

# ADVANCED FUNCTIONAL MATERIALS

[www.afm-journal.de](http://www.afm-journal.de)



## DNA Mutation

On page 6905, J. Weng and team prepare a hydrogel electrode with ultrasensitive detection from graphene oxide and fish sperm DNA. The linear range for mitochondrial DNA detection is from  $1.0 \times 10^{-9}$  to  $1.0 \times 10^{-20}$  M with a detection limit of  $1.0 \times 10^{-20}$  M. The result is ascribed to the bionic interface and tuneable conductivity of the hydrogel electrode.

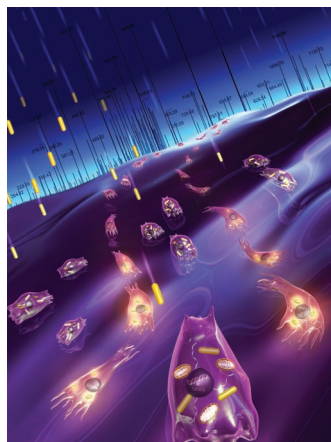
## Sensors

A flexible inorganic piezoelectric acoustic nanosensor is demonstrated using high performance PZT thin films. As reported by S. Hur, S.-H. Oh, K. J. Lee, and colleagues on page 6914, the acoustic nanosensor can utilize artificial hair cell with transducing electric signals to the sensory nerves.



## Cancer Treatment

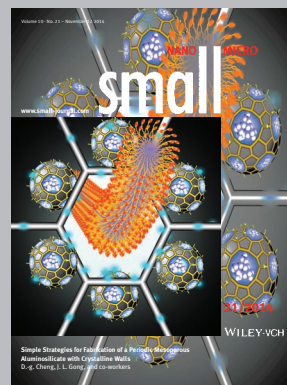
A quantitative proteomic analysis by C. Chen, T. Wei, and co-workers on page 6922 shows that gold nanorods (AuNRs) effectively inhibit the metastatic phenotype of cancer cells by modulating the expression of energy metabolism-related genes, which might provide a new direction for future investigations of functionalized AuNRs as a nano-platform for cancer therapy.



*Advanced Materials* has been bringing you the best in materials research for over twenty-five years.

With its increased ISI Impact Factor of 15.409, *Advanced Materials* is one of the most influential journals in the field. Publishing every week, *Advanced Materials* now brings you even more of the latest results at the cutting edge of materials science.

[www.advmat.de](http://www.advmat.de)



*Small* is the very best interdisciplinary forum for all experimental and theoretical aspects of fundamental and applied research at the micro and nano length scales.

With an ISI impact Factor of 7.514 and publishing every two weeks in 2014 with papers online in advance of print, *Small* is your first-choice venue for top-quality communications, detailed full papers, cutting-edge concepts, and in-depth reviews of all things micro and nano.

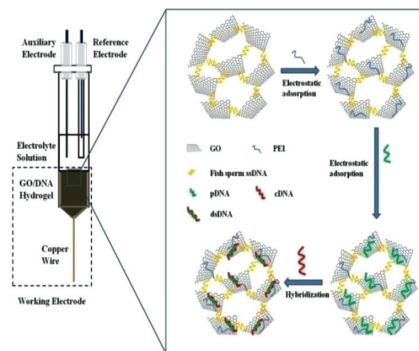
[www.small-journal.com](http://www.small-journal.com)

# FULL PAPERS

## DNA Mutation

L. P. Sun, N. Hu, J. Peng, L. Y. Chen, J. Weng\* ..... 6905–6913

### Ultrasensitive Detection of Mitochondrial DNA Mutation by Graphene Oxide/DNA Hydrogel Electrode

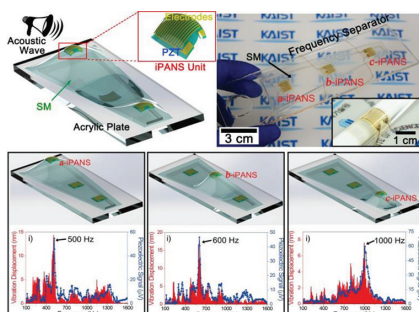


A hydrogel electrode with ultrasensitive detection is prepared from graphene oxide and fish sperm DNA, and the linear range for mitochondrial DNA detection is from  $1.0 \times 10^{-9}$  to  $1.0 \times 10^{-20}$  M with a detection limit of  $1.0 \times 10^{-20}$  M. The result is ascribed to the bionic interface and tuneable conductivity of the hydrogel electrode.

## Sensors

H. S. Lee, J. Chung, G.-T. Hwang, C. K. Jeong, Y. Jung, J.-H. Kwak, H. Kang, M. Byun, W. D. Kim, S. Hur,\* S.-H. Oh,\* K. J. Lee\* ..... 6914–6921

### Flexible Inorganic Piezoelectric Acoustic Nanosensors for Biomimetic Artificial Hair Cells

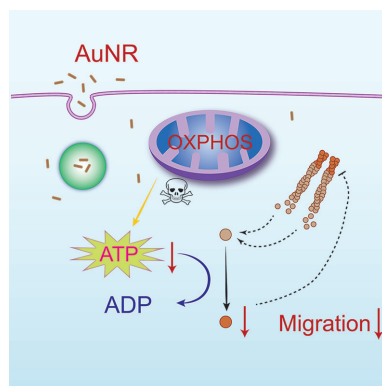


The new concept of a biomimetic artificial hair cell using a flexible inorganic piezoelectric acoustic nanosensor (iPANS) is presented. A highly sensitive flexible piezoelectric sensor that responds to sound-driven vibrations of a thin silicone membrane is fabricated using a laser lift-off process. The iPANS shows remarkable capability to sense tiny vibrations caused by an external sound wave.

## Cancer Treatment

T. Zhou, M. Yu, B. Zhang, L. Wang, X. Wu, H. Zhou, Y. Du, J. Hao, Y. Tu, C. Chen,\* T. Wei\* ..... 6922–6932

### Inhibition of Cancer Cell Migration by Gold Nanorods: Molecular Mechanisms and Implications for Cancer Therapy

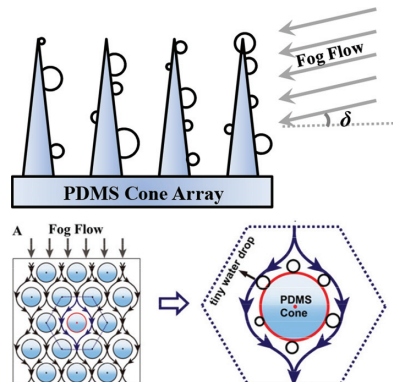


Inhibitory effects of gold nanorods on cancer cell migration and the underlying mechanisms are revealed. After endocytosed by cancer cells, gold nanorods down-regulate the expression of energy generation-related genes, decrease mitochondrial oxidative phosphorylation and glycolysis, reduce ATP synthesis, impair F-actin cytoskeletal assembly and lamellipodia formation, and finally inhibit cancer cell migration.

## Bioinspired Materials

J. Ju, X. Yao, S. Yang, L. Wang, R. Sun, Y. He, L. Jiang\* ..... 6933–6938

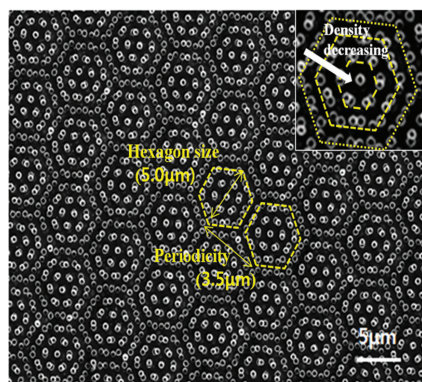
### Cactus Stem Inspired Cone-Arrayed Surfaces for Efficient Fog Collection



The intersite of clusters of spines on a cactus stem is found to be densely covered with cones, which can collect fog efficiently. Inspired by this, artificial cones are fabricated with different arrangements using mechanical perforation followed by template replication. The as-prepared surface, which has hexagonally arranged cones, is proven to be efficient at collecting fog arising from the turbulent fog flow around the cones and the directional drop movement along the cones.

## FULL PAPERS

A powerful new method is reported for fabricating complex lateral superlattice structures with 10 nm resolution, using the moiré fringe and secondary sputtering lithography. A large assortment of moiré superstructures can be easily fabricated by a simple rotation of the periodic layer. These superlattice structures widen the range of application of moiré patterns to not only the fields of photonics or optical characterization tools, but also to functional nano materials trapping and ordering.

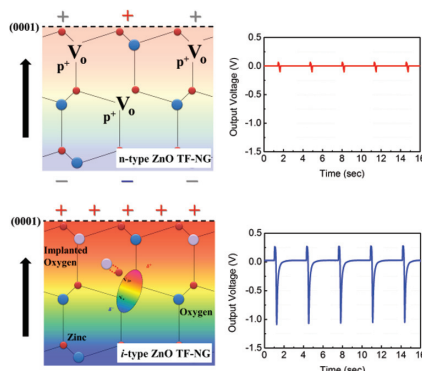


### Nanopatterns

S.-Y. Cho, H.-J. Jeon, J.-S. Kim, J. M. Ok, H.-T. Jung\* .....6939–6947

**Hierarchical Ordering of Quantum Dots and Liquid with Tunable Super-Periodicity into High Aspect Ratio Moiré Superlattice Structure**

High performance piezoelectric nanogenerators based on self-compensated insulating ZnO via native defect control are demonstrated. Self-compensation of donor and acceptor-type native defects makes ZnO insulating. Without additional passivation agents, dramatic enhancement of the piezoelectric output performance from the insulating ZnO-based piezoelectric nanogenerator is observed compared to a donor-defect-rich ZnO-based piezoelectric nanogenerator under the same mechanical strain.

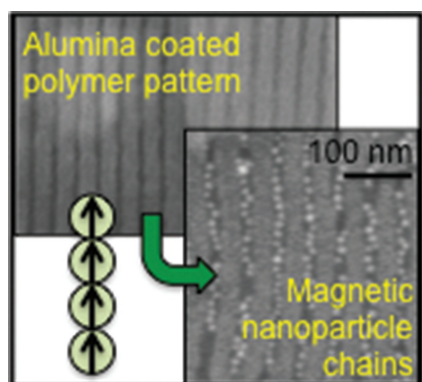


### Nanogenerators

D. Kim, K. Y. Lee, M. K. Gupta, S. Majumder, S.-W. Kim\* .....6949–6955

**Self-Compensated Insulating ZnO-Based Piezoelectric Nanogenerators**

Self-assembled alumina coated block co-polymer patterned substrates are used to organize ferromagnetic and superparamagnetic nanoparticles into arrays. The alumina coating creates a patterned substrate with tuneability of the trench width, while at the same time making the material robust to both heating and solvent-based deposition.

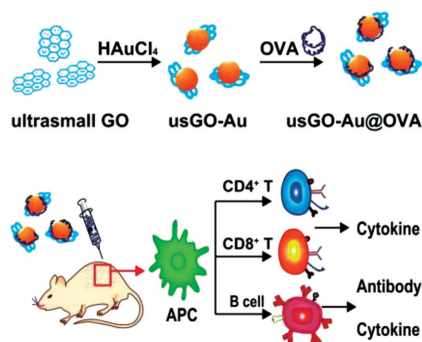


### Self-Assembly

L. T. Schelhas, R. A. Farrell, U. Halim, S. H. Tolbert\* .....6956–6962

**Directed Self-Assembly as a Route to Ferromagnetic and Superparamagnetic Nanoparticle Arrays**

Gold nanoparticles grown in situ on ultrasmall graphene oxide (usGO) are decorated with antigen ovalbumin (OVA) through physically adsorbing and Au-S bonding. The usGO-Au@OVA composites can efficiently stimulate RAW264.7 cells to secrete tumor necrosis factor- $\alpha$  and promote an OVA-specific antibody response, CD8<sup>+</sup> T cells proliferation, and different cytokines secretion, thus demonstrating the capability to promote potent humoral and cellular immune responses.



### Adjuvants

Y. Cao, Y. Ma, M. Zhang, H. Wang, X. Tu, H. Shen, J. Dai, H. Guo,\* Z. Zhang\* .....6963–6971

**Ultrasmall Graphene Oxide Supported Gold Nanoparticles as Adjuvants Improve Humoral and Cellular Immunity in Mice**

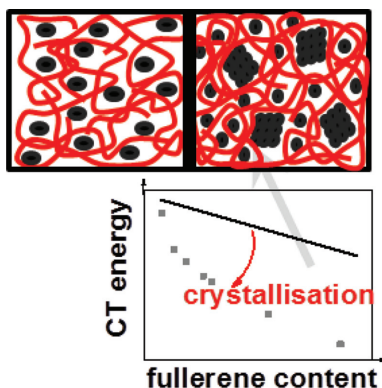


## FULL PAPERS

## Photovoltaics

A. A. Y. Guilbert, M. Schmidt, A. Bruno, J. Yao, S. King, S. M. Tuladhar, T. Kirchartz, M. I. Alonso, A. R. Goñi, N. Stingelin, S. A. Haque, M. Campoy-Quiles,\* J. Nelson\* ..... 6972–6980

### Spectroscopic Evaluation of Mixing and Crystallinity of Fullerenes in Bulk Heterojunctions

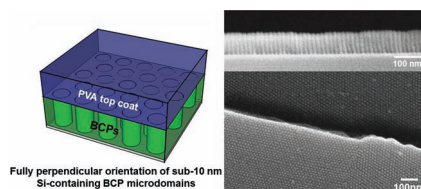


It is demonstrated that a combination of optical spectroscopy techniques such as UV–Vis absorption, steady-state and ultra-fast photoluminescence, electroluminescence, and variable angle spectroscopic ellipsometry can be used to probe the degree of mixing of polymer:fullerene blends but also distinguishes between aggregation and crystallization of fullerenes. Both degree of mixing and crystallization have a huge impact on the organic photovoltaic device performance.

## Thin Films

E. Kim, W. Kim, K. H. Lee, C. A. Ross, J. G. Son\* ..... 6981–6988

### A Top Coat with Solvent Annealing Enables Perpendicular Orientation of Sub-10 nm Microdomains in Si-Containing Block Copolymer Thin Films

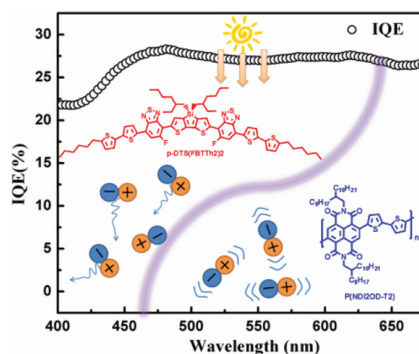


A top coat layer in the solvent annealing system can be a general approach for perpendicular orientation of microdomains in high-interaction parameter ( $\chi$ ) block copolymer microdomains. They simultaneously employ top surface neutrality and sufficient film thickness for the control of the solvent concentration gradient and evaporation rate.

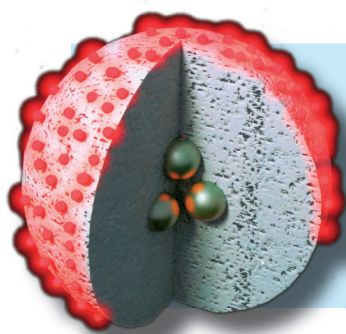
## Solar Cells

Z. Li, J. D. A. Lin, H. Phan, A. Sharenko, C. M. Proctor, P. Zalar, Z. Chen, A. Facchetti, T.-Q. Nguyen\*...6989–6998

### Competitive Absorption and Inefficient Exciton Harvesting: Lessons Learned from Bulk Heterojunction Organic Photovoltaics Utilizing the Polymer Acceptor P(NDI2OD-T2)



Organic solar cells based on a small molecule donor and the polymer acceptor P(NDI2OD-T2) are fabricated and investigated. Through a comprehensive study of the optical and electronic properties of the blend films, the poor exciton diffusion length of P(NDI2OD-T2) is identified as the primary cause of the poor performance. In order to make non-fullerene acceptors competitive, the exciton diffusion length must be considered.



## How to contact us:

## Editorial Office:

Phone: (+49) 6201-606-286/531  
Fax: (+49) 6201-606-500  
Email: [afm@wiley-vch.de](mailto:afm@wiley-vch.de)

## Reprints:

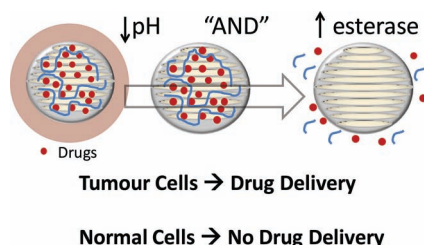
[cherth@wiley-vch.de](mailto:cherth@wiley-vch.de)

## Copyright Permission:

Fax: (+49) 6201-606-332  
Email: [rights@wiley-vch.de](mailto:rights@wiley-vch.de)

## FULL PAPERS

**Logic “AND” gate drug release:** Mesoporous silica nanoparticle (MSNs) with an “AND” logic gated provided by dual bioresponsive polymeric system polyacrylic acid (pH responsive) and polycaprolactone (enzyme degradable) for tumor targeting drug delivery nanocarrier. DOX-loaded PAA-PCL-MSNs system is shown to selectively release DOX only with low pH and enzyme presence and results in an eightfold efficacy towards cancer cells compare to healthy cells.

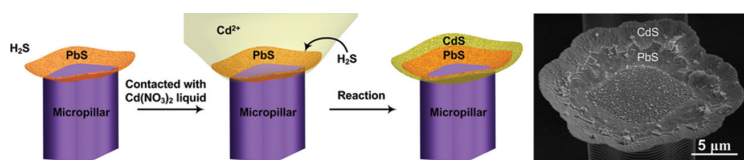


## Drug Delivery

X. Chen, A. H. Soeriyadi, X. Lu,  
S. M. Sagnella, M. Kavallaris,  
J. J. Gooding\* ..... 6999–7006

**Dual Bioresponsive Mesoporous Silica Nanocarrier as an “AND” Logic Gate for Targeted Drug Delivery Cancer Cells**

**Owing to ambient-connected gas network trapped upon superhydrophobic surfaces,**  $\text{H}_2\text{S}$  gas can be continuously transported and react with metal ions along solid/liquid/gas triphase contact interface, forming precisely positioning metal sulfide microstructure arrays. This strategy can be widely applied to many metal sulfides and heterostructured metal sulfide architectures, such as PbS/CdS concentric microflower arrays, exhibiting the advanced applications of this interface-mediated growth strategy.

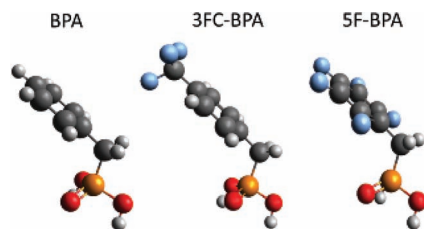


## Optoelectronics

S. S. Wang, Y. C. Wu, X. N. Kan, B. Su,\*  
L. Jiang\* ..... 7007–7013

**Regular Metal Sulfide Microstructure Arrays Contributed by Ambient-Connected Gas Matrix Trapped on Superhydrophobic Surface**

**The tuning of the ZnO work function from 4.1 to 5.7 eV** is realized by the application of a variety of phosphonic acid based self-assembled monolayers (SAMs). This enables the use of ZnO as both the electron- and hole-injecting contact. The homogenous dense packing of the SAMs is thoroughly characterized using a range of complementary techniques.

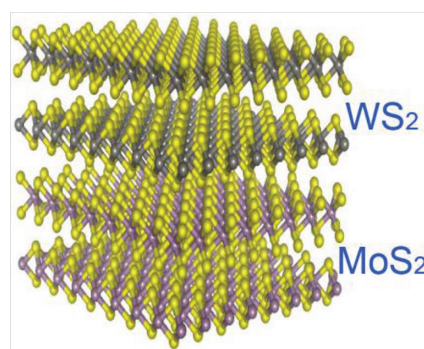


## Self-Assembly

I. Lange, S. Reiter, M. Pätzelt, A. Zykov,  
A. Nefedov, J. Hildebrandt, S. Hecht,  
S. Kowarik, C. Wöll, G. Heimel,  
D. Neher\* ..... 7014–7024

**Tuning the Work Function of Polar Zinc Oxide Surfaces using Modified Phosphonic Acid Self-Assembled Monolayers**

**Newly designed  $\text{MoS}_2$ - $\text{WS}_2$  heterostructures** perform novel and enhanced optoelectronic performances. Vertical transistors possess new functionalities such as rectifying, bipolarity, photovoltaic effect, and self-driven photodetection. Planar devices exhibit superior optoelectronic properties with high field-effect ON/OFF ratio ( $>10^5$ ), electron mobility of  $65 \text{ cm}^2/\text{Vs}$ , and photoresponsivity of  $1.42 \text{ A/W}$  that far exceed the one for their constituents  $\text{MoS}_2$  or  $\text{WS}_2$ .



## Optoelectronics

N. Huo, J. Kang, Z. Wei, S.-S. Li, J. Li,\*  
S.-H. Wei\* ..... 7025–7031

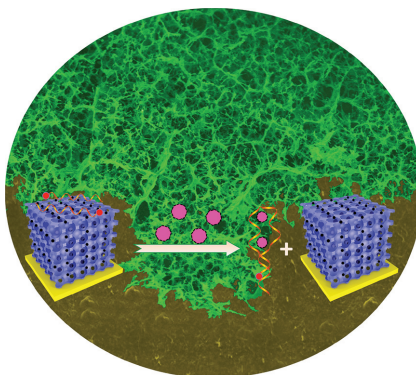
**Novel and Enhanced Optoelectronic Performances of Multilayer  $\text{MoS}_2$ - $\text{WS}_2$  Heterostructure Transistors**

## FULL PAPERS

## Graphene

L. Shi, Z. Y. Chu, Y. Liu, W. Q. Jin,\*  
N. P. Xu ..... 7032–7041

**In Situ Fabrication of Three-Dimensional Graphene Films on Gold Substrates with Controllable Pore Structures for High-Performance Electrochemical Sensing**

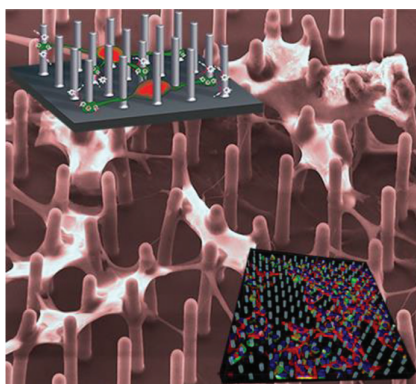


Three dimensional graphene films (GFs) with controllable pore structures are directly fabricated on the gold substrate through a facile and reliable approach. The resulting GFs exhibit large surface area, excellent binding strength and high conductivity, which will enable many advanced applications in electronic and energy-related systems. As examples, novel electrochemical aptasensors with high performance are constructed in this work.

## Dopamine

L. Amato, A. Heiskanen, C. Caviglia,  
F. Shah, K. Zór, M. Skolimowski,  
M. Madou, L. Gammelgaard, R. Hansen,  
E. G. Seiz, M. Ramos, T. R. Moreno,  
A. Martínez-Serrano, S. S. Keller,  
J. Emnéus\* ..... 7042–7052

**Pyrolysed 3D-Carbon Scaffolds Induce Spontaneous Differentiation of Human Neural Stem Cells and Facilitate Real-Time Dopamine Detection**

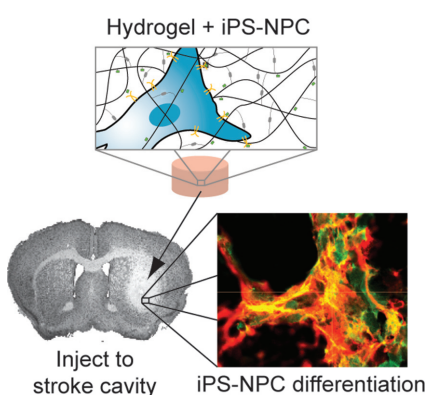


Pyrolysed 3D carbon scaffolds dimensionally reaching the limit of UV-lithography are for the first time presented and applied for differentiation of human neural stem cells (hNSCs), demonstrating the uniqueness of pyrolysed carbon as a material that induces spontaneous differentiation in 80% of hNSCs into dopaminergic neurons. The scaffold simultaneously serves as a mechanical and biocompatible support and 3D electrochemical sensor for dopamine detection.

## Hydrogels

J. Lam, W. E. Lowry, S. T. Carmichael,\*  
T. Segura\* ..... 7053–7062

**Delivery of iPS-NPCs to the Stroke Cavity within a Hyaluronic Acid Matrix Promotes the Differentiation of Transplanted Cells**



Hydrogels can be used to deliver neural progenitor cells to the brain post-stroke. Comprehensively studying the parameters involved in the transplantation process allows to keep cells viable in the infarct cavity post-transplantation. Further, delivering induced pluripotent cell-derived neural progenitors encapsulated in the hydrogel promotes differentiation to a neuronal phenotype compared to a cell only condition.