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2022 年医药卫生领域工程研究前沿

2023-第 10 期

“每年发布的《工程前沿》报告已经成为中国工程院学术引领的重要组成部分。中国工程院将持续跟踪全球工程科技发展前沿，把握世界科技发展大势，研判科技革命新方向，为推动经济社会高质量发展提供更加强大的动力。

——中国工程院副院长

本期快报结合科睿唯安与中国工程院战略咨询中心、高等教育出版社联合发布的《2022 全球工程前沿》，介绍医药卫生领域的部分工程研究前沿。

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《2022 全球工程前沿》¹报告的结论指出：医药卫生领域的工程研究前沿涉及基础医学、临床医学、医学信息学和生物医学工程、药学、中药学等学科方向，包括“实体瘤的免疫异质性及干预策略研究”“肿瘤动态演进机制研究”“干细胞衰老”“蛋白质折叠结构的精准预测与设计研究”“人工智能辅助药物设计”“生物大分子相分离与相变”“基因组调控机制研究”“新生抗原产生及其在肿瘤免疫中的作用机制”“3D 打印和器官再生”和“人工智能辅助疾病诊疗系统”。

其中，“**实体瘤的免疫异质性及干预策略研究**”是该领域工程研究前沿的 Top 1，本次快报重点对其进行介绍。



2022 该领域工程研究前沿相关报道

实体瘤中普遍存在免疫微环境的异质性，并且随着肿瘤的发展以及治疗干预而在空间上或时间上发生变化。这种免疫异质性与疾病进展和治疗反应性密切相关，准确了解免疫异质性、开展相应的干预策略研究，对于临床中正确评估免疫异质性、促进更加有效的个体化治疗发展至关重要。在多部位活检取样、多组学测序、单细胞测序以及纵向液体活检 (liquid biopsy) 等方法的帮助下，一系列研究进展显示了肿瘤免疫异质性的复杂性及其在指导临床诊疗策略中的潜在价值。

目前主要的研究方向包括：建立健全免疫异质性的诊断技术；开发免疫异质性研究的新模型；发展针对免疫异质性的治疗策略，如利用细胞毒剂、光动力疗法等新型治疗策略诱发表位扩展与漂移增强免疫原性；利用联合治疗手段克服异质性等。作为肿瘤治疗研究的重要前沿领域，世界多国对实体瘤的免疫异质性均有较大的研究投入，并开展了广泛的合作。我国目前处于与国外同类研究跟跑的姿态。

¹ 《2022 研究前沿》下载地址：<https://mp.weixin.qq.com/s/CYloi1ON9E0oxs29ki6zMw>



该领域工程研究前沿论文推荐

利用 ESI 数据库的 “Research Fronts” , 从 BIOLOGY & BIOCHEMISTRY, CLINICAL MEDICINE, IMMUNOLOGY, MOLECULAR BIOLOGY & GENETICS, PHARMACOLOGY & TOXICOLOGY 5 个领域的 4532 个研究前沿中筛选出与 “**实体瘤的免疫异质性及干预策略研究**” 相关性最高的 6 个前沿。

前沿 1: PANCREATIC CANCER-ASSOCIATED FIBROBLASTS;MOUSE PANCREATIC DUCTAL ADENOCARCINOMA PROGRESSION;HUMAN PANCREATIC DUCTAL ADENOCARCINOMA;CANCER-ASSOCIATED FIBROBLAST HETEROGENEITY;PANCREATIC CANCER PRECURSORS

前沿 2: INJURY RESPONSE TRANSCRIPTIONAL STATES DEFINES FUNCTIONAL VULNERABILITIES UNDERPINNING GLIOBLASTOMA HETEROGENEITY;PROLIFERATING GLIOBLASTOMA CELLS RESIDE;GLIOBLASTOMA MICROENVIRONMENT;HUMAN GLIOBLASTOMA;SINGLE-CELL RNA-SEQ ANALYSIS

前沿 3: COMPREHENSIVE HUMAN GASTRIC CANCER ORGANOID BIOBANK CAPTURES TUMOR SUBTYPE HETEROGENEITY;PRIMARY HUMAN PANCREATIC CANCER ORGANOID;BREAST CANCER ORGANOID CAPTURES DISEASE HETEROGENEITY;PATIENT-DERIVED LUNG CANCER ORGANOID;SHORT-TERM PATIENT-DERIVED OVARIAN CANCER ORGANOID

前沿 4: BULK TUMOR GENE EXPRESSION DATA;TUMOR IMMUNE CONTEXTURE;IMMUNE CELL TYPES;RNA-SEQ DATA;TISSUE CELLULAR HETEROGENEITY LANDSCAPE

前沿 5: TARGETING GLUTAMINE METABOLISM;GLUTAMINE METABOLISM;CANCER TREATMENT;CANCER;HETEROGENEITY

前沿 6: CANCER STEM CELL HETEROGENEITY;CANCER STEM CELL PERSPECTIVE;INTRA-TUMOR HETEROGENEITY;CSC TARGETING;NEW PERSPECTIVES

下表是上述前沿中筛选出来的该领域中近年来代表性的 6 篇前沿论文。

序号	标题	作者	出处	研究机构	出版年
1	<u>MESENCHYMAL LINEAGE HETEROGENEITY UNDERLIES NONREDUNDANT FUNCTIONS OF PANCREATIC CANCER-ASSOCIATED FIBROBLASTS</u>	HELMS, EJ;BERRY, MW;CHAW, RC;et al.	CANCER DISCOVERY	DAVID GEFFEN SCHOOL OF MEDICINE AT UCLA;UNIVERSITY OF WASHINGTON SEATTLE;UNIVERSITY OF WASHINGTON; etc	2022
2	<u>IDENTIFICATION OF FUNCTIONAL HETEROGENEITY OF CARCINOMA-ASSOCIATED FIBROBLASTS WITH DISTINCT IL6-MEDIATED THERAPY RESISTANCE IN PANCREATIC CANCER</u>	MCANDREWS, KM;CHEN, Y;DARPOLOR, JK;et al.	CANCER DISCOVERY	BAYLOR COLLEGE OF MEDICINE;UTMD ANDERSON CANCER CENTER;UNIVERSITY OF TEXAS SYSTEM;	2022
3	<u>GLIOBLASTOMA HIJACKS NEURONAL MECHANISMS FOR BRAIN INVASION</u>	VENKATARAMANI, V;YANG, Y;SCHUBERT, MC;et al.	CELL	UNIV HOSP HEIDELBERG; COLUMBIA UNIV; UNIV MANNHEIM;etc	2022
4	<u>SINGLE-CELL PROFILING OF MYELOID CELLS IN GLIOBLASTOMA ACROSS SPECIES AND DISEASE STAGE REVEALS MACROPHAGE COMPETITION AND SPECIALIZATION</u>	ANTUNES, ARP;SCHEYL TJENS, I;LODI, F;et al.	NATURE NEUROSCIENCE	EUROPE HOSP ST ELISABETH;VRIJE UNIVERSITEIT BRUSSEL;UZ BRUSSELS;etc	2021
5	<u>PATIENT-DERIVED ORGANOIDS PREDICT CHEMORADIATION RESPONSES OF LOCALLY ADVANCED RECTAL CANCER</u>	YAO, Y;XU, XY;YANG, LF;et al.	CELL STEM CELL	FUDAN UNIVERSITY;UTRECHT UNIVERSITY MEDICAL CENTER;UTRECHT UNIVERSITY;etc	2020
6	<u>MOLECULAR AND PHARMACOLOGICAL MODULATORS OF THE TUMOR IMMUNE CONTEXTURE REVEALED BY DECONVOLUTION OF RNA-SEQ DATA</u>	FINOTELLO, F;MAYER, C;PLATTNER, C;et al.	GENOME MEDICINE	AUSTRIAN DRUG SCREENING INST;VANDERBILT UNIVERSITY;RUPRECHT KARLS UNIVERSITY HEIDELBERG;etc	2019



该领域 ESI 高被引论文推荐

在 Web of Science 中，构建检索式 $Tl = (tumor \text{ OR } tumour \text{ OR } cancer) \text{ AND } Tl = heterogen^*$ 。截止 2023 年 4 月 21 日，共有 8431 条检索结果。在这些结果中，发文量前十的机构见下表。

机构名称	发文数
HARVARD UNIVERSITY	495
UNIVERSITY OF TEXAS SYSTEM	329
UNIVERSITY OF CALIFORNIA SYSTEM	274
UNIVERSITY OF LONDON	262
UTMD ANDERSON CANCER CENTER	218
UDICE FRENCH RESEARCH UNIVERSITIES	213
NATIONAL INSTITUTES OF HEALTH NIH USA	204
MEMORIAL SLOAN KETTERING CANCER CENTER	187
INSTITUT NATIONAL DE LA SANTE ET DE LA RECHERCHE MEDICALE INSERM	183
UNIVERSITY OF TORONTO	164

筛选其中 2020 年以来的高被引论文，共有 31 篇。结合被引频次、发表时间，以及本校在该领域的研究方向，筛选出 10 篇高被引论文，详情如下表所示。

序号	标题	作者	出处	研究机构	出版年	被引频次
1	Cellular heterogeneity and plasticity in liver cancer	Chan, LK; Tsui, YM; Ho, DWH; Ng, IOL	SEMINARS IN CANCER BIOLOGY	University of Hong Kong	2022	27
2	Novel molecular regulators of breast cancer stem cell plasticity and heterogeneity	Zhang, R; Tu, JCL; Liu, SL	SEMINARS IN CANCER BIOLOGY	Fudan University	2022	17
3	Single-cell profiling of tumor heterogeneity and the microenvironment in advanced non-small cell lung cancer	Wu, FY; Fan, J; He, YY; et al.	NATURE COMMUNICATIONS	Tongji University; University of Cologne	2021	119
4	Characterizing genetic intra-tumor heterogeneity across 2,658 human cancer genomes	Dentro, SC; Leshchiner, I; Haase, K; et al.	CELL	Francis Crick Institute; Wellcome Trust Sanger Institute; University of Oxford; etc	2021	118
5	Intratumor heterogeneity in cancer progression and response to immunotherapy	Vitale, I; Shema, E; Loi, S; Galluzzi, L	NATURE MEDICINE	Italian Institute for Genomic Medicine (IIGM); IRCCS Fondazione del Piemonte	2021	190

序号	标题	作者	出处	研究机构	出版年	被引频次
				per l'Oncologia; Weizmann Institute of Science; etc		
6	Genomic and phenotypic heterogeneity in prostate cancer	Haffner, MC; Zwart, W; Roudier, MP; et al.	NATURE REVIEWS UROLOGY	Fred Hutchinson Cancer Center; University of Washington; Johns Hopkins University; etc	2021	115
7	A pan-cancer blueprint of the heterogeneous tumor microenvironment revealed by single-cell profiling	Qian, JB; Olbrecht, S; Boeckx, B; et al.	CELL RESEARCH	Flanders Institute for Biotechnology (VIB); KU Leuven; University Hospital Leuven; etc	2020	184
8	Liquid biopsy and tumor heterogeneity in metastatic solid tumors: the potentiality of blood samples	Russano, M; Napolitano, A; Ribelli, G; et al.	JOURNAL OF EXPERIMENTAL & CLINICAL CANCER RESEARCH	University Campus Bio-Medico - Rome Italy; IRCCS Istituto Tumori Bari Giovanni Paolo II; Universita degli Studi di Bari Aldo Moro	2020	108
9	Metastatic heterogeneity of breast cancer: Molecular mechanism and potential therapeutic targets	Liang, YR; Zhang, HW; Song, XJ; Yang, QF	SEMINARS IN CANCER BIOLOGY	Shandong University	2020	264
10	Cancer-associated fibroblast heterogeneity in axillary lymph nodes drives metastases in breast cancer through complementary mechanisms	Pelon, F; Bourachot, B; Kieffer, Y; et al.	NATURE COMMUNICATIONS	UDICE-French Research Universities; Universite PSL; UNICANCER; etc	2020	157



该领域东大相关研究

东大近年来相关研究论文共有 3 篇，详情如下表所示。

序号	标题	作者	出处	出版年
1	Identifying Associations between DCE-MRI Radiomic Features and Expression Heterogeneity of Hallmark Pathways in Breast Cancer: A Multi-Center Radiogenomic Study	Ming, WL; Zhu, YH; Li, FY; Bai, YF; Gu, WJ; Liu, Y; Sun, X; Liu, XA; Liu, HD	GENES	2023
2	Dissecting super-enhancer heterogeneity: time to re-examine cancer subtypes?	Wu, T; Huang, H; Wang, X	TRENDS IN GENETICS	2022
3	Single-cell RNA-seq dissects the intratumoral heterogeneity of triple-negative breast cancer based on gene regulatory networks	Zhou, SH; Huang, YE; Liu, HZ; Zhou, X; Yuan, MQ; Hou, F; Wang, LH; Jiang, W	MOLECULAR THERAPY-NUCLEIC ACIDS	2021