

# Materials Horizons

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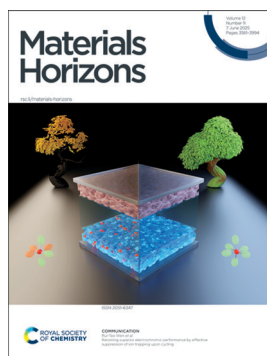
## IN THIS ISSUE

ISSN 2051-6347 CODEN MHAOAL 12(11) 3561-3994 (2025)



### Cover

See Vadim M. Kovrugin *et al.*, pp. 3712–3720. Image reproduced by permission of Vadim M. Kovrugin from *Mater. Horiz.*, 2025, 12, 3712.



### Inside cover

See Rui-Tao Wen *et al.*, pp. 3721–3730. Image reproduced by permission of Menghan Yin and Rui-Tao Wen from *Mater. Horiz.*, 2025, 12, 3721.

## EDITORIAL

3573

**Materials Horizons Emerging Investigator Series:**  
Dr Kyu-Young Park, Pohang University of Science and Technology, Republic of Korea

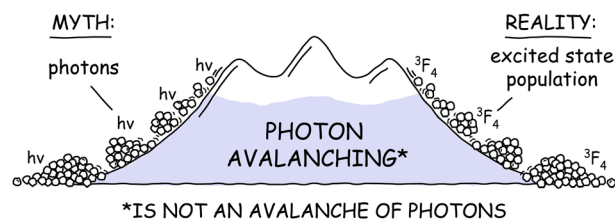


## FOCUS

3575

**Unraveling the myths and mysteries of photon avalanching nanoparticles**

Artiom Skripka\* and Emory M. Chan\*



# Environmental Science: Atmospheres

GOLD  
OPEN  
ACCESS

## Connecting communities and inspiring new ideas



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Fundamental questions  
Elemental answers

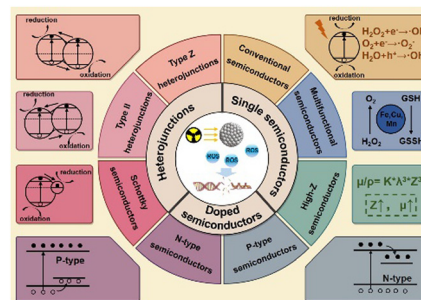


## REVIEWS

3598

**Semiconductor-mediated radiosensitizers: progress, challenges and perspectives**

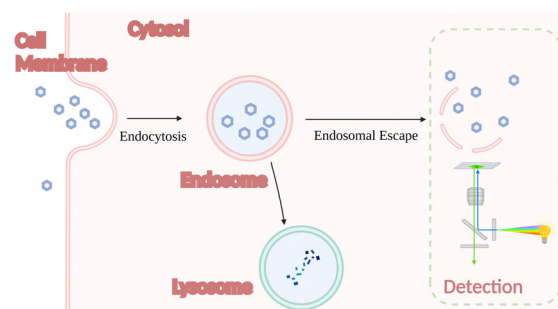
Yunsong Wang, Bocan Yang, Shujuan Liu,\* Jiahe Song, Jinghui Zhang, Xiangqun Chen, Nannan Zheng, Liangcan He,\* Wei Cai and Shaoqin Liu\*



3622

**Advancing endosomal escape of polymeric nanoparticles: towards improved intracellular delivery**

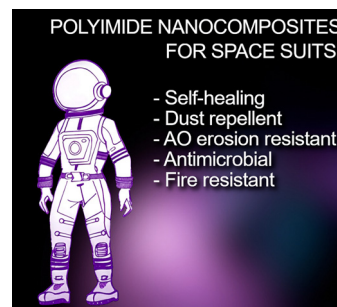
Yufu Wang, Vajini Ukwattage, Yijun Xiong and Georgina K. Such\*



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**Polyimide nanocomposites for next generation spacesuits**

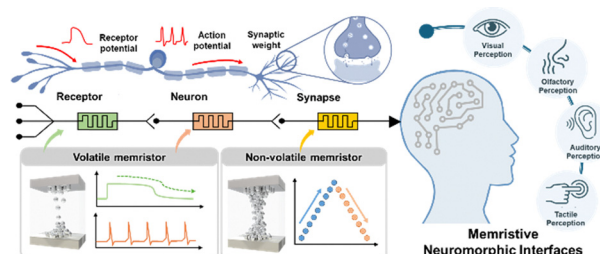
Priyanka Prakash, Janith Weerasinghe, Igor Levchenko, Karthika Prasad\* and Katia Alexander\*



3667

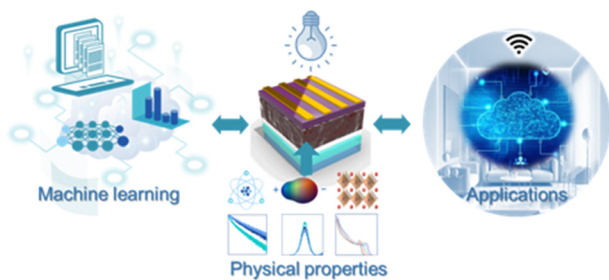
**Memristive neuromorphic interfaces: integrating sensory modalities with artificial neural networks**

Ji Eun Kim, Keunho Soh, Su In Hwang, Do Young Yang and Jung Ho Yoon\*



## REVIEWS

3691

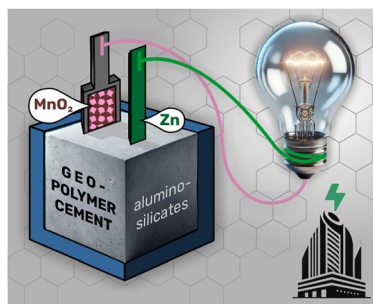


### Indoor light energy harvesting perovskite solar cells: from device physics to AI-driven strategies

Wenning Chen, Kelvian T. Mularso, Bonghyun Jo\* and Hyun Suk Jung\*

## COMMUNICATIONS

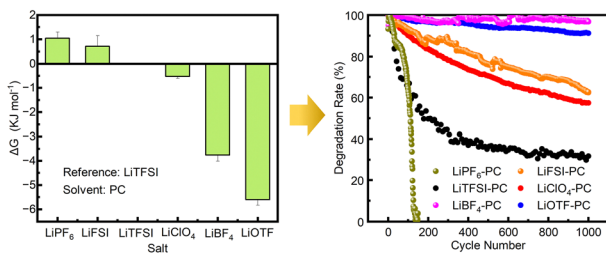
3712



### A sustainable approach to energy storage in buildings: the first rechargeable geopolymer-based battery

Vadim M. Kovrugin,\* Liliane Guerlou-Demourgues, Laurence Croguennec, Jorge S. Dolado and Cyril Aymonier

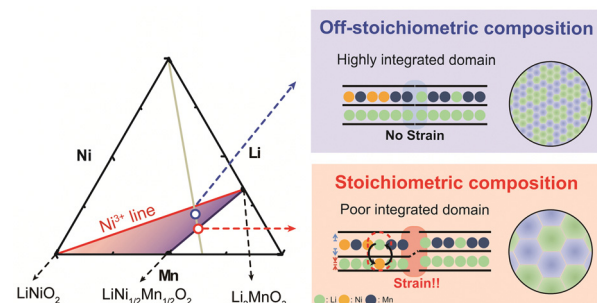
3721



### Retaining superior electrochromic performance by effective suppression of ion trapping upon cycling

Renfu Zhang, Qingjiao Huang, Zhexuan Ou, Tooba Afaq Khan, Menghan Yin, Er Gao, Jiawei Sun and Rui-Tao Wen\*

3731



### Elucidating and controlling phase integration factors in Co-free Li-rich layered cathodes for lithium-ion batteries

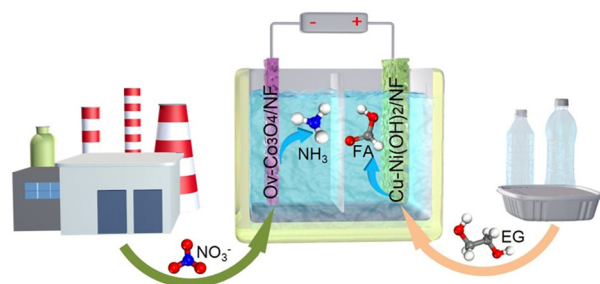
Youngsu Lee, Jaesub Kwon, Jong-Heon Lim, Eunseong Choi, Kyoung Eun Lee, Shin Park, Docheon Ahn, Changshin Jo, Yong-Tae Kim, Yoon-Uk Heo, Geunho Choi, Byongyong Yu, Inchul Park\* and Kyu-Young Park\*



3743

### Efficient co-production of ammonia and formic acid from nitrate and polyester *via* paired electrolysis

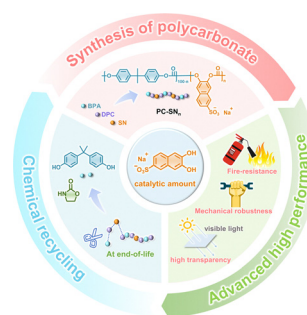
Mengmeng Du, Tao Sun, Xuyun Guo, Mingzhu Han, Yu Zhang,\* Wenxuan Chen, Mengxiang Han, Jizhe Ma, Wenfang Yuan, Chunyu Zhou, Valeria Nicolosi, Jian Shang,\* Ning Zhang\* and Bocheng Qiu\*



3752

### Catalytic amounts of sodium-sulfonate–naphthol enable mechanically robust, ultra-transparent, super-fire-resistant and easily recyclable polycarbonate

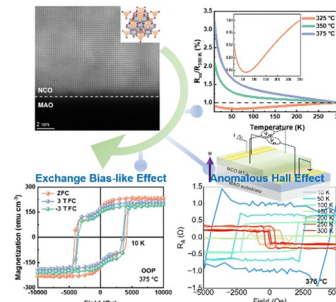
Yue Li, Lin Chen,\* Pan Deng, Yan Guo, Xiu-Li Wang\* and Yu-Zhong Wang



3762

### Revealing the reversal of the anomalous hall effect and the exchange bias-like effect in single-phase perpendicularly magnetized NiCo<sub>2</sub>O<sub>4</sub> epitaxial films

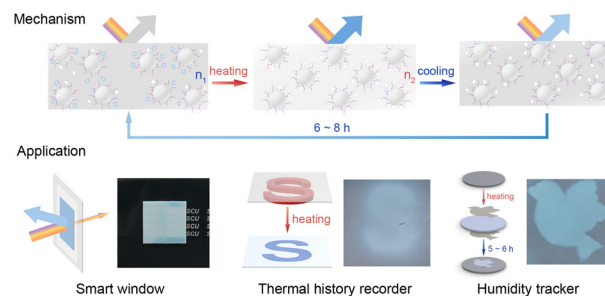
Penghua Kang, Guowei Zhou,\* Jiashuo Liang, Guoxiu Ren, Jiahui Ji, Liying Wang, Chao Jin\* and Xiaohong Xu\*



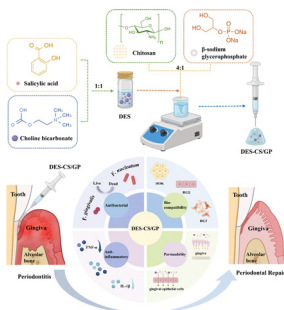
3777

### Unravelling the mechanism of coloration and prolonged discoloration in abnormally thermochromic PDMS nanocomposites

Yujie Peng, Peipei Shao, Ye Yuan, Jingru Mou, Rui-Tao Wen, Hong Chen and Ming Xiao\*



3788



### Development of an injectable salicylic acid–choline eutectic hydrogel for enhanced treatment of periodontitis

Jin Zhang, Lingzhuang Meng, Yinan Jia, Jianshu Li, Xinyuan Xu\* and Xin Xu\*

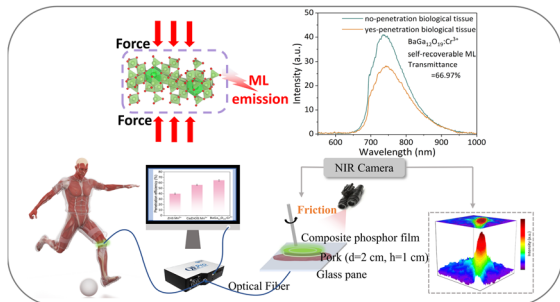
3803



### Data-driven modelling for electrolyte optimisation in dye-sensitised solar cells and photochromic solar cells

Johan Liotier,\* Antonio J. Riquelme, Valid Mwalukuku, Quentin Huaultmé, Yann Kervella, Renaud Demadrille\* and Cyril Aumaitre\*

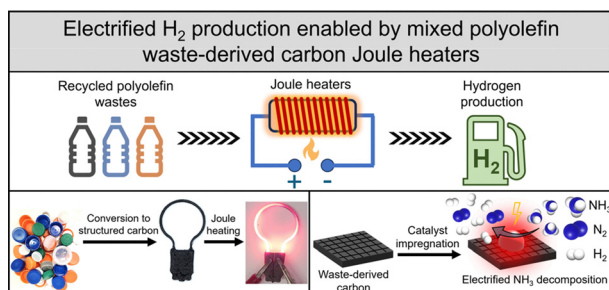
3815



### Self-recoverable broadband near infrared mechanoluminescence from $\text{BaGa}_{12}\text{O}_{19}:\text{Cr}^{3+}$ using a multi-site occupation strategy

Xuesong Wang, Yao Xiao, Puxian Xiong,\* Pan Zheng, Sheng Wu, Zhiyao Zhou, Binli Xiao, Peishan Shao, Meihui Zhang, Jianhui Liu, Jiulin Gan, Yan Wang\* and Qi Qian\*

3827



### Upcycling of mixed polyolefin wastes to 3D structured carbon Joule heaters for decarbonized hydrogen production

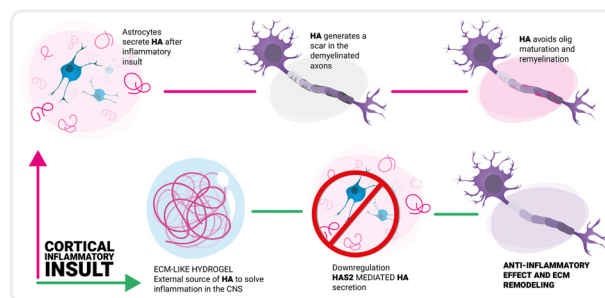
Anthony Griffin, Jiachun Wu, Adam Smerigan, Paul Smith, Gbadeoluwa Adedigba, Rui Shi, Yizhi Xiang\* and Zhe Qiang\*



3841

### Hyaluronic acid-based hydrogels modulate neuroinflammation and extracellular matrix remodelling in multiple sclerosis: insights from a primary cortical cell model

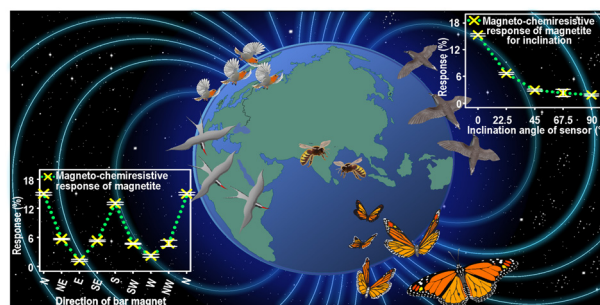
Sergio Martin-Saldaña,\* Mansoor Al-Waeel, Enrico Bagnoli, Merari Tumin Chevalier, Yazhong Bu, Christopher Lally, Una Fitzgerald and Abhay Pandit\*



3855

### Discovery of magnetic field line dependent anisotropic chemiresistive response in magnetite: a new piece to the puzzle of magnetoreception

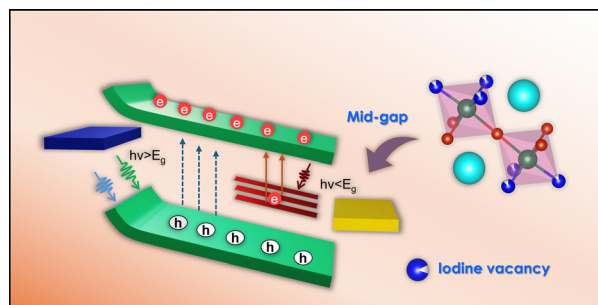
Pratyasha Rudra and Swastik Mondal\*



3865

### Benign mid-gap halide vacancy states in 2D-bismuth-based halide perovskite microcrystals for enhanced broadband photodetectors

Kuntal Singh, Mozakkar Hossain, Pabitra Kumar Nayak, Sougata Karmakar, Akash Tripathi, Prakash Sarkar, Pratyasha Rudra, A. V. Muhammed Ali, G. Krishnamurthy Grandhi, Paola Vivo, Swastik Mondal, K. V. Adarsh, Dibyajyoti Ghosh and K. D. M. Rao\*



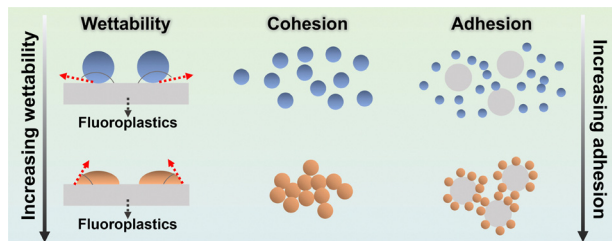
3878

### Transdermal therapeutic polymer: *in situ* synthesis of biocompatible polymer using 5-aminolevulinic acid as a photosensitizer precursor and a polymer initiator

Jaehoon Kim, Eun Woo Seo, Hyunyoung Choi, Hyo In Kim, Jinbong Park, Junyang Jung\* and Dokyoung Kim\*



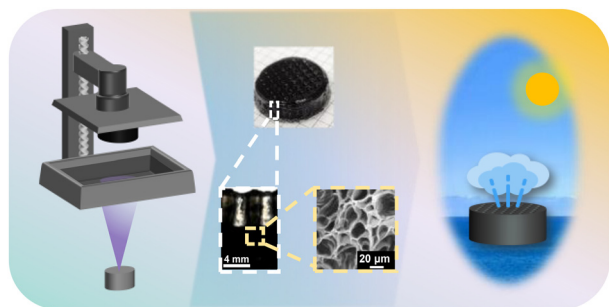
3888



### Adhesion and affinity of supramolecular adhesives on fluorinated surfaces

Guohong Yao, Zhiyuan Guo, Gai Zhao\* and Shengyi Dong\*

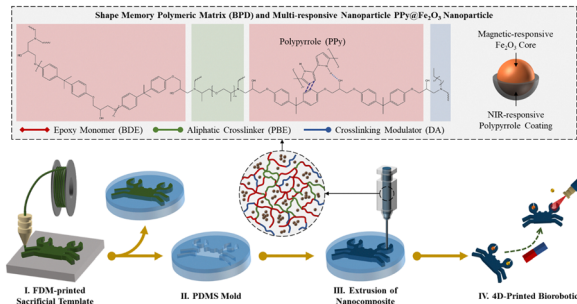
3897



### Precision-engineered, polymer-lean, digital light processing 3D-printed hydrogels for enhancing solar steam generation and sustainable water treatment

Shudi Mao, Xin Stella Zhang, Yihan Shi, An Feng, Casey Onggowarsito, Xiaoxue Helen Xu, Lisa Aditya, Youyi Sun,\* Long D. Nghiem\* and Qiang Fu\*

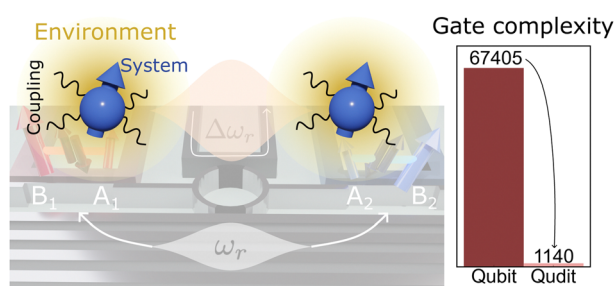
3907



### Development of novel multi-responsive 4D printed smart nanocomposites with polypyrrole coated iron oxides for remote and adaptive transformation

Shengbo Guo, Tarun Agarwal, Shuaiqi Song, Kausik Sarkar and Lijie Grace Zhang\*

3918



### Simulating open quantum systems with molecular spin qubits

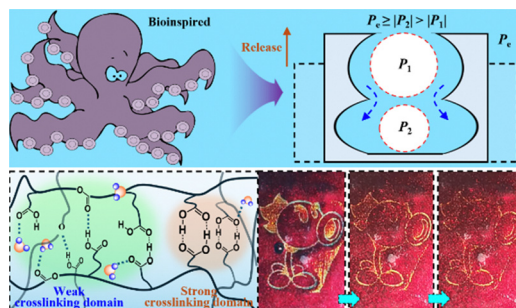
Sebastián Roca-Jerat, Emilio Macaluso, Alessandro Chiesa, Paolo Santini and Stefano Carretta\*



3929

### Self-damping photonic crystals with differentiated reversible crosslinking domains for biomimetic delayed visual perception of underwater impact stress

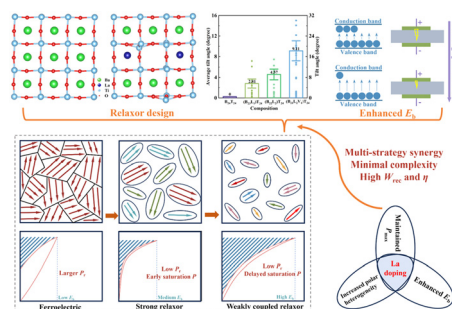
Yong Qi, Jiahui Wang, Tong Hu, Xianfei Cao, Shi Li, Qingyu Liu, Zhaoyong Gao and Shufen Zhang\*



3939

### Weakly coupled relaxor construction in lead-free ferroelectrics with simple composition for superior energy-storage performance

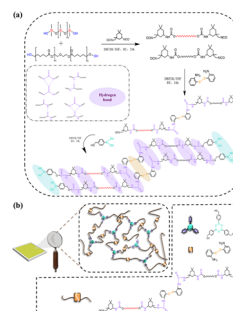
Minghao Liu, Chen Ming, Zhen Liu,\* Hongbo Liu,\* Bing Han, Narendrakumar Narayanan, Xuantong Liu, Kai Dai, Teng Lu, Xuefeng Chen, Zhigao Hu, Yun Liu and Genshui Wang\*



3949

### Development of highly robust polyurethane elastomers possessing self-healing capabilities for flexible sensors

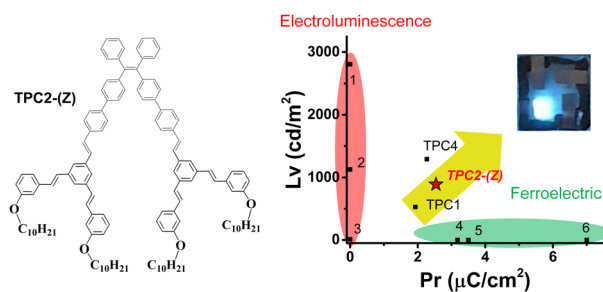
Hao Tian, Wentong Lu, Caiyan Wang, Runhua Wang, Peilong Zhou, Fan Fei, Mengyang Xu and Jincheng Wang\*



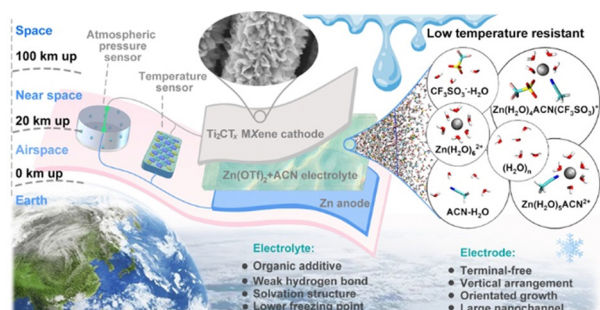
3965

### Synergistic enhancement of luminescence and ferroelectricity driven by (Z)-clipping of a tetraphenylethene

Sewon Lim, Donghwan Kim, Hee Jung Kim, Hwandong Jang, Sienoh Park and Eunyoung Kim\*



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## Low-temperature, low-pressure Zn-ion hybrid supercapacitor in extreme near-space application

Weijia Liu, Haiqing Liu, Yin Sun, Zhiyi Gao,\* La Li\* and Guozhen Shen\*

CORRECTION

3991

## Correction: Transforming patterned defects into dynamic poly-regional topographies in liquid crystal oligomers

Yuxin You, Youssef M. Golestani, Dirk J. Broer, Tinghong Yang, Guofu Zhou, Robin L. B. Selinger,\* Dong Yuan\* and Danqing Liu\*

