為 “This is how a pathologist could save your life” 的文章中。

A. Philips

B. IBM

C. PathAI

D. Leica Biosystems

When a patient has been coughing up blood, and a chest scan reveals a suspicious mass in his lungs, a surgeon will remove a small cylindrical sample from the potential tumor. Then, if a pathologist sees that the cells have the telltale signs of lung cancer through a microscope, treatments will be required 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. 讓神經元與電子設備相互交流，一直以來都很困難，最新研究顯示工程師們認為形狀記憶材料（shape-memory materials）可能有助於突破這困境。透過調整形狀記憶材料，使其纏繞於血管周圍並像藤蔓一樣攀爬神經藉以達成目的。來自中國清華大學和浙江大學的一組工程師正探索一種對 神經損傷更小，更易於植入的電極。該團隊研發了由形狀記憶聚合物製成的基底，並透過沈積金鍍 層傳導神經信號。請問他們所開發的基底有多厚？

   提示：請至 IEEE Xplore 之Advanced Search 進階檢索，輸入關鍵字" Shape- shifting electrodes" ，在檢索結果選擇由Samuel K. Moore撰寫之 "This is how a pathologist could save your life" 的文章，答案就在第十一段中。

   .

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. 肺炎（pneumonia）和其他肺部疾病（lung ailments）的是全球兒童死亡的主要原因。約翰·霍普金斯大學的工程師、醫生和公共衛生專家合作進行一項專案，共同開發了一套設備。該設備使用數 位聲音感應偵測和主動降噪技術，並結合人工智會以協助醫事人員進行準確的肺炎診斷。他們希望 這一智能聽診器（smart stethoscope）能在世界各地使用，以預防兒童肺炎。2015 年在 5 歲前死於肺炎的兒童占比有多少？

提示：請至 IEEE Xplore 之Advanced Search 進階檢索，輸入段落 “The Stethoscope Gets Smart” 點選Search，在檢索結果選擇標題為 “The Stethoscope Gets Smart: Engineers from Johns Hopkins are giving the humble stethoscope an AI upgrade” 的文章，答案就在Figure 2.的圖表中。

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, what percentage of 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 percentage.

A. 6.1%

B. 8.6%

C. 15.5%

D. 24.9%

8. 一般來說，透過指紋、牙科記錄，或 DNA 進行身份識別可能要花費數小時甚至數天。而虹膜的結構（如指紋的結構）對於每個人都是唯一的，並且在一生中不會發生變化。傳統觀點認為，虹膜 在死亡後僅幾分鐘就開始衰減。但一系列研究發現這是錯誤的，虹膜掃描幾乎可以立即進行識別。這一發現具有重要而積極的意義：虹膜識別可能成為法醫檢查人員進行屍體身份驗證的有力新選擇。如果屍體進行低溫保存，多長時間內仍然可以進行虹膜識別？

提示：請至 IEEE Xplore 在檢索欄位左側之下拉式選單選擇作者”Author”，在 last name 輸入”Maciejewicz”點選Search，篩選文獻類型”Magazines” 點選Apply，在檢索結果選擇標題為 “The Eyes have it: New iris-recognition techniques can tell whether an Eye is healthy, diseased—or dead”文章，答案就在第十段中。

A. 21 天

B. 6 個月

C. 12 個月

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. 盧安達（Rwanda）被稱為千山之國，從穆漢加（Muhanga）小鎮到迷你小鎮基納齊（Kinazi）驅車要花費一個多小時。但是裝載鮮血的無人機能在很短時間內完成運送。無人機由位於加州的Zipline 公司運營，該公司致力於為基礎設施較差的地區提供醫療用品。無人機到達接收地點後，下降、打開位於機腹的門、並向地面空投包裹，工作人員即可穿越停車場領取半小時前透過 WhatsApp 訂購的一批血液。下單之後，醫院工作人員將會收到自動簡訊提醒，告訴他們要派人到外面等待。醫院工作人員大概什麼時候會收到簡訊提醒？

提示：請至 IEEE Xplore 之 Advanced Search 進階檢索，輸入關鍵字“Zipline”後點選Search，在檢索結果中點選標題為“The blood is here: Zipline's medical delivery drones are changing the game in Rwanda”的文章，答案就在第十四段中。

A. 無人機抵達醫院後

B. 無人機到達前 60 秒

C. 無人機到達前 5 分鐘

D. 在無人機起飛前

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. 根據世界衛生組織的調查，在發展中國家至少有十分之一的藥品品質不合格。即使是在已開發 國家，市面上也存在著大量劣質甚至仿冒的藥物。凱斯西儲大學、佛羅里達大學和倫敦國王學院的 研究者發現可以利用核四極矩共振（nuclear quadrupole resonance，NQR）對藥品進行品質鑒定，這種無需損壞藥品的方法利用原子核（atomic nuclei）內不同化學物質回應頻率不同的這種能量轉移所產生的圖譜來進行比對認證。請問在此方法中，研究者是採取對哪兩種化學物質進行核四 極矩共振測試，其相應的頻率又是多少？

提示：請至 IEEE Xplore 之 Advanced Search 進階檢索，輸入關鍵字“Counterfeit drugs”後點選 Search，篩選文獻類型”Magazines” 點選Apply，在檢索結果中點選 “Countering counterfeit drugs: A technique used for detecting explosives can also verify the integrity of medicines”，答案就在文章第十四段及第十五段中。

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