

# Cell Research



Q K 1 9 4 2 4 5 9

[www.nature.com/cr](http://www.nature.com/cr)  
[www.cell-research.com](http://www.cell-research.com)

Volume 29 Number 9 September 2019



**Generating functional human hepatocytes from fibroblasts via hHPLCs**  
**Coagulation factors are effective antibacterial agents**  
**Single-cell RNA-seq analyses of pancreatic cancer**  
**Finding drugs against SFTSV infection**

ISSN 1001-0602



Institute of Biochemistry and Cell Biology  
Shanghai Institutes for Biological Sciences  
Chinese Academy of Sciences

SPINGER NATURE

# Cell Research

(Founded in 1990)

Online submission via:  
<http://www.nature.com/cr>  
<http://www.cell-research.com>

*Cell Research* is published monthly by Nature Publishing Group (NPG) in partnership with Shanghai Institutes for Biological Sciences (SIBS), Chinese Academy of Sciences (CAS) since 2006.

**Sponsored by:**  
Institute of Biochemistry and Cell Biology (IBCB), Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences  
© 2019 IBCB, SIBS, CAS



Affiliated with:  
The Chinese Society for Cell Biology since August 2007



Granted by:  
Publishing Foundation of Chinese Academy of Sciences, National Natural Science Foundation of China, and China Association for Science and Technology



This journal is a member of, and subscribes to the principles of, the Committee on Publication Ethics (COPE)  
[www.publicationethics.org](http://www.publicationethics.org)



SPRINGER NATURE

Volume 29 Number 9 September 2019

## Contents

### RESEARCH HIGHLIGHTS

#### 687 Towards precise, safe genome editing

Sebastian Memczak, Yanjiao Shao,  
Juan Carlos Izpisua Belmonte



**Cover:** The cover uses a Chinese historical allusion of "beans casted on the ground magically turn into soldiers" to depict the intra-tumoral heterogeneity in pancreatic ductal adenocarcinoma and the battle between tumor cells (soldiers with shields) and T cells (soldiers with swords). See page 725-738 by Junya Peng et al. for details.

#### 690 Lnc(ing) interferon production and action

Ganes C. Sen, Bryan R. G. Williams

#### 692 Interferon- $\gamma$ induces cancer cell ferroptosis

Laurence Zitvogel, Guido Kroemer

#### 694 Histone lysine de- $\beta$ -hydroxybutyrylation by SIRT3

Susan M. Abmayr, Jerry L. Workman

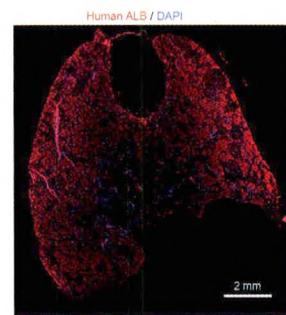
### ARTICLES

#### 696 A two-step lineage reprogramming strategy to generate functionally competent human hepatocytes from fibroblasts *Open*

Bingqing Xie, Da Sun, Yuanyuan Du, Jun Jia, Shicheng Sun, Jun Xu, Yifang Liu, Chengang Xiang, Sitong Chen, Huangfan Xie, Qiming Wang, Guangya Li, Xuehui LYU, Hui Shen, Shiyu Li, Min Wu, Xiaonan Zhang, Yue Pu, Kuanhui Xiang, Weifeng Lai, Peng Du, Zhenghong Yuan, Cheng Li, Yan Shi, Shichun Lu, Hongkui Deng

#### 711 Coagulation factors VII, IX and X are effective antibacterial proteins against drug-resistant Gram-negative bacteria *Open*

Jinwu Chen, Xiaojie Li, Ling Li, Ting Zhang, Qing Zhang, Fangming Wu, Diyue Wang, Hongze Hu, Changlin Tian, Dongsheng Liao, Liang Zhao, Danxia Song, Yongyun Zhao, Chuanfang Wu, Xu Song



Expression of human ALB in the injured recipient mouse liver engrafted with human hepatic progenitor-like cells (hHPLC). See page 696-710 by Bingqing Xie et al. for details.

#### 725 Single-cell RNA-seq highlights intra-tumoral heterogeneity and malignant progression in pancreatic ductal adenocarcinoma

Junya Peng, Bao-Fa Sun, Chuan-Yuan Chen, Jia-Yi Zhou, Yu-Sheng Chen, Hao Chen, Lulu Liu, Dan Huang, Jialin Jiang, Guan-Shen Cui, Ying Yang, Wenze Wang, Dan Guo, Menghua Dai, Junchao Guo, Taiping Zhang, Quan Liao, Yi Liu, Yong-Liang Zhao, Da-Li Han, Yupei Zhao, Yun-Gui Yang, Wenming Wu

Coordinating Editor for this issue  
Li Lu

**739 Calcium channel blockers reduce severe fever with thrombocytopenia syndrome virus (SFTSV) related fatality**

*Hao Li, Lei-Ke Zhang, Shu-Fen Li, Shao-Fei Zhang, Wei-Wei Wan, Yu-Lan Zhang, Qi-Lin Xin, Ke Dai, Yuan-Yuan Hu, Zhi-Bo Wang, Xiang-Tao Zhu, Yu-Jie Fang, Ning Cui, Pan-He Zhang, Chun Yuan, Qing-Bin Lu, Jie-Ying Bai, Fei Deng, Geng-Fu Xiao, Wei Liu, Ke Peng*

**754 NDUFAB1 confers cardio-protection by enhancing mitochondrial bioenergetics through coordination of respiratory complex and supercomplex assembly *Open***

*Tingting Hou, Rufeng Zhang, Chongshu Jian, Wanqiu Ding, Yanru Wang, Shukuan Ling, Qi Ma, Xinli Hu, Heping Cheng, Xianhua Wang*

## LETTERS TO THE EDITOR

**767 Multivalent m<sup>6</sup>A motifs promote phase separation of YTHDF proteins**

*Yifei Gao, Gaofeng Pei, Dongxue Li, Ru Li, Yanqiu Shao, Qiangfeng Cliff Zhang, Pilong Li*

**770 Forkhead domain mutations in FOXA1 drive prostate cancer progression**

*Shuai Gao, Sujun Chen, Dong Han, David Barrett, Wanting Han, Musaddeque Ahmed, Susan Patalano, Jill A. Macoska, Housheng Hansen He, Changmeng Cai*

**773 Altered chromatin recruitment by FOXA1 mutations promotes androgen independence and prostate cancer progression**

*Bohan Xu, Bing Song, Xiaodong Lu, Jung Kim, Ming Hu, Jonathan C. Zhao, Jindan Yu*

## CORRECTIONS

**776 Author Correction: Threshold for neural tube defect risk by accumulated singleton loss-of-function variants**

*Zhongzhong Chen, Yunping Lei, Yusang Zheng, Vanessa Aguiar-Pulido, M. Elizabeth Ross, Rui Peng, Li Jin, Ting Zhang, Richard H. Finnell, Hongyan Wang*

**777 Author Correction: Single-cell RNA-seq highlights intra-tumoral heterogeneity and malignant progression in pancreatic ductal adenocarcinoma**

*Junya Peng, Bao-Fa Sun, Chuan-Yuan Chen, Jia-Yi Zhou, Yu-Sheng Chen, Hao Chen, Lulu Liu, Dan Huang, Jialin Jiang, Guan-Shen Cui, Ying Yang, Wenze Wang, Dan Guo, Menghua Dai, Junchao Guo, Taiping Zhang, Quan Liao, Yi Liu, Yong-Liang Zhao, Da-Li Han, Yupei Zhao, Yun-Gui Yang, Wenming Wu*

**778 Publisher Correction: Molecular basis of vasohibins-mediated detyrosination and its impact on spindle function and mitosis**

*Shanhui Liao, Girish Rajendraprasad, Na Wang, Susana Eibes, Jun Gao, Huijuan Yu, Gao Wu, Xiaoming Tu, Hongda Huang, Marin Barisic, Chao Xu*

## ADVANCE ONLINE PUBLICATION

**Structural insights into the recognition of γ-globin gene promoter by BCL11A**

*Yang Yang, Ziyian Xu, Chao He, Beibei Zhang, Yunyu Shi and Fudong Li*

**Cryo-EM structure of human lysosomal cobalamin exporter ABCD4**

*Da Xu, Zhang Feng, Wen-Tao Hou, Yong-Liang Jiang, Liang Wang, Linfeng Sun, Cong-Zhao Zhou and Yuxing Chen*

# Cell Discovery

Making publication fun for you

*Cell Discovery* is an open access international journal that publishes results of high significance and broad interest in all areas of molecular and cell biology. The basic bar of acceptance is comparable to prestigious society journals in the respective field of the work. It is established in 2015 as a sister journal of *Cell Research*, a high-profile international journal with a current impact of 17.848. The new impact of *Cell Discovery* is 4.600.

## Authors benefit from:

- Open Access Publication – anyone can download and read your paper
- Wide exposure to a large global audience on nature.com
- Internationally renowned editors and editorial board
- Quality peer-review and fast publication
- Indexed in Scopus and PubMed Central (PMC)
- Science Citation Index Expanded (SciSearch®),  
Journal Citation Reports/Science Edition

## Featured articles

Structural insights into DNA recognition by AimR of the arbitrium communication system in the SPbeta phage  
*Cell Discov.* 2019 May 28; 5:29. doi: 10.1038/s41421-019-0101-2.

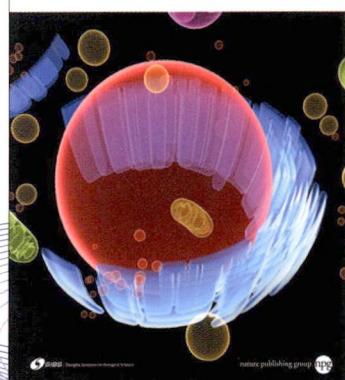
A chemical approach for global protein knockdown from mice to non-human primates  
*Cell Discov.* 2019 Feb 5; 5:10. 10.1038/s41421-018-0079-1.

Repurposing CRISPR-Cas12b for mammalian genome engineering  
*Cell Discov.* 2018 Nov 27; 4:63. doi: 10.1038/s41421-018-0069-3.

A novel antibody-TCR (AbTCR) platform combines Fab-based antigen recognition with gamma/delta-TCR signaling to facilitate T-cell cytotoxicity with low cytokine release  
*Cell Discov.* 2018 Nov 20; 4:62. doi: 10.1038/s41421-018-0066-6.

ADRB2 polymorphism Arg16Gly modifies the natural outcome of heart failure and dictates therapeutic response to β-blockers in patients with heart failure  
*Cell Discov.* 2018 Oct 23; 4:57. doi: 10.1038/s41421-018-0058-6.

**Cell Discovery**



Editor-in-Chief: Gang Pei  
Executive Editor: Dangsheng Li

**SUBMIT**

Visit [www.nature.com/celldisc/](http://www.nature.com/celldisc/)  
to read the Published Papers and Submit Today!