Dr. Yen Wei (危岩), Herman B. Wagner Professor of Chemistry, Drexel University, Philadelphia, PA 19104, USA, weiyen@drexel.edu

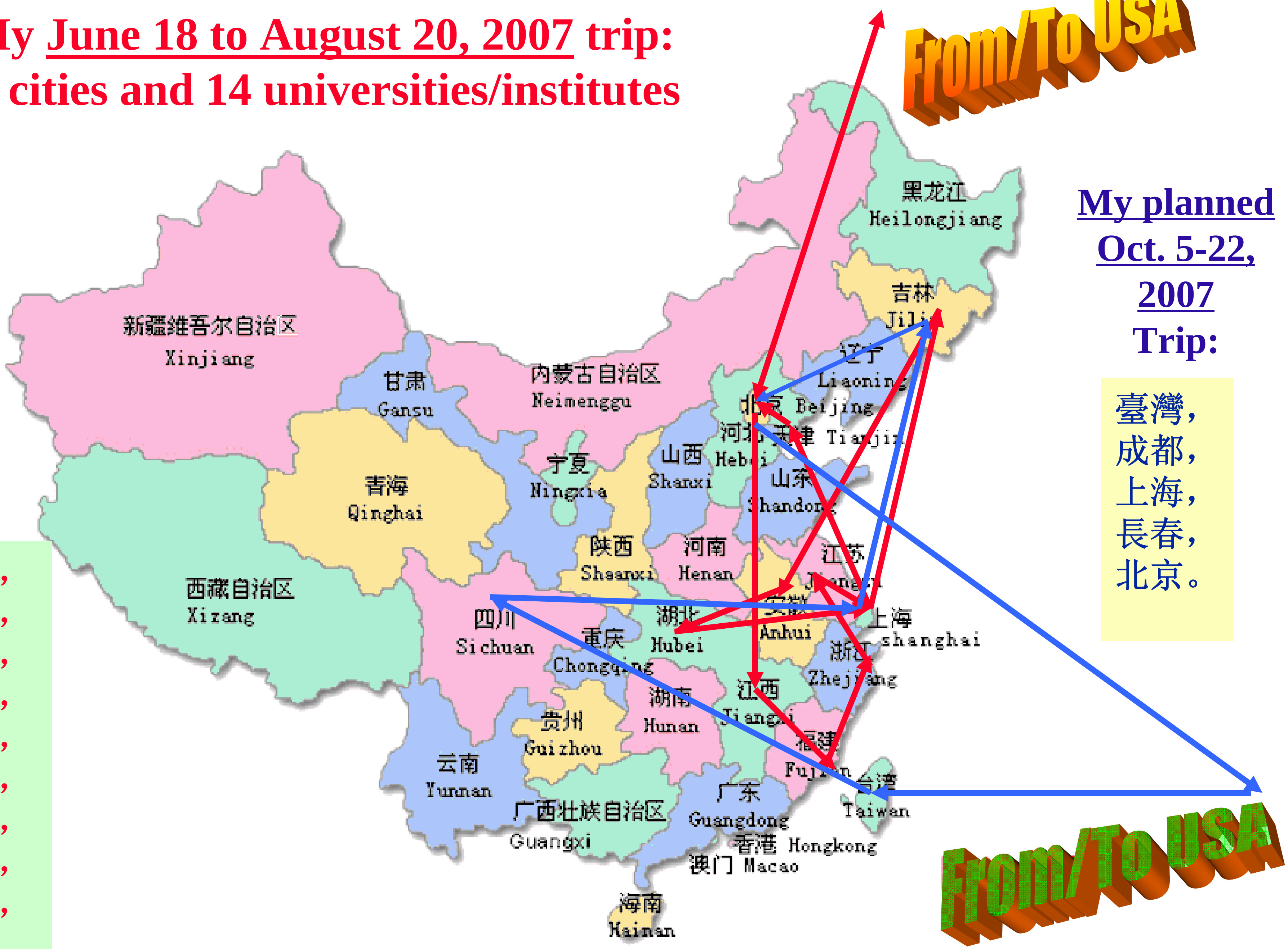
- 1977-1979年 北京大學化學系畢業 。
- 1981年 在馮新德院士指導下獲得北大理學碩士學位。
- 1986年初 在George Odian教授指導下獲美國紐約市立大學博士學位。
- 1986-1987年 麻省理工學院（MIT)博士後。
- 1987年 在費城爵碩大學(Drexel University)化學系任助理教授。
- 1991年 升為杜邦副教授並被授予終生教職。
- 1995年 升為正教授。
- 2004年 初升為瓦格納高分子與材料化學講座教授。同時兼任爵碩大學先進聚合物與材料化學研究中心主任以及材料科學與工程系和生物醫學工程學院兼聘教授。
- 1995年至今，被北京大學，中科院化學所，吉林大學，清華大學，中科院長春應用化學所，浙江大學，復旦大學，中科大等14所院校聘為客座教授。
- 2006年 被評爲李嘉誠-教育部長江學者任**上海交通大學長江講座教授**。
- 2006年被**中原大學奈米化學講座教授**。
- **研究興趣**：導電高分子，聚合理論，有機-無機雜化材料，界孔分子篩，奈米材料，酶固化，生物催化及傳感，蛋白質折疊，干細胞與組織工程，腦神經科學等。
- 發表論文395餘篇（被引用3500餘次），編專著2本，獲美國專利10項，數百次被世界各地邀請作學術報告。

國立宜蘭大學
National Ilan University NIU

謝謝江彰吉校長的邀請又來到美麗的
國立宜蘭大學！

上次是在10.19.2006

My June 18 to August 20, 2007 trip:
11 cities and 14 universities/institutes



My planned Oct. 5-22, 2007 Trip:

臺灣，
成都，
上海，
長春，
北京。

南昌，
厦门，
杭州，
苏州，
上海，
长春，
合肥，
武汉，
上海，
天津，
北京。

六月十八至八月二十中国讲学

2007

吉大麦氏
实验室

My bosses, mentors (and great friends!)

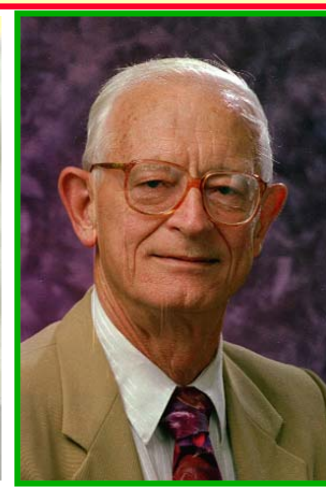
We do science ONLY because we love it.

Prof. Xin-De Feng of Peking University (**1915-2005**).

一日为師，終生为父。

Prof. W.X. Cao & X.R. Jia of Peking University

Prof. George McLendon of Princeton, now Duke University

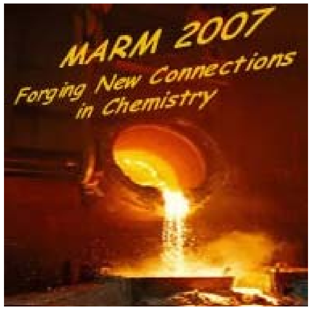


Prof. Alan G. MacDiarmid of U Penn (1927-2007)

Prof. George Odian and Prof. Nan-Loh Yang of CUNY.

Prof. Gary Wnek of Case Western Reserve Univ. My postdoc boss at MIT and one of my best friends.

為財，為權，為獎而作科學的人是找錯了工作。 危岩



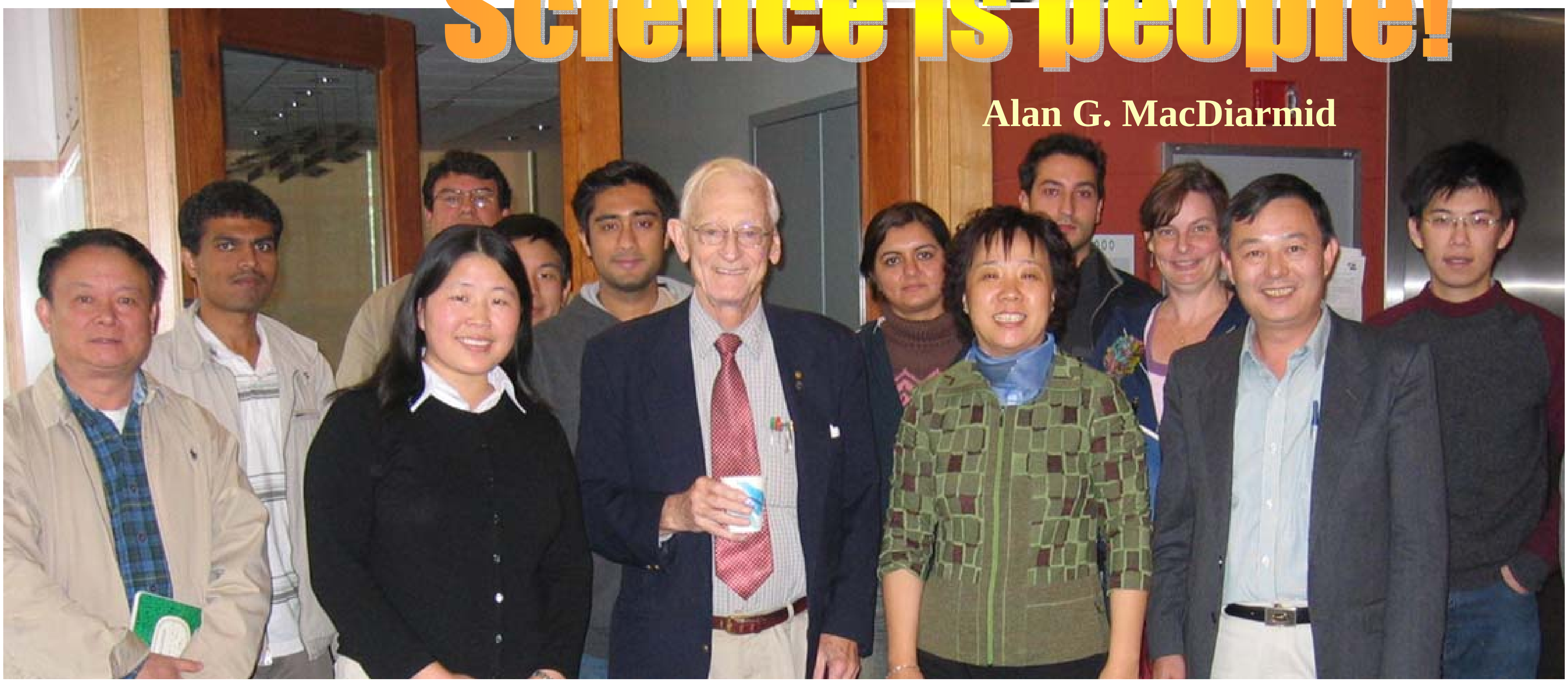
Alan G. MacDiarmid Memorial Symposium

Wednesday, 16 May 2007

http://www.marmacs.org/

Celebrate the life of Alan MacDiarmid (4/14/1927-2/7/2007)

"Science is people!"



Organic-Inorganic Hybrid and Nanostructured Materials for Dental Applications

October 19, 2006

Yen Wei (危岩)

…n B. Wagner Professor of Chemistry

…partment of Chemistry, Drexel University

…lphia, PA 19104, USA, Tel. 215-895-2650; Fax 215-895-1265; E-mail: weiyen@drexel.edu

Four "nano" stories to tell related to dental applications:

- ***Hybrids/nanocomposites: Best of 2 worlds (organic polymers and inorganics) Dental restoratives and adhesives***
- ***Assembly of monomer-modified nanoparticles: Non- or low- shrinkage dental nanocomposites***
- ***Use vinyl monomers as templates in the synthesis of nanoporous materials: Nanocomposites and novel fillers.***
- ***Nanonecklace: Novel nanomechanical filler-matrix interlocking.***

國立宜蘭大學

National Ilan University NIU

October 19, 2006

奈米生物材料：
電活性分子篩及聚合物在生物醫學技術中的應用

Yen Wei (危岩 中原大學講座教授)
Department of Chemistry, Drexel University
Philadelphia, PA 19104, USA, E-mail: weiyen@drexel.edu

- **Introduction: Three Stories of Nanostructured Electroactive Polymers.**
- **Part 1: Making the first electroactive mesoporous molecular sieves.**
- **Part 2: Nanobiotechnology of conducting polymers in neural and cardiovascular tissue engineering. Stem cells.**
- **Part 3: PEG-Oligoaniline-PEG polymer: Self-assembly and nanostructures controlled by electrochemical potential or pH.**
- **Conclusions and Look Forward.**

In memory of my friend, Prof. Alan G. MacDiarmid.

國立宜蘭大學
National Ilan University NIU

谢谢江彰吉校长的邀請！

October 11, 2007

Inorganic Polymerization

Fundamental Reactions:

(Hydrothermal or sol-gel synthesis)

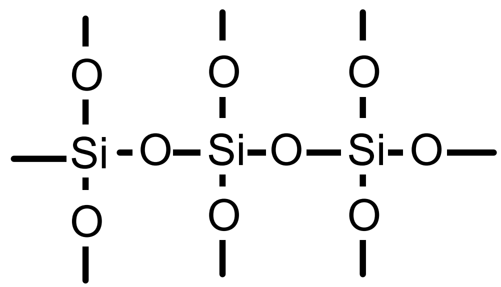
Sol-Gel Reactions: Chemistry to Ceramics

Hydrolysis

$$Si(OR)_4 \xrightarrow[+\ H_2O;\ -\ ROH]{HCl/THF/\sim 20°C}$$

Condensation

$$Si(OH)_4 \xrightarrow[-\ H_2O]{H^+}$$



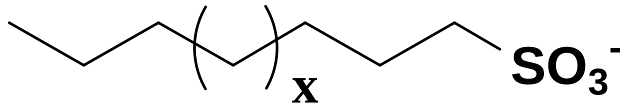
A New Family of Mesoporous Molecular Sieves — M41S

- **Pore shape: hexagonal (MCM-41) and cubic (MCM-48)**
- **Narrow pore size distribution**
- **Tunable pore size: 20 - 100 Å (or higher)**
- **Large surface area: > 1000 m^2/g**
- **Large pore volume: > 0.5 cm^3/g**
- **Ordered structures**

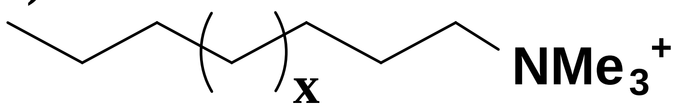
Kresge et al.(Mobil Co) *Nature* 1992, 359, 710.

Synthetic Keys to Mesoporosity —Templates

- **Charged surfactants:**
  - **anionic, e.g.**



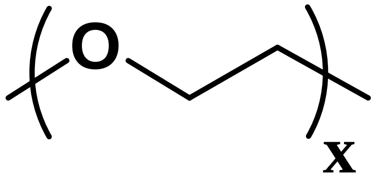
    ($C_nH_{2n+1}OSO_3^-$ n = 12, 14, 16, 18, ...)
  - **cationic, e.g.**



    ($C_nH_{2n+1}(CH_3)_3N^+$ n = 8, 9, 10, ...)

Stucky et al. *Nature* **1994**, *368*, 317; Ozin et al. *Nature* **1996**, *379*, 703.

- **Neutral surfactant: e.g. primary amines and poly(ethylene oxides)**



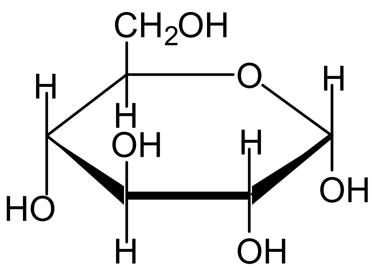
- **Block copolymers**

Pinnavaia et al. *Science* **1995**, *269*, 1242 and 865.
Attard et al. *Nature* **1995**, *378*, 317. E. Thomas, *Science*, Dec 23, **1999**.

Non-surfactant templates

Yen Wei , et al., *Adv. Mater*. 10, 313, 1998
US Pat. 6,696,258 (2004); 6,989,254 (2006).

Glucose, cyclodextrins, fructose, agar, polypeptides, acrilamide, hydroxyethyl methacrylate (HEMA), glycerol, urea, dibenzoyl-L-tartaric acid (DBTA), etc.



Mesoporous materials using surfactant-templated sol-gel process

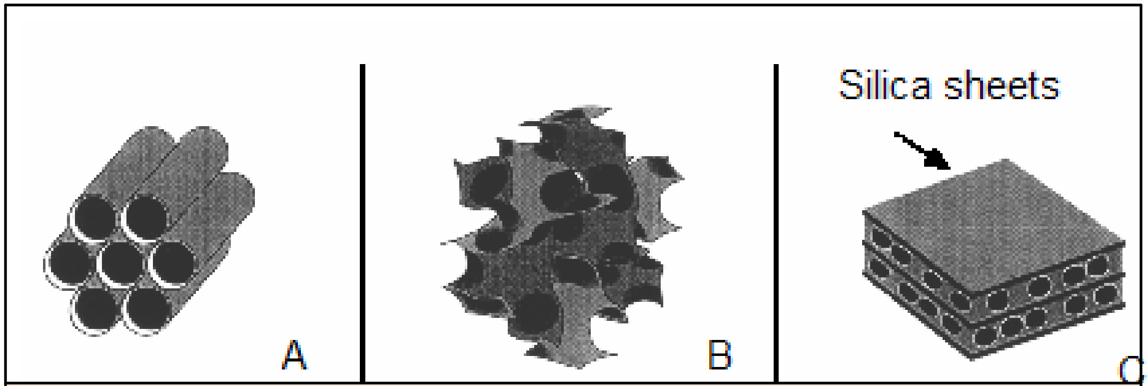


Figure 3a: The proposed structures of MCM-41 (Hexagonal, A), MCM-48 (Cubic, B), and MCM-50 (Lamellar, C) [58]

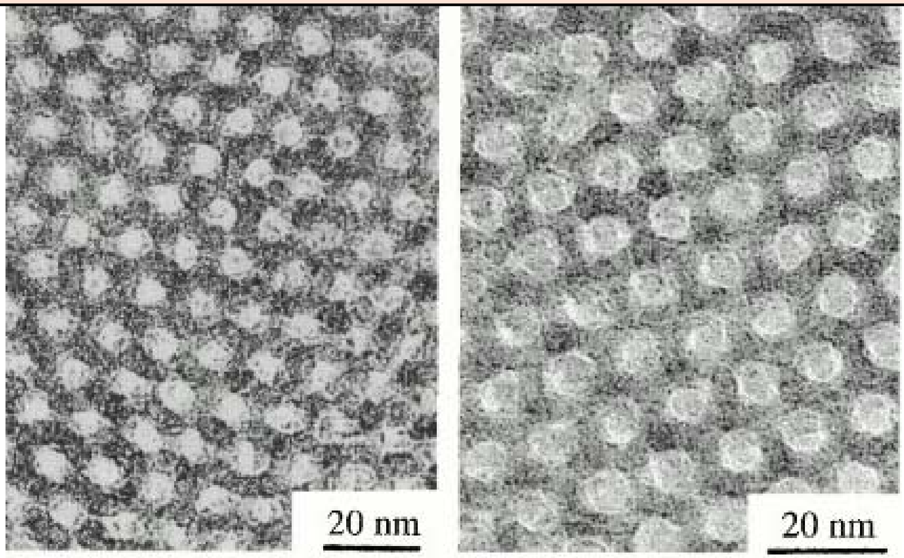
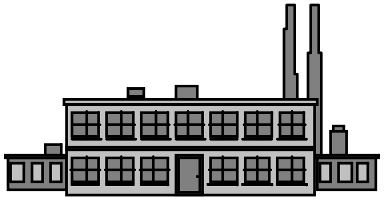


Figure 3b: TEM images of calcined hexagonal SBA-15 mesoporous silica [59]

Potential Applications

- **Catalysts:**

  Ti, Mn and V containing mesoporous molecular sieves
- **Supports or substrates:**
  - for noble-metal oxidation and hydrogenation catalysts; Ni-Mo in hydrocracking; high surface area adsorbents
- **Hosts, nano-reactors, and nano-biosensors:**
  - carbon wires for nanometer electronic devices
  - conducting polyaniline filaments
  - ZnS semiconductor particles
  - **Biomolecules and therapeutic agents**.
- **Separation: size and shape selectivity**
- **Novel nanocomposites and fillers.**
- **Drug delivery devices.**

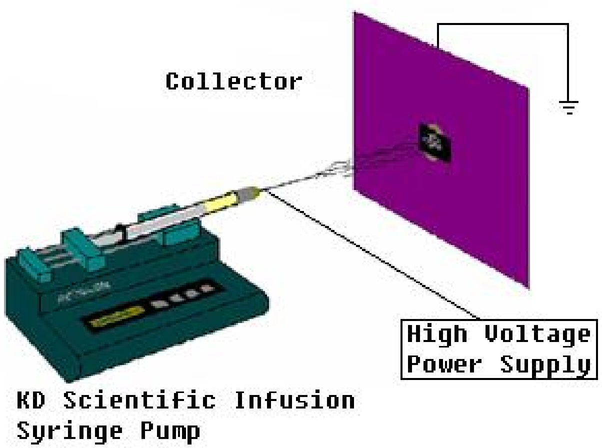


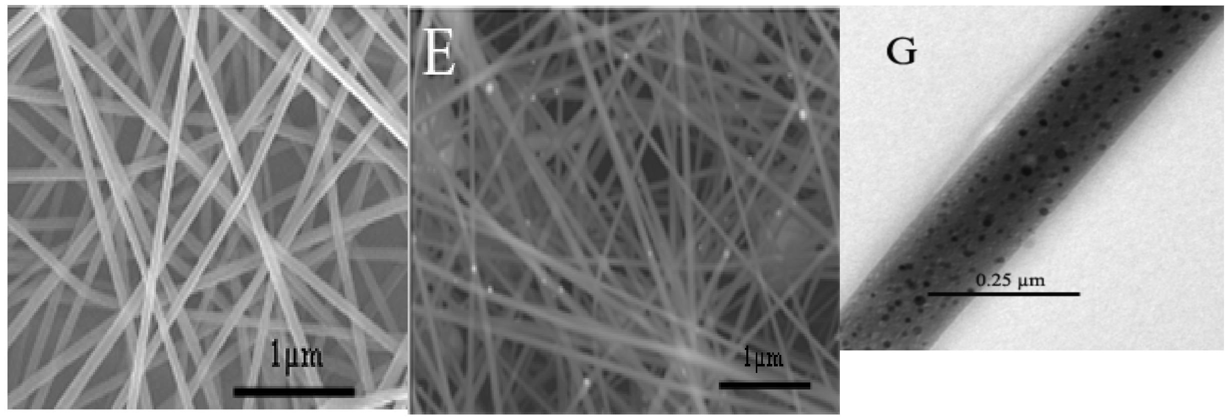
Electrospinning of Porous Silica Nanofibers Containing Silver Nanoparticles for Catalytic Applications

A. Patel, S. Li, C. Wang, W. Zhang, Y. Wei*,

***Chem. Mater.*, 19, 1231, 2007.**

Silica fibers containing $AgNO_3$ were electrospun. The mats when heated above 400 °C to yield **Ag nanoparticles** (**8 to 20 nm**), thus producing porous silica golden yellow fiber mats. The Ag particles present inside the fibers showed high catalytic activity.





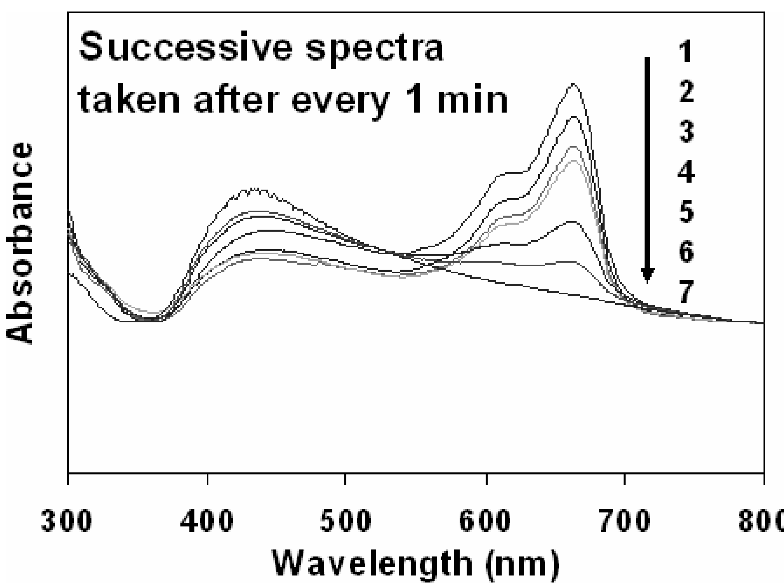
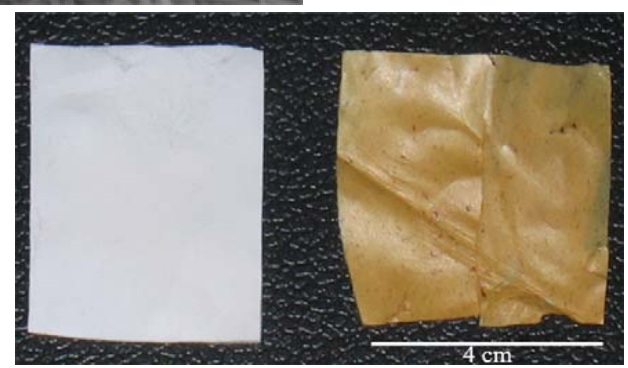
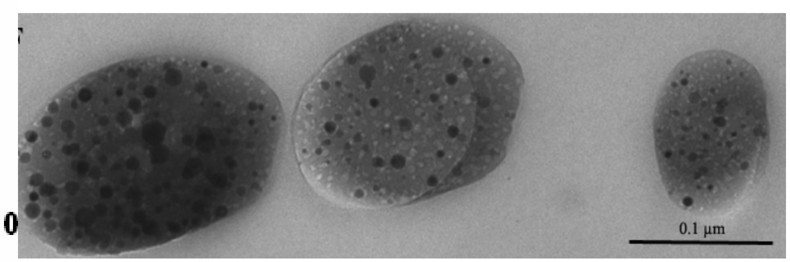


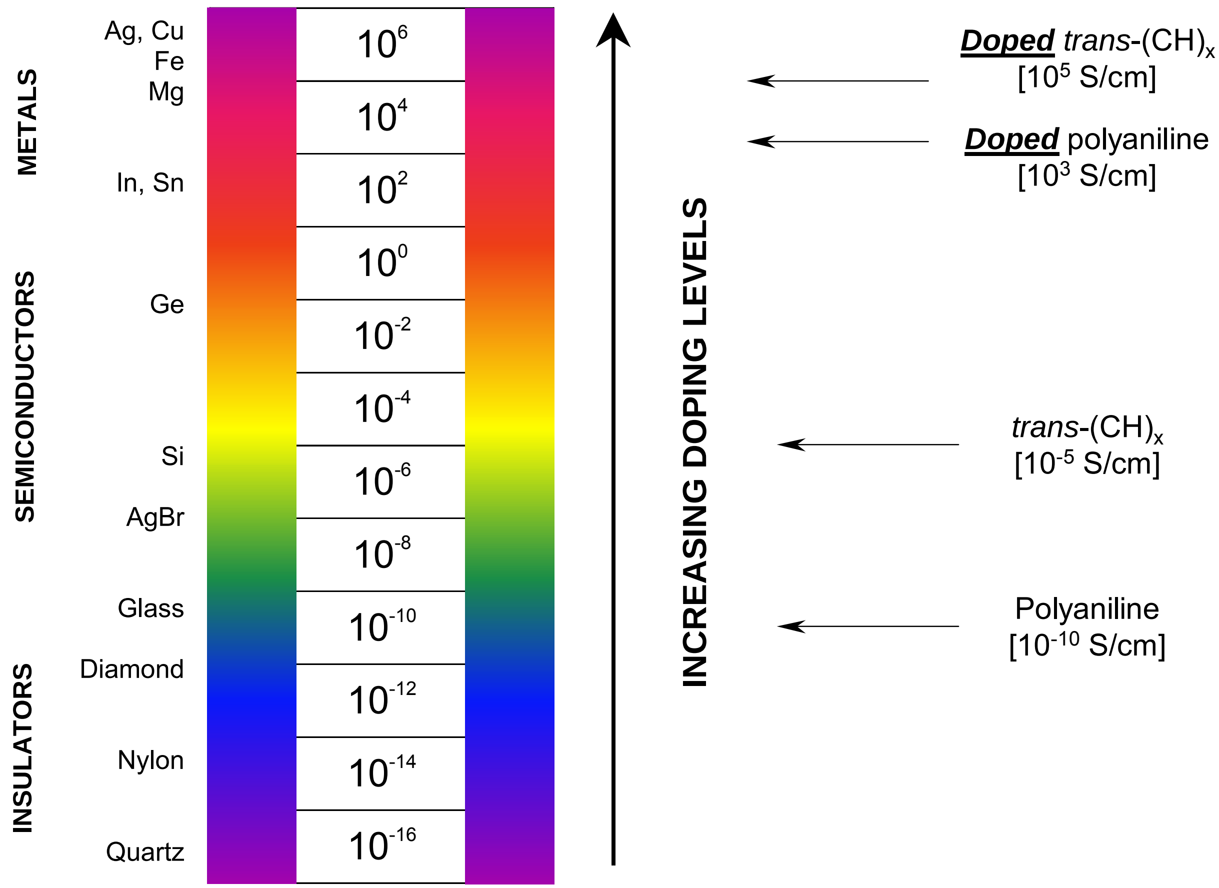
Figure 8. Successive UV-visible spectra of methylene blue (MB) dye reduction, using silica nanofibers containing silver nanoparticles as the catalyst and $NaBH_4$ as the reducing agent.





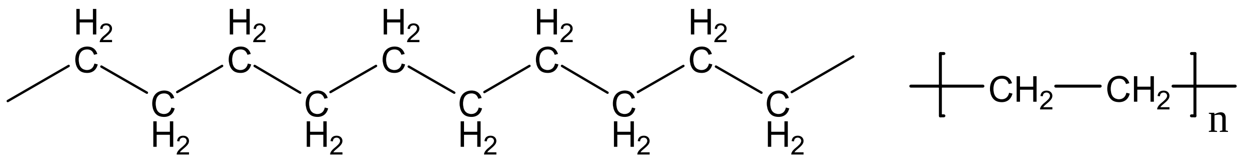
Conductivity of Electronic Polymers

Conductivity increases with increased doping

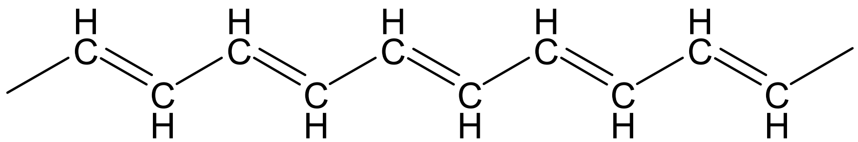


Alan MacDiarmid, Alan Heeger and Hideki Shirakawa won *2000 Nobel Prize in Chemistry* for the discovery of Conducting Polymers.

Insulating Polyethylene

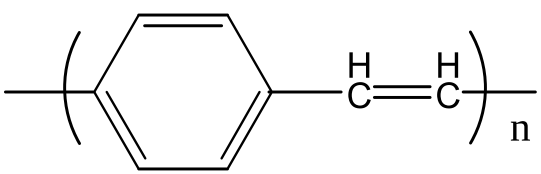


Conjugated Polyacetylene

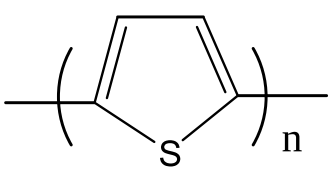


$\Downarrow$

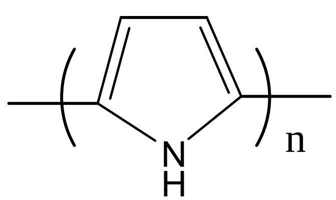
Doping (Redox Reactions) to high conductivity of **10^4 S/cm**



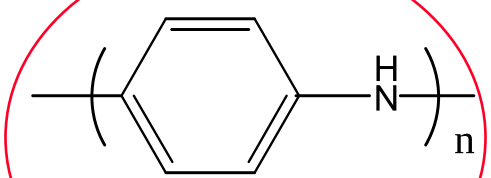
Poly(phenylene vinylene) Electroluminescence



Polythiophene

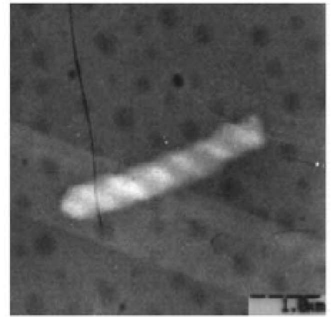


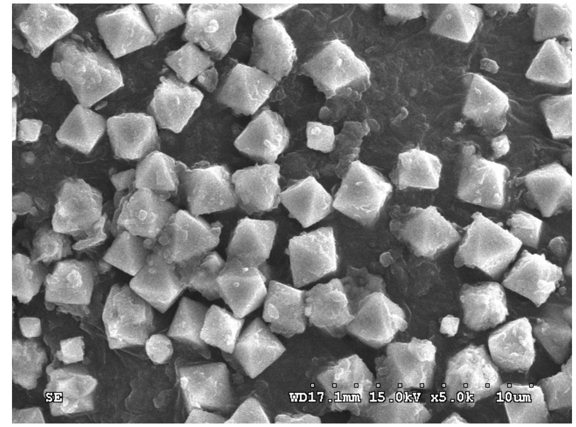
Polypyrrole



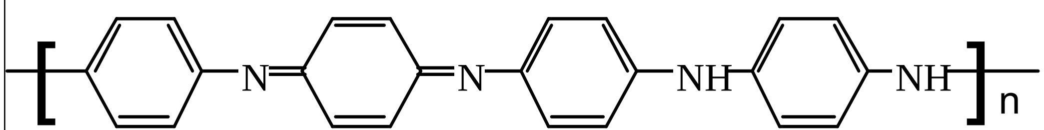
"Polyaniline"

Polyaniline



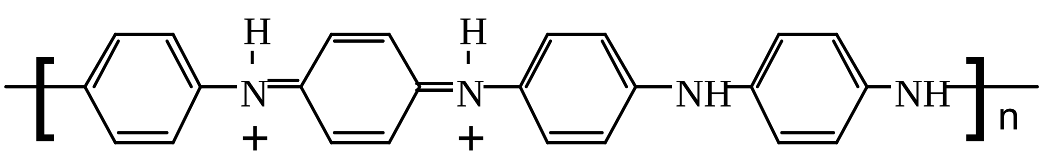


A Schematic Presentation of Doping:



Emeraldine Base: Non-conductive

HCl doping ⇌ Dedoping with a base



Emeraldine Salt: Conductivity: ca 10 S/cm

W.J. Zhang, M.X. Wan, J. Lei, et al.

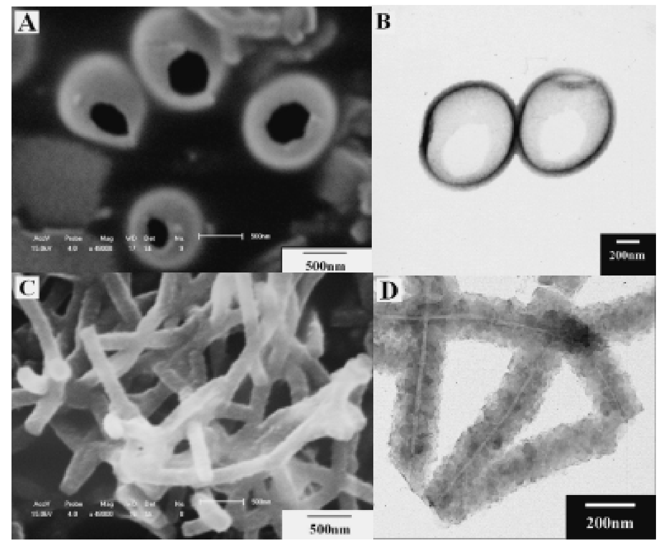
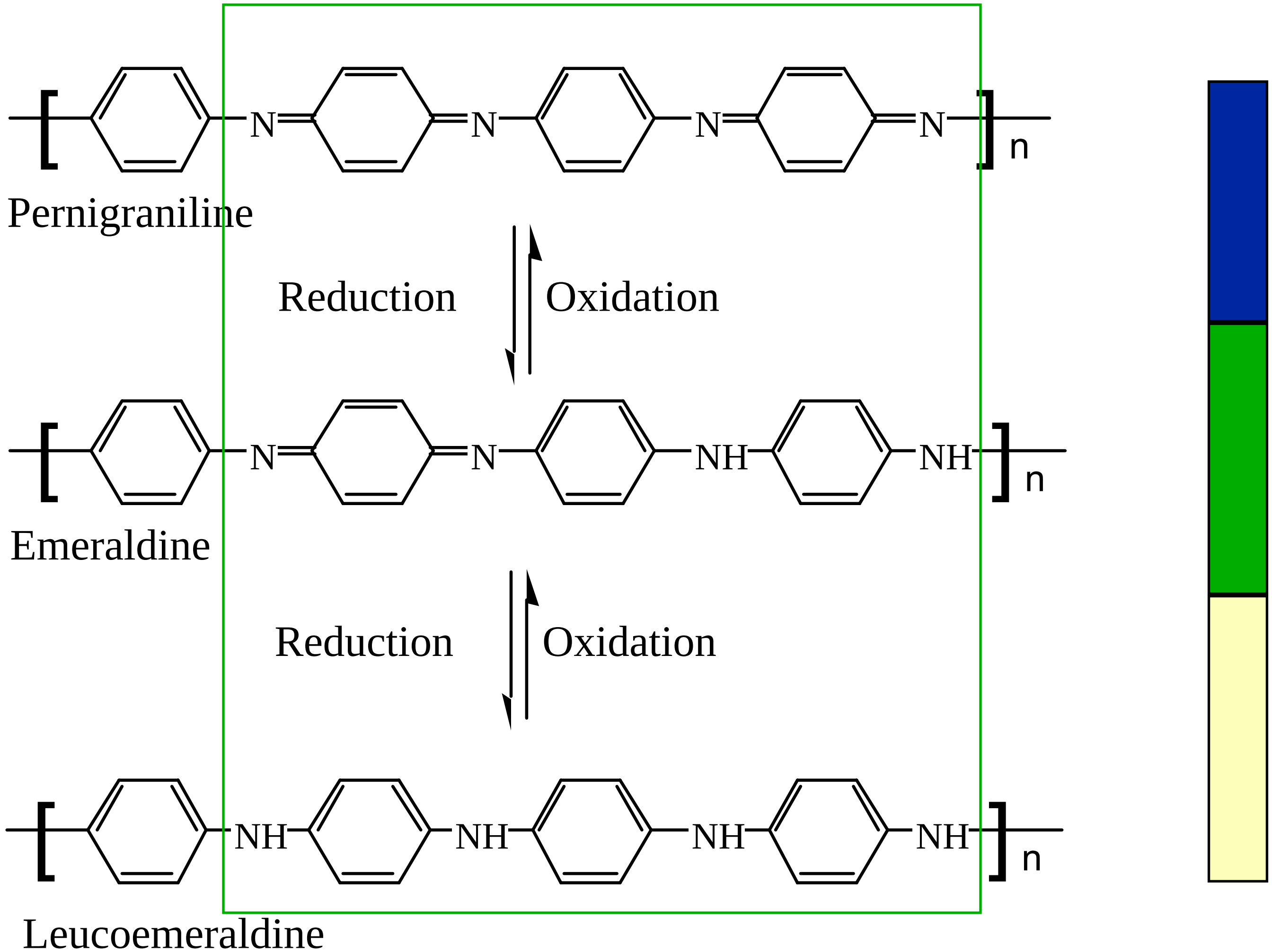


Figure 1. Typical SEM images (A and C) and TEM images (B and D) of the polyaniline micro/nanostructures: (A and B) hollow microspheres; (C and D) nanotubes. Micrograins and solid spheres were shown in supporting information.

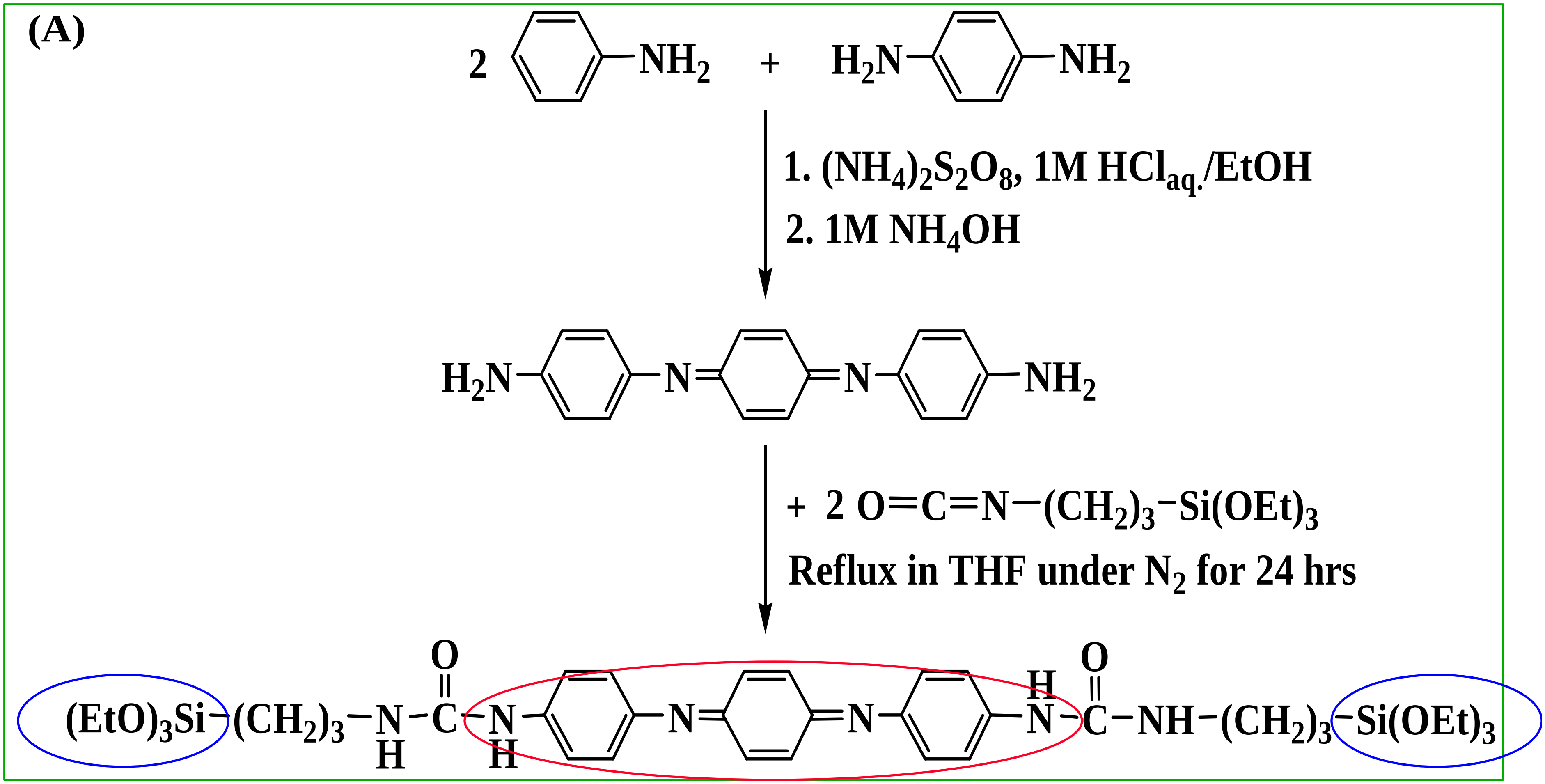
Chem. Let. 34, 4243, **2005**;
Adv. Mat. 17, 2854, **2005**;
Adv. Mat. 19, 465, **2007**.
Adv. Mat. in press, **2007**.

About Polyaniline: A Schematic Presentation of the Oxidation State Change in Polyaniline:



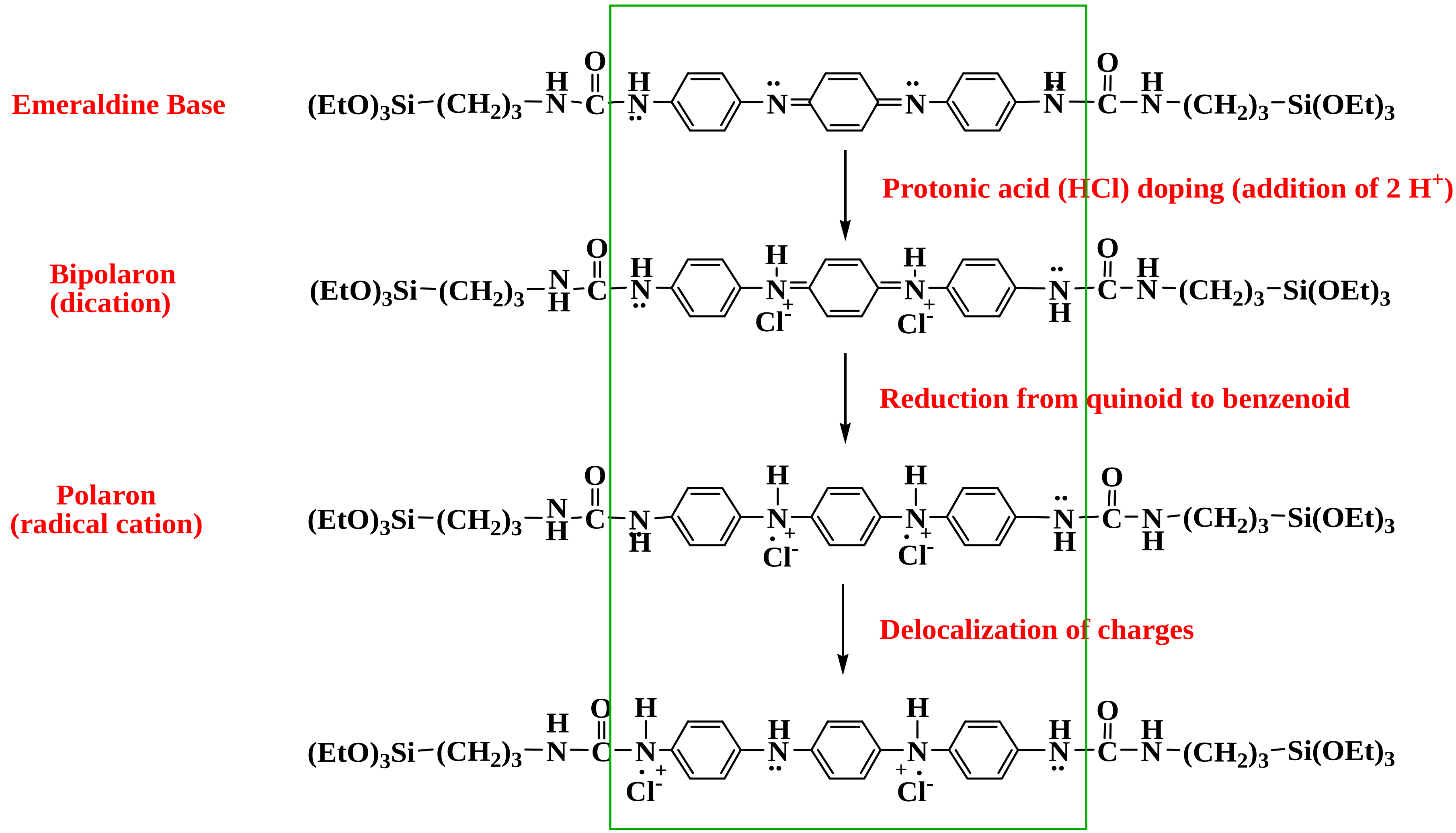
Yen Wei*, Jie-Bin Pang and Kun-Yuan Qiu, “Re-Activation Chain Polymerization”, *Chinese Polymer Bulletin* (高分子通报), No. 5, pp. 94-98, May 2006.

Scheme I. Synthesis of (A) N,N'-bis(4'-(3-triethoxysilylpropyl-ureido) phenyl)-1,4 quinonene-diimine (TSUPQD) and (B) trimer-containing hybrid materials through sol-gel process.



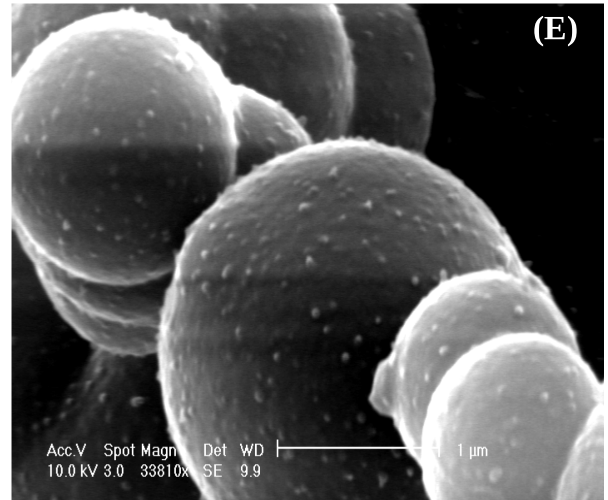
Y. Guo, et al. *Macromolecules*, **2006**.

Scheme II. Protonic acid-doping structures and mechanism for TSUPQD.



Guo Y., Zhang ZT, et al. *Macromolecules*, **2007;** Guo Y. PhD dissertation **2007**.

Both the TSUPQD and its sol-gel product have some characteristic electroactivity of polyaniline.



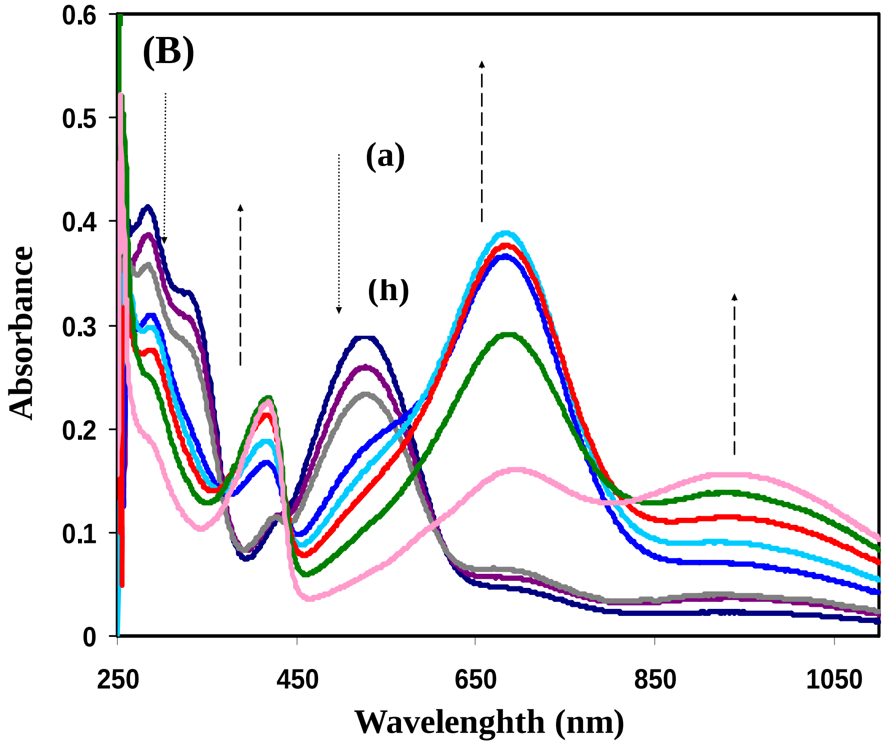


Figure 1: UV-Vis spectra of TSUPQD following HCl doping. (a) Undoped TSUPQD, (b) doping ratio 1 : 1, (c) 1 : 10, (d) 1 : 200, (e) 1 : 500, (f) 1 : 1000, (g) 1 : 5000, (h) 1 : 10000.

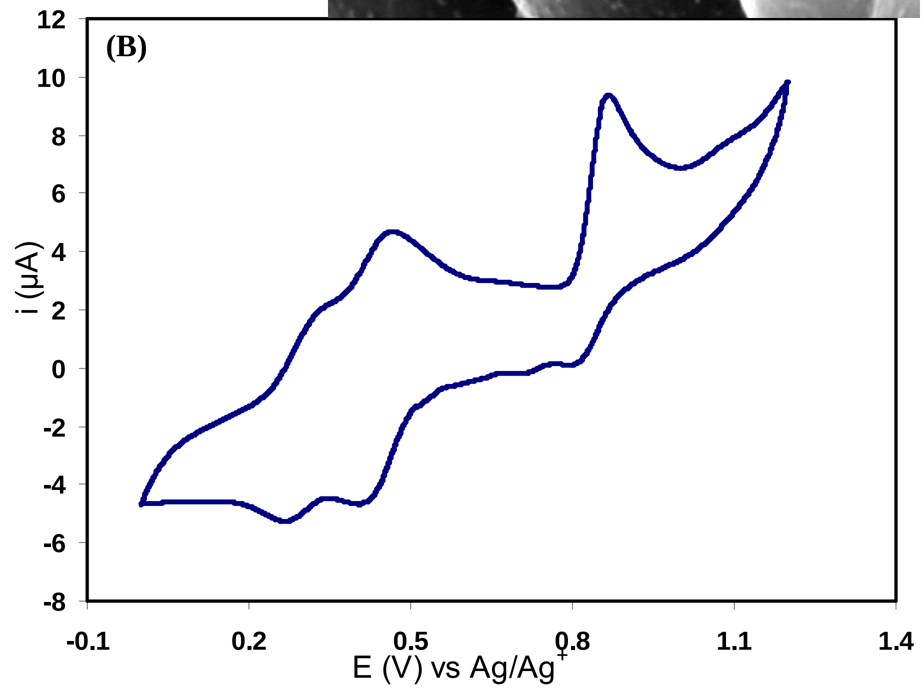


Figure 5: Cyclic Voltammogram of TSUPQD in acetonitrile containing 0.1 M Et4NPF6 and 0.77 M MeHSO4.

Scheme I: Synthesis of electroactive TSU-PMO

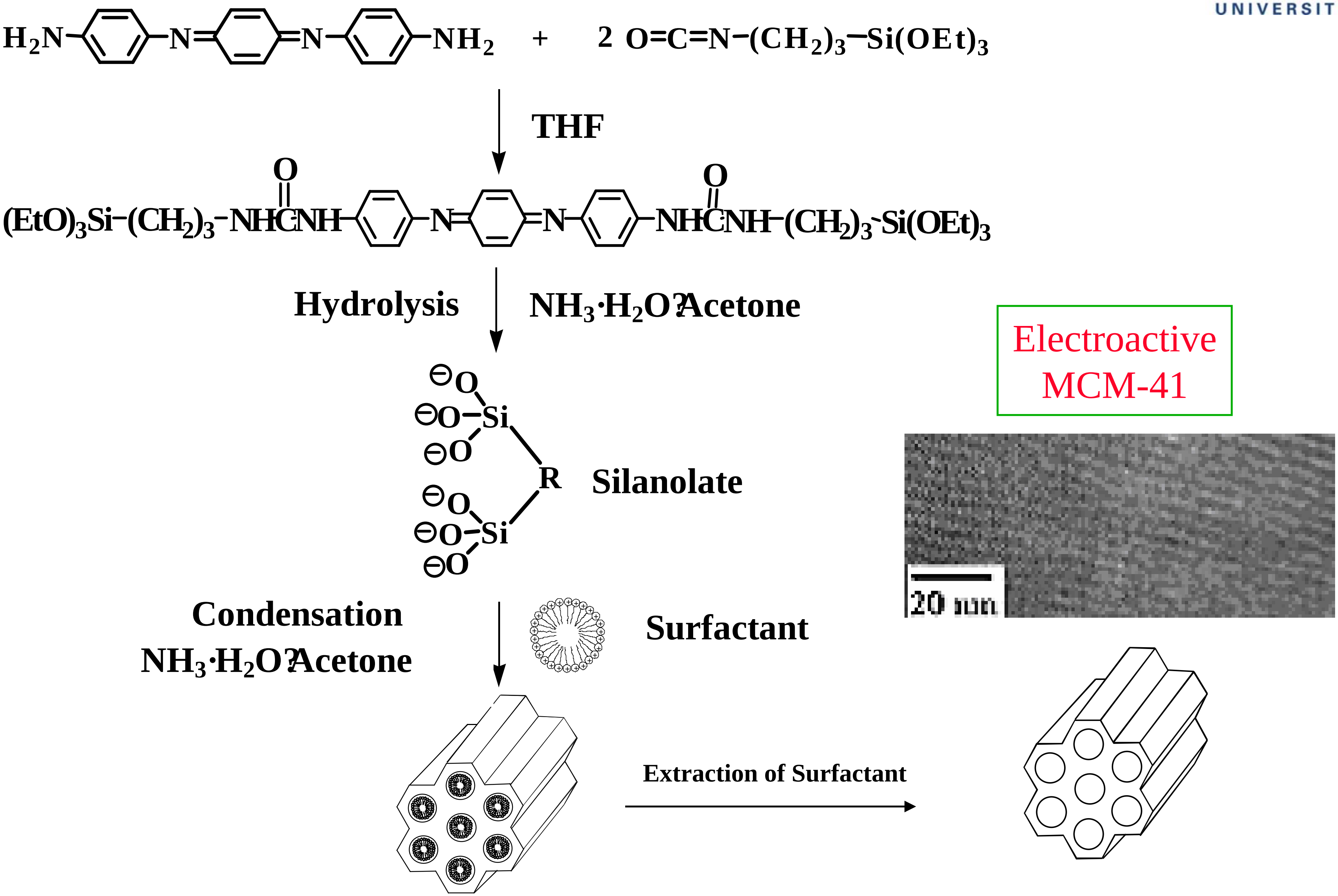
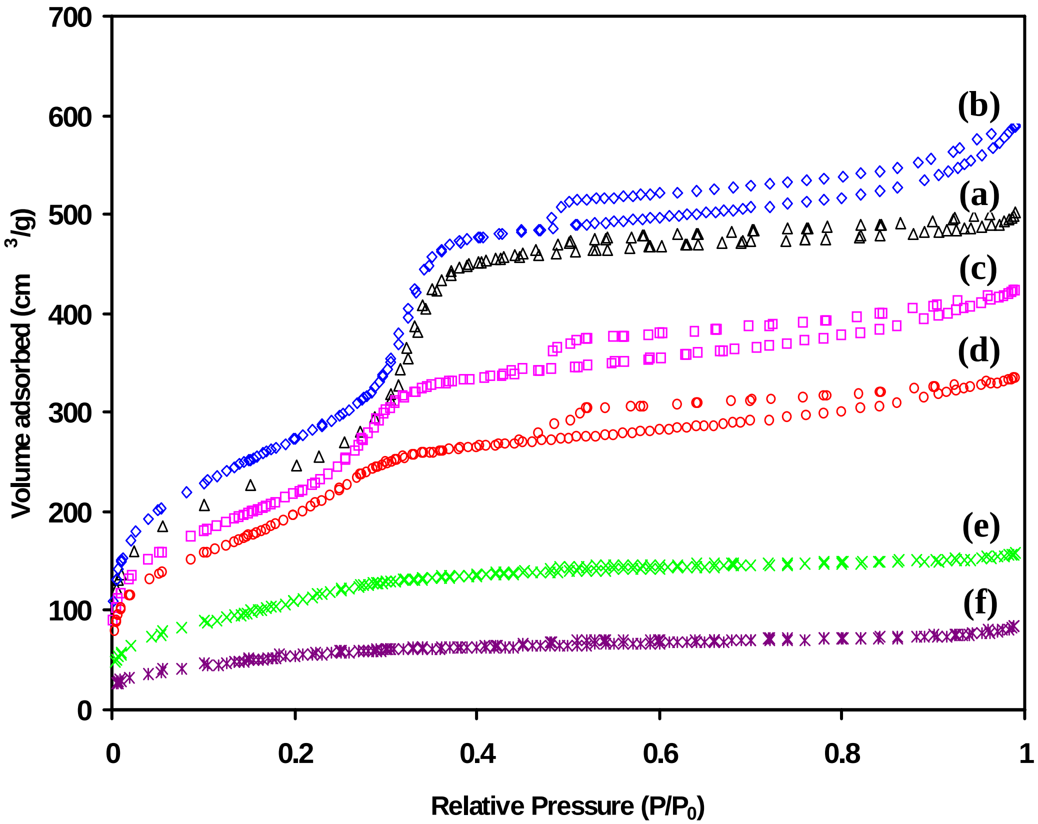


Figure 4: Nitrogen adsorption/desorption isotherms. (a) 0 wt% TSU-PMO; (b) 5 wt%; (c) 10 wt%; (d) 20 wt%; (e) 33 wt%; (f) 66 wt%.
Figure S4. BJH pore size distribution curves of the TSU-PMOs.



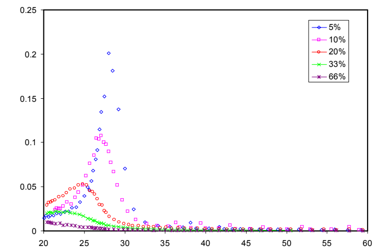


Figure 3.

Pore diameter is about 3 nm and tunable.

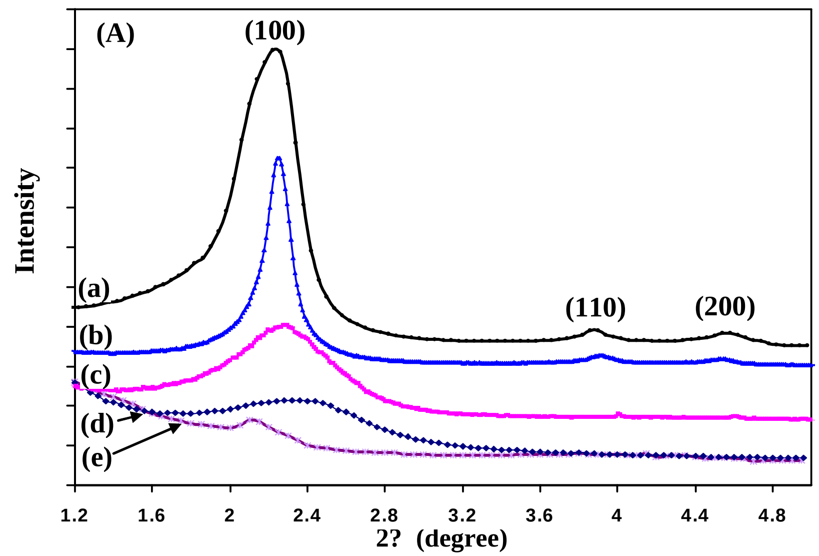


Fig. 3: XRD patterns of (A) electroactive PMOs with various compositions of TSUPQD and TEOS. (a) 0 wt%; (b) 5 wt%; (c) 33 wt%; (d) 66 wt%; (e) 100 wt%; (B) Debye-Scherrer diffraction pattern rings of 10 wt%, 33 wt%, 66 wt%, and 100 wt% TSU-PMOs.

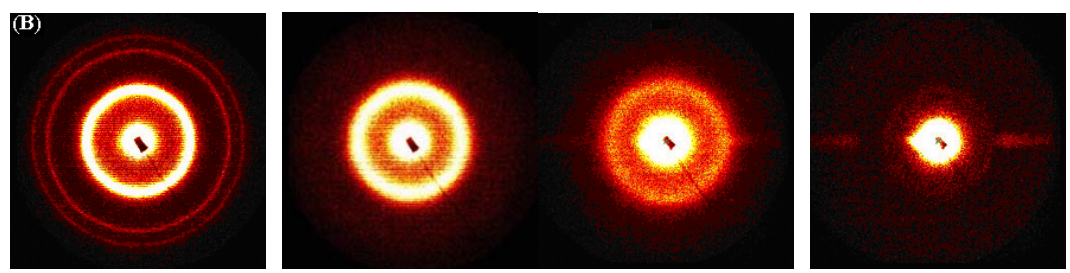
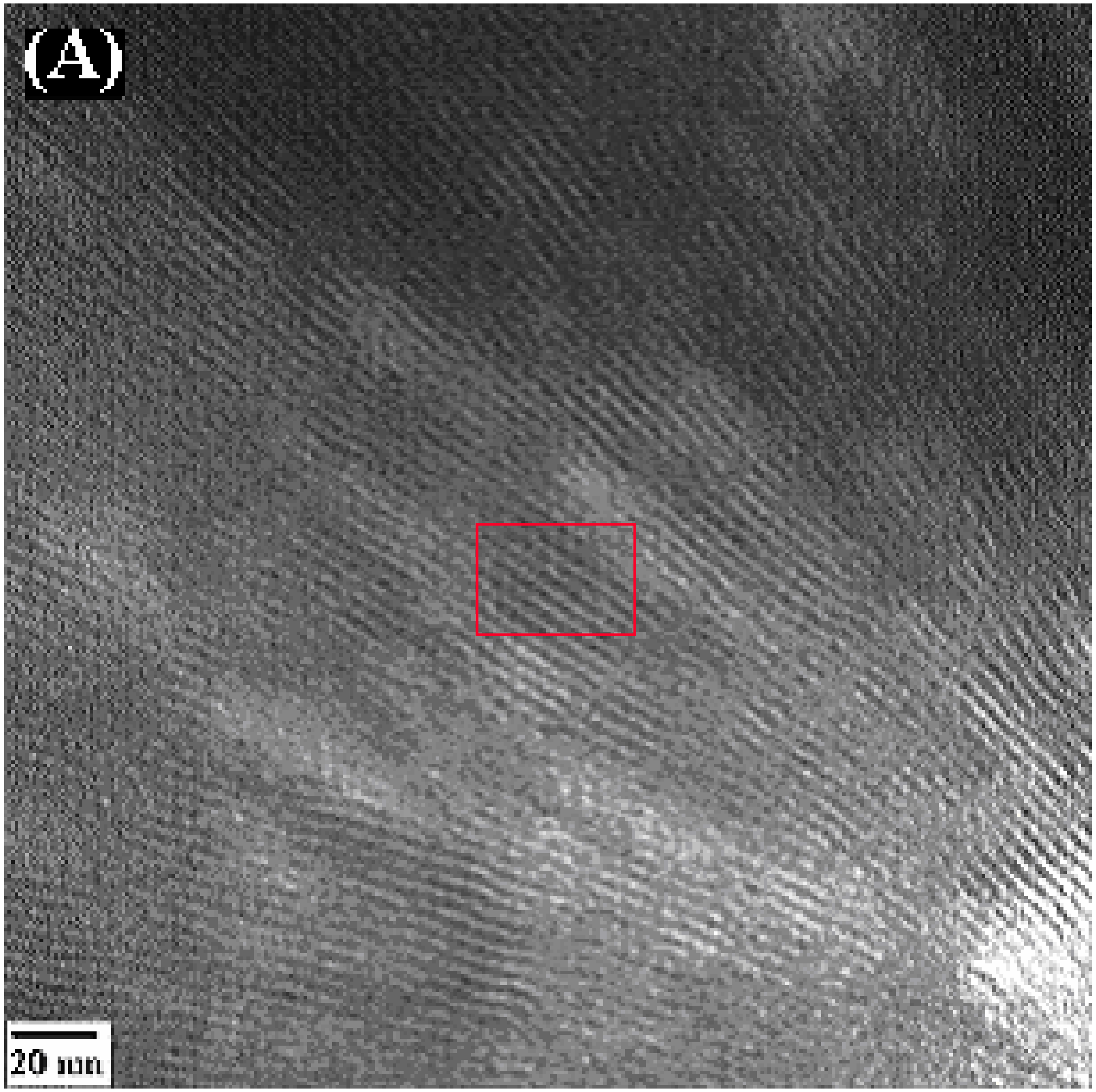
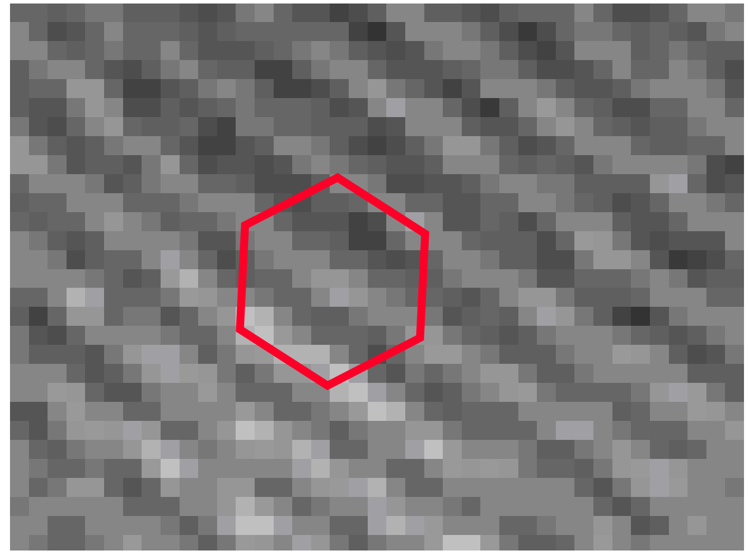


Figure 5: TEM images of oligoaniline-containing hybrid mesoporous organosilica, **(A) 20 wt%** and **(B)** 66 wt%. (The scale bar: 20 nm)





At 20% oligoaniline modification, the hexagonal order of the MCM-41 molecular sieves perserved. Pore diameter is about 3 nm.

The oligoaniline-containing hybrid mesoporous organosilica **is electroactive** and have many potential applications

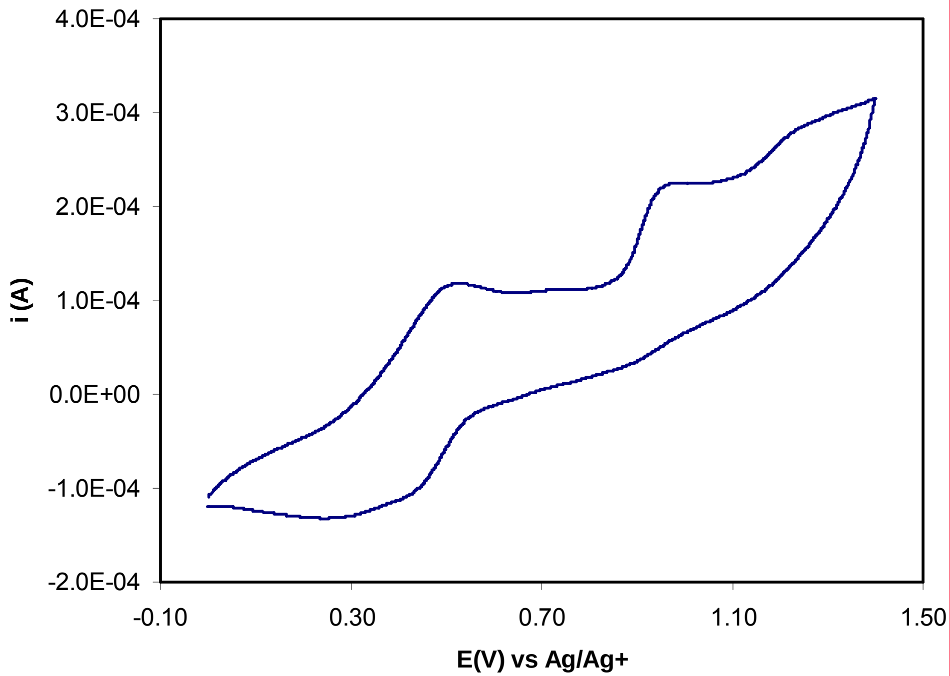


Figure 6: Cyclic Voltammograms of 100 wt% TSU-PMO in acetonitrile containing 0.1 M Et_4NPF_6 and 0.77 M $MeHSO_4$.

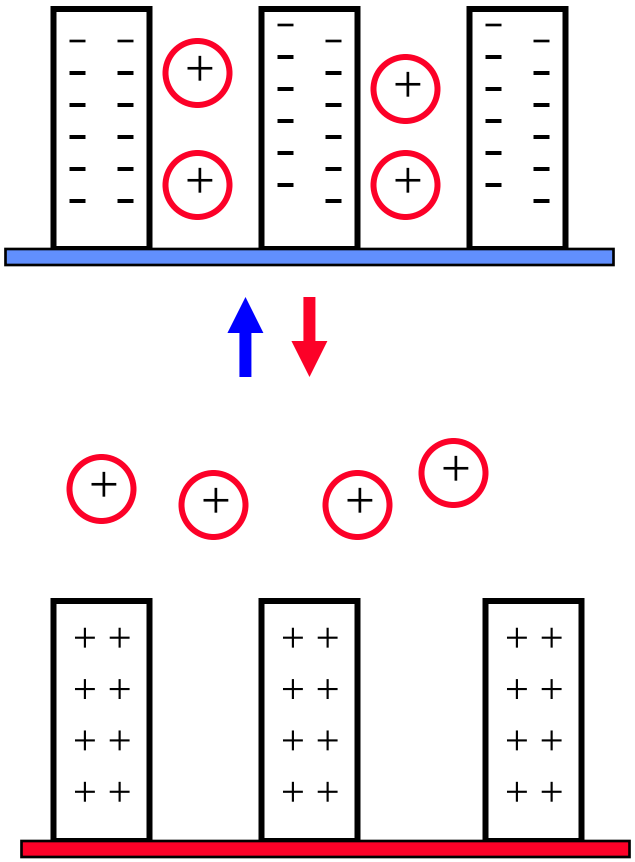
Many intriguing possibilities for applications because of the unique redox and pH (charge) related switchabilities:

(1) **Switchable host-guest system (for capture and release of drugs, biomolecules like DNA, RNA and proteins), "Nanoinjector", "Nanomissile"……**
(2) Controlled and switchable nanochannels ("smart biomembranes and pumps"),
(3) Chemical and biological sensors,
(4) Separation technology,
(5) Etc., etc., imagination goes on…..

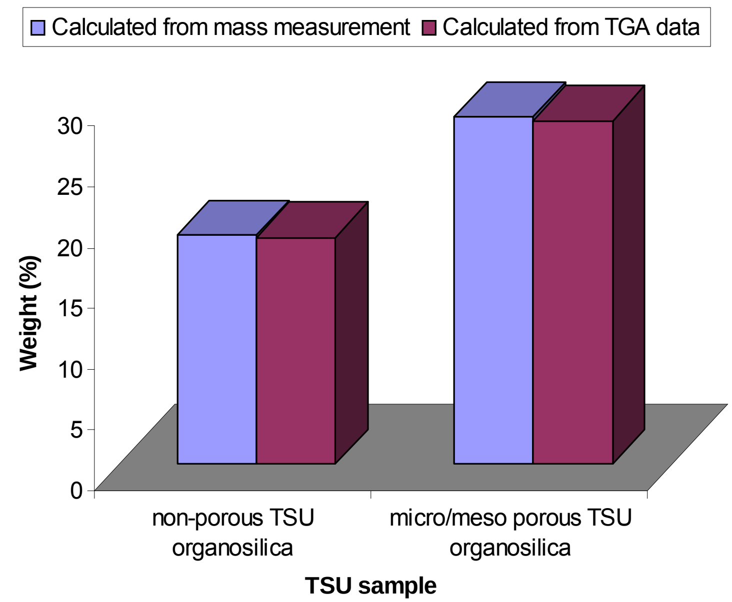
Y. Guo, A. Mylonakis, Z. Zhang, C.-M. Dong, S.A. Che, Q.H. Lu, P.I. Lelkes, Y. Wei, "Templated Synthesis of Electroactive Periodic Mesoporous Organosilica Bridged with Oligoaniline", Submitted, 2007.

"Nano-injector" or "Nano-guns" for drug, protein or DNA delivery.

Cartoon: **Capture and release Cc, etc. (Y. Guo, et al. 2007).**



-Si-O$^-$



$\overset{+}{\text{-NH=}}$

Figure 7: Diagram of **L-camphorsulfonate** adsorption capacity for nonporous and mesoporous TSU materials.

A positively charged species, e.g., cytochrome c.

Switch charges by pH or electropotential.

Why Study Proteins and Neurons? Our motivation:

"Full understanding of *protein folding* is probably one of few remaining fundamental problems in life science (another is the *molecular understanding of consciousness* or free will or soul)."

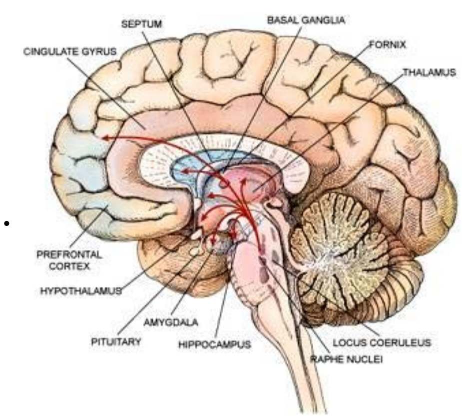
Yen Wei* and Kun-Yuan Qiu,
Nanoporous Materials –Science and Engineering, Edited by G.Q. Max Lu and X.S. Zhao, Imperial College Press, UK, *Series on Chemical Engineering*, 4, 873-892, **2004.**

The 3 approaches that we have been taking:

(1) Study neurological diseases: Alzheimer's, Parkinson's, mad cow diseases (protein aggregation in confined space).

(2) Nanoprobes (electric, electrochemical and photo-optical).

(3) Neural tissue engineering for building network & hopefully spinal cord repairing.



Y. Wei, P. I. Lelkes, A. G. MacDiarmid, E. Guterman, S. Cheng, K. Palouian and P. Bidez, *Contemp. Topics in Adv. Polym. Sci. Tech.*, pp. 430-436, **2004**.

Li, et al. 中国医学科学院学报 (*Acta Acad. Med. Sin.*), 28, 845-848, **2006**.

Motivations & Ideas

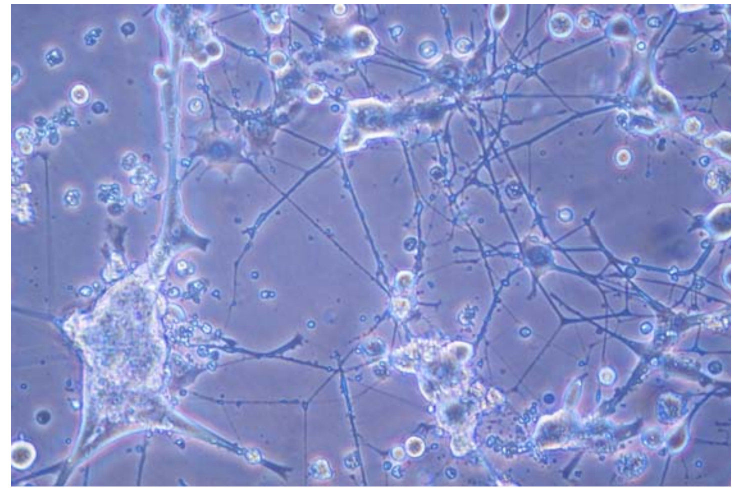
Intelligent, Differentiative Scaffolds for Tissue Engineering

Novel scaffolds or substrates for Tissue Engineering

Biocompatible conductive materials

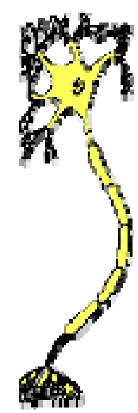
Conductive Polymer

Bio-Materials



Effect of electric stimuli on cellular functions:

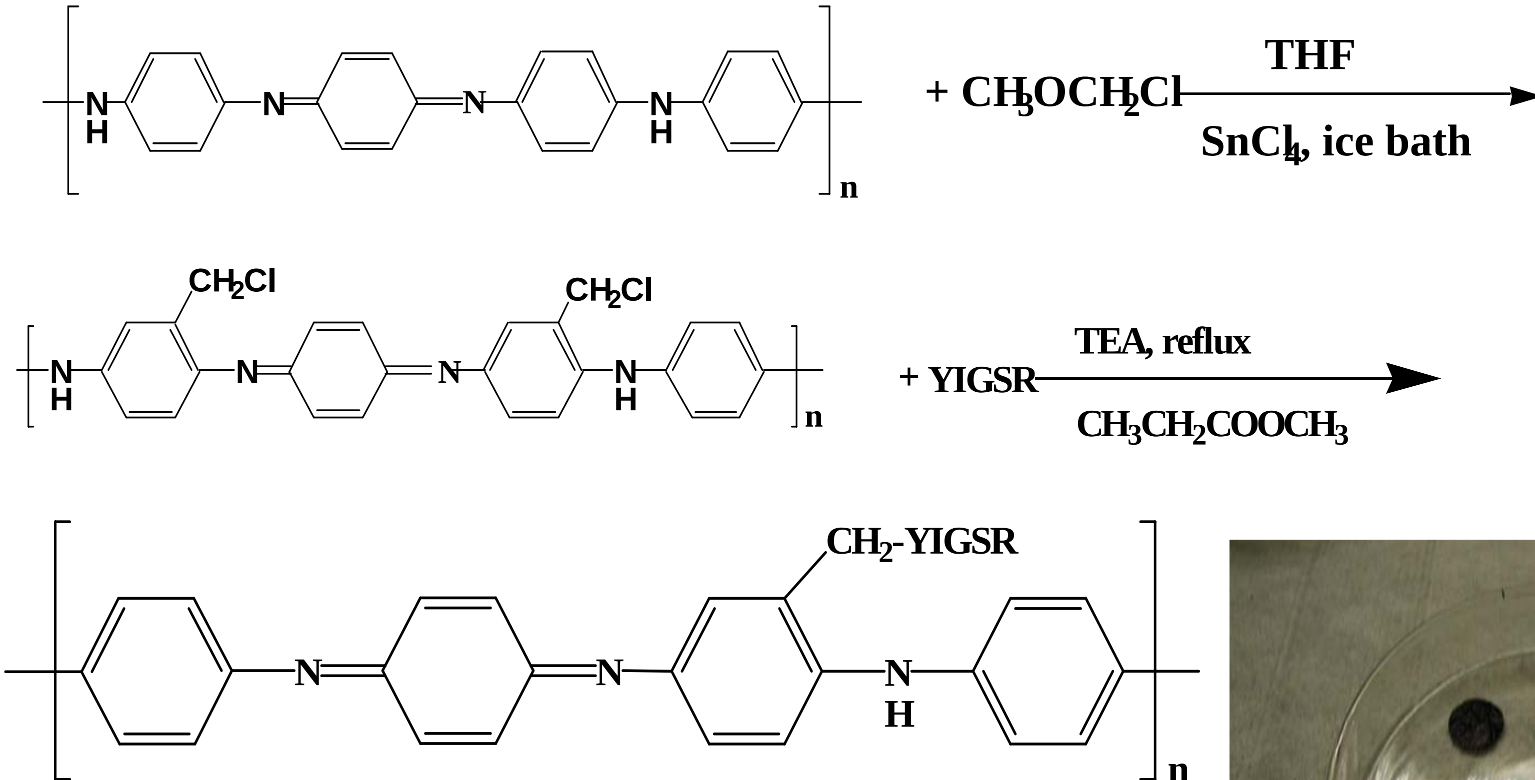
- **adhesion**
- **migration**
- **proliferation**
- **differentiation**



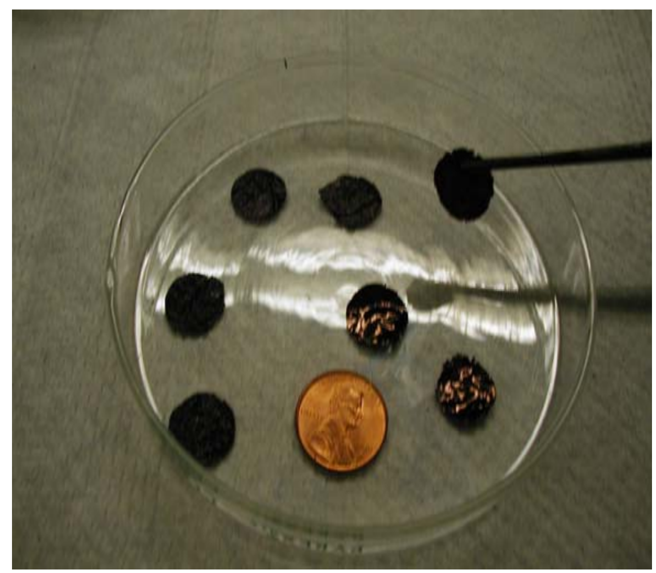
Important materials issues: Biocompatibility, Adhesion, Proliferation, Differentiation, “Biodegradability”.

Synthesis of chloromethylated and peptide-modified polyaniline.

Tyr-Ile-Gly-Ser-Arg (**YIGSR**) and "Random" Control Sequence **RYSGI**

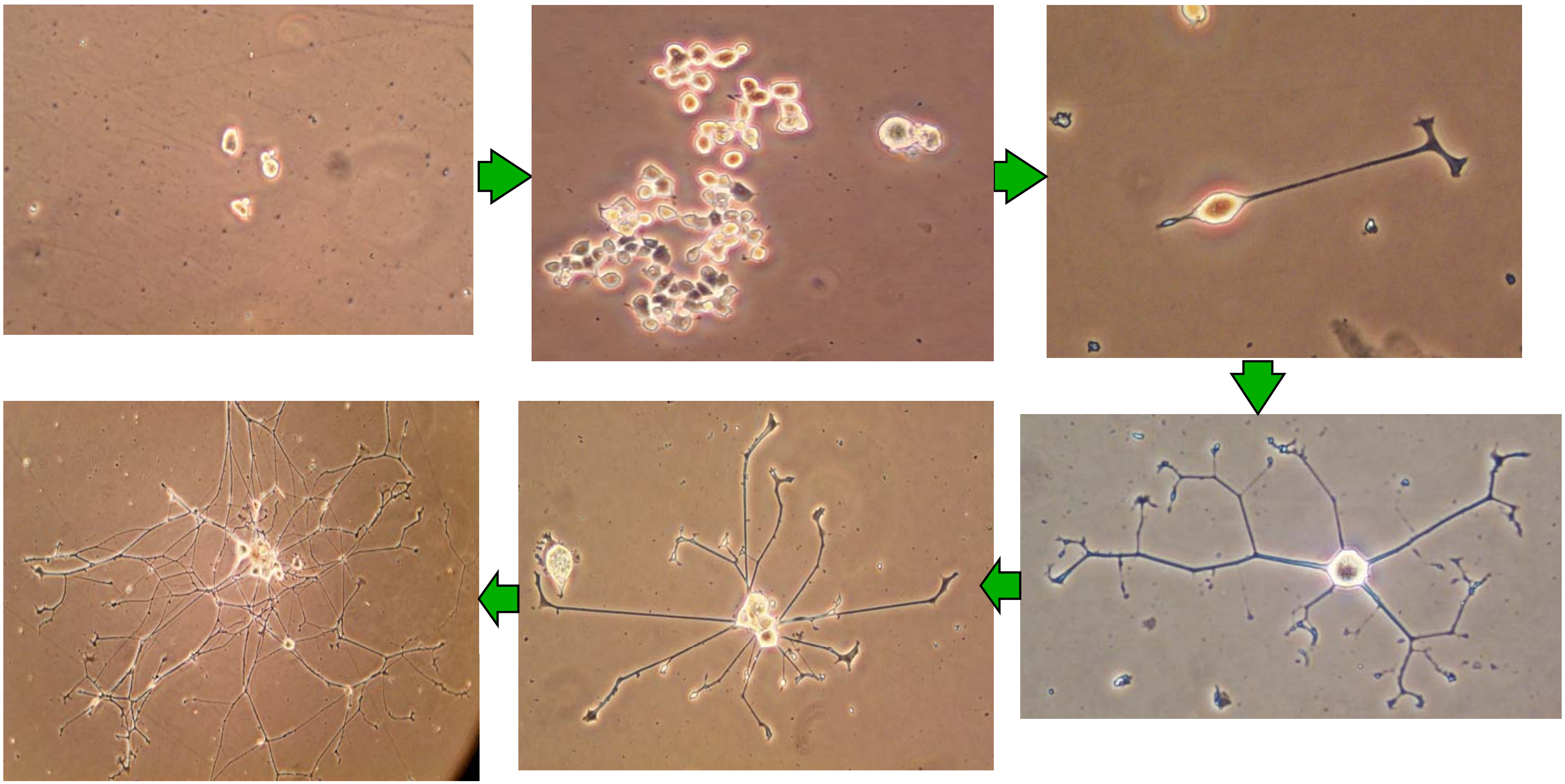


Y. Wei, P. I. Lelkes, A. G. MacDiarmid, E. Guterman, S. Cheng, K. Palouian and P. Bidez, *Contemp. Topics in Adv. Polym. Sci. Tech.*, pp. 430-436, **2004**. M. Li, et al. *Ch. J. Polym. Sci.* 25, 331-340, **2007**.



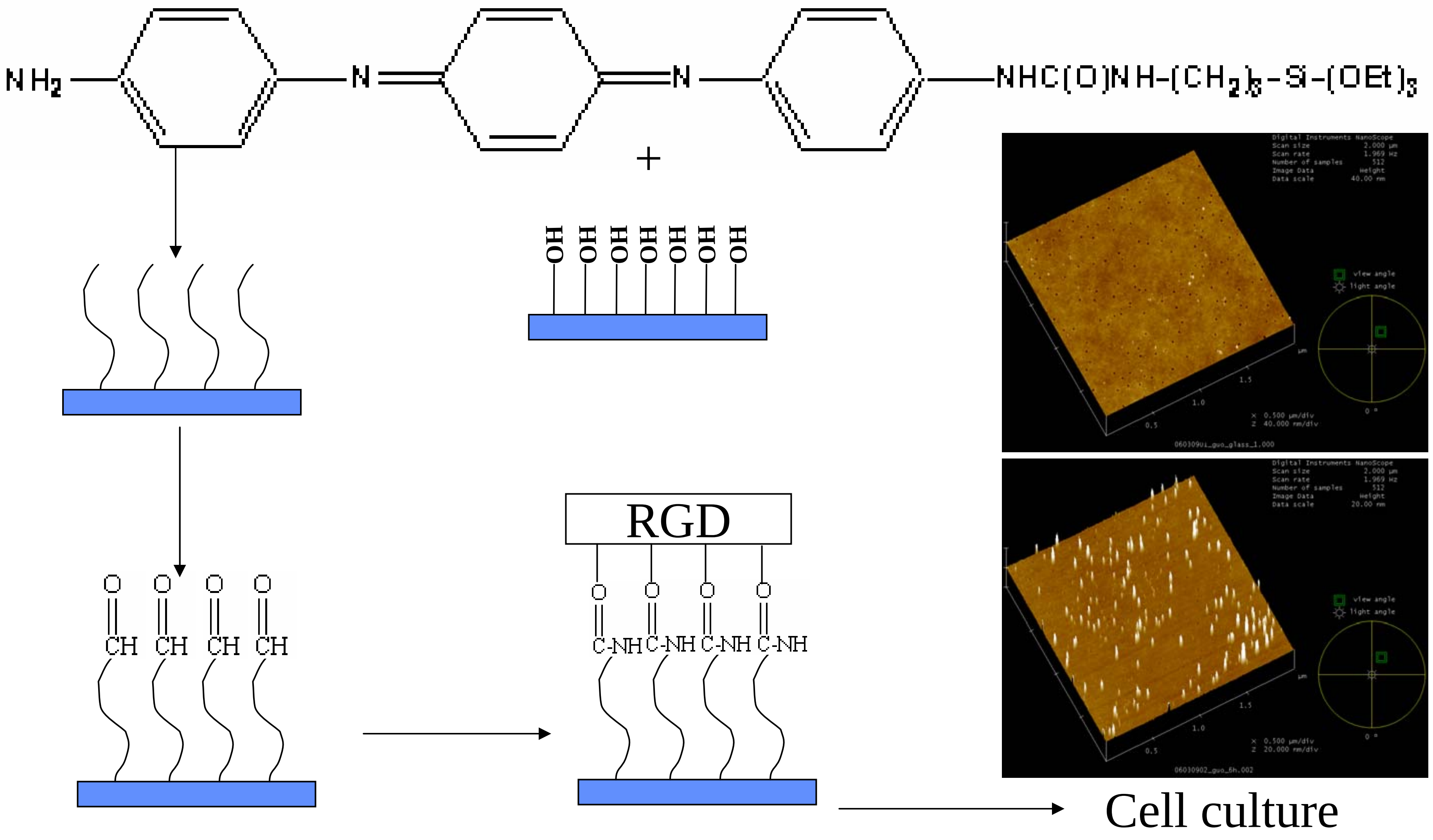
PC12-Differentiation into Sympathetic Neurons

Neuritogenic bioactive laminin peptide sequences YIGSR and RYSGI facilitate axonal growth in PC12 cells day 1 through 16



Patterned electroactive silica as scaffold in tissue engineering

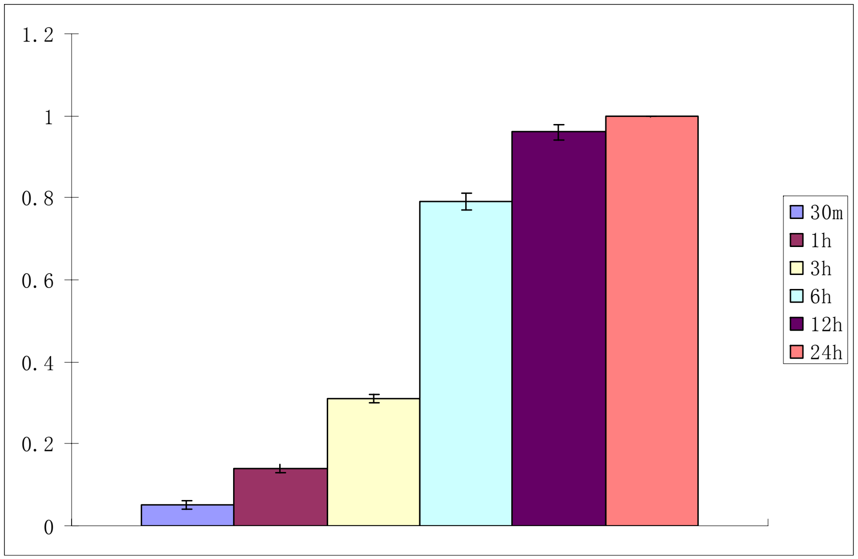
Y Guo, M Li, A Mylonakis, J Han, A MacDiarmid, P Lelkes, and Y Wei, *Biomacromolecules*, in press, 2007. Y. Guo et al. *Macromolecules*, 40, 2721, 2007.

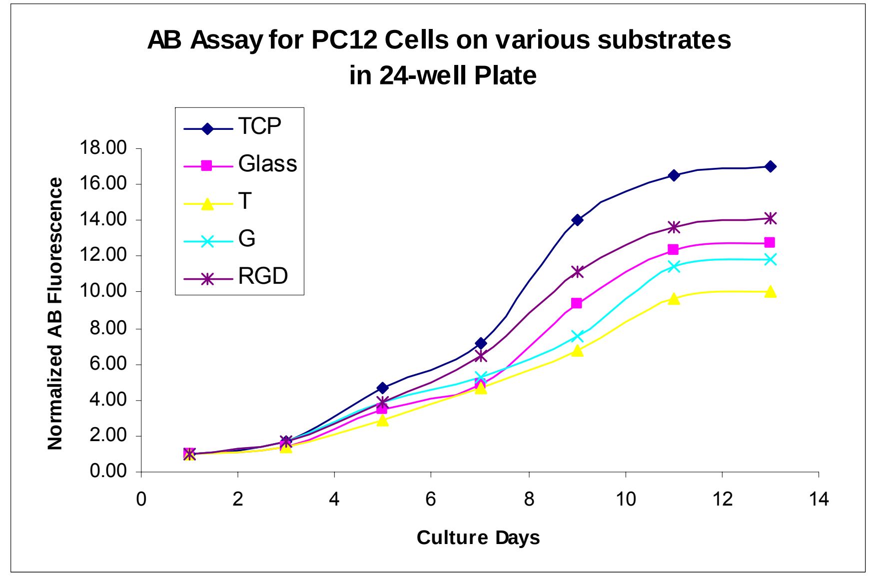


PC-12 cells

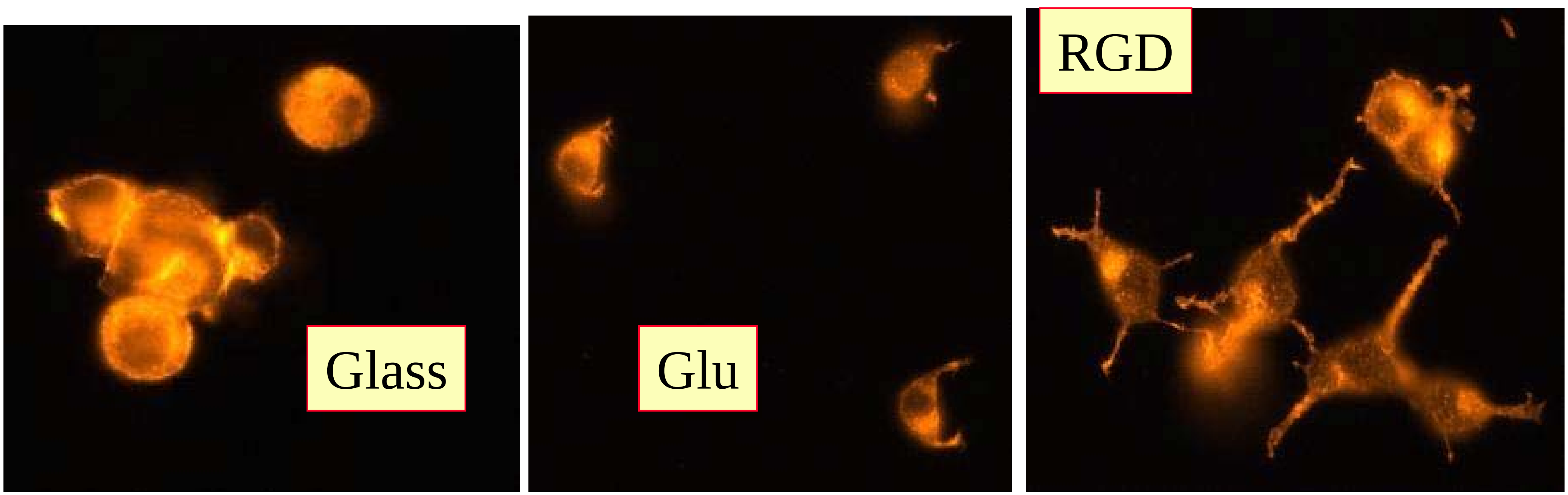
Attachment, Proliferation

Y. Guo et al., ***Biomacromolecules***, **September 11, 2007.**



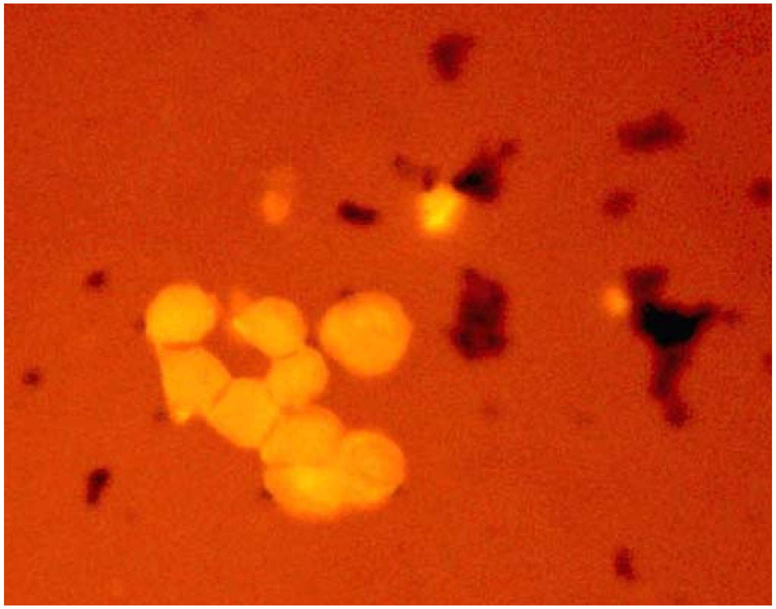


Differentiation

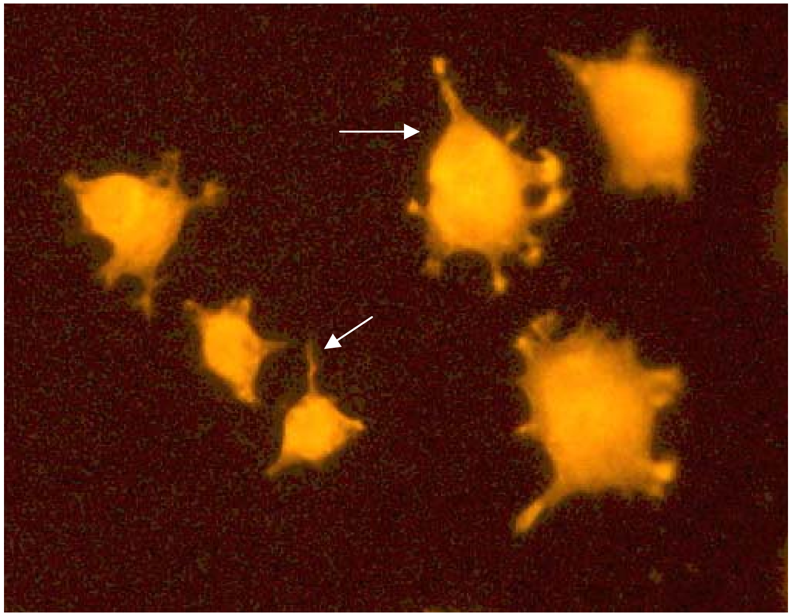


Results with applied electric field
(Implication: Stem Cell Research)

PC12 cells on:



Overhead transparency



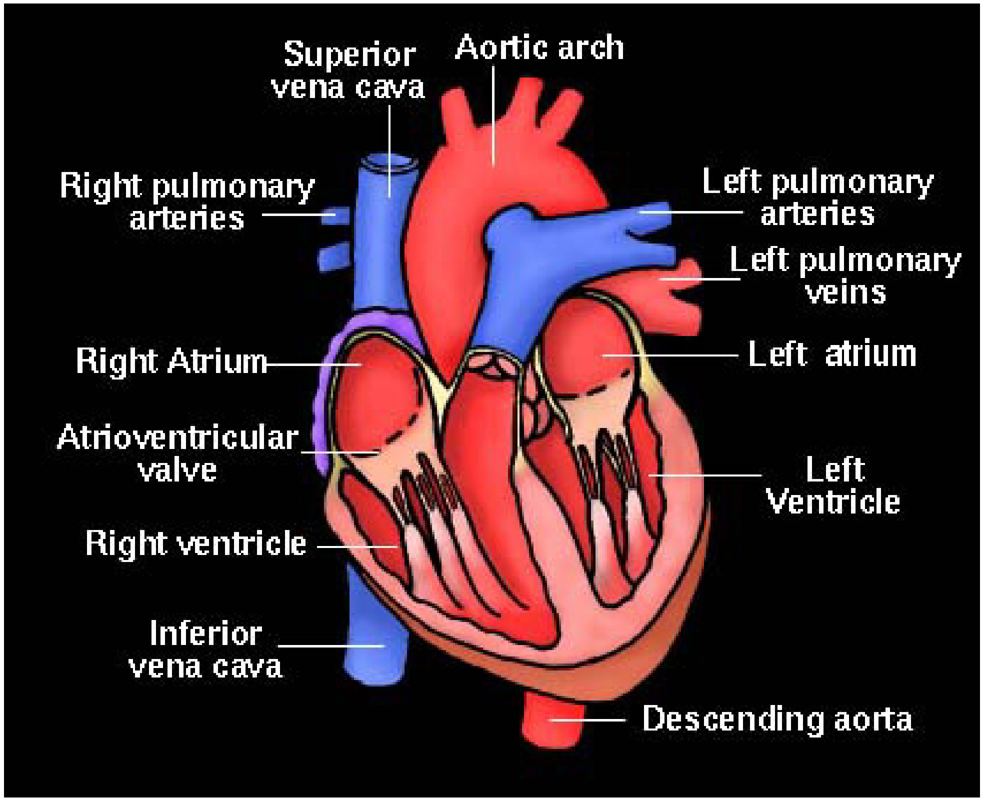
Line-Patterned graphite film after
72 hours stimulation (10 mV DC).

Conclusion:

Electrically stimulated neurite production on a solid substrate under the influence of an electric potential in the absence of NGF is demonstrated.

Bidez, Li, MacDiarmid, Venancio, Wei, Lelkes, *J. Biomaterials Sci. Polymer Ed.* 17, 199-213, **2006**.

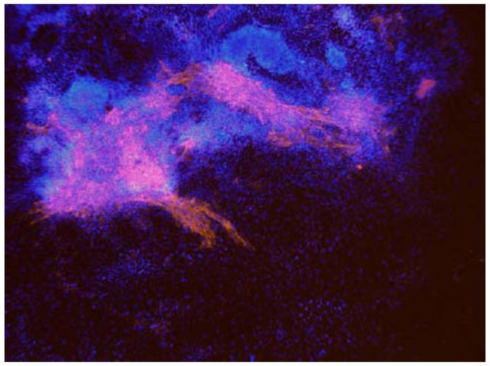
Heart attack damages heart tissues

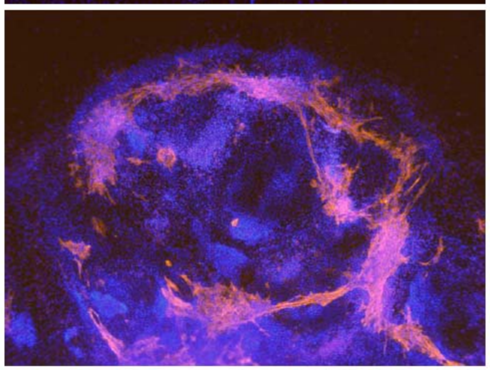


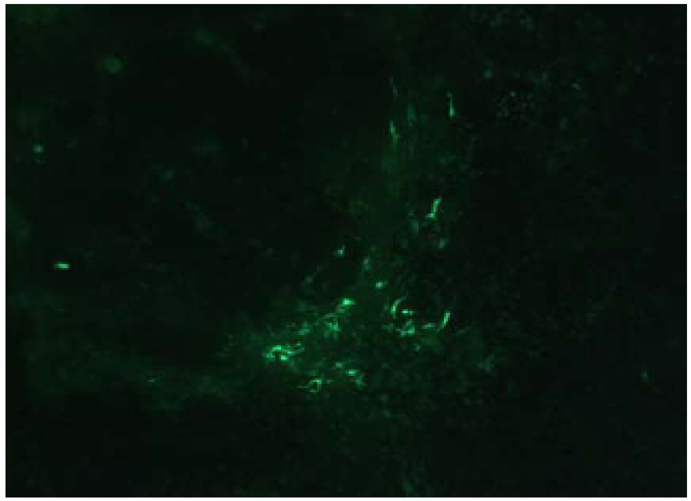
- G Selling, A Biswas, A Patel, D Walls, C Dunlap, Y Wei, *Macromol. Chem. Phys.*, 208, 1002-1010, **2007**.
- M Li, P Bidez, E Guterman-Tretter, Y Guo, A MacDiarmid, P Lelkes, X Yuan, X Yuan, J Sheng, H Li, C Song, Y Wei, *Chinese Journal of Polymer Science*, 25(4), 331-340, **2007**.

Enhanced Cardiac-Specific Differentiation of Mouse Embryonic Stem (mES-3D) Cells via Electrical Stimulation

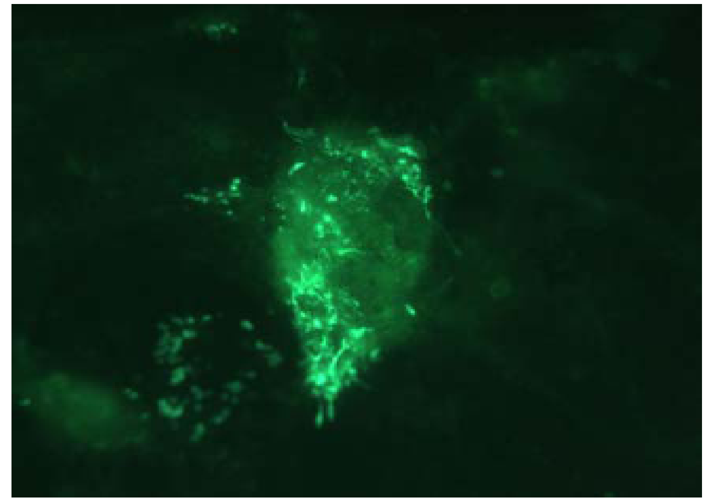
(Paul R. Bidez, Alan G. MacDiarmid, Yen Wei and Peter I. Lelkes, **May, 2007**)



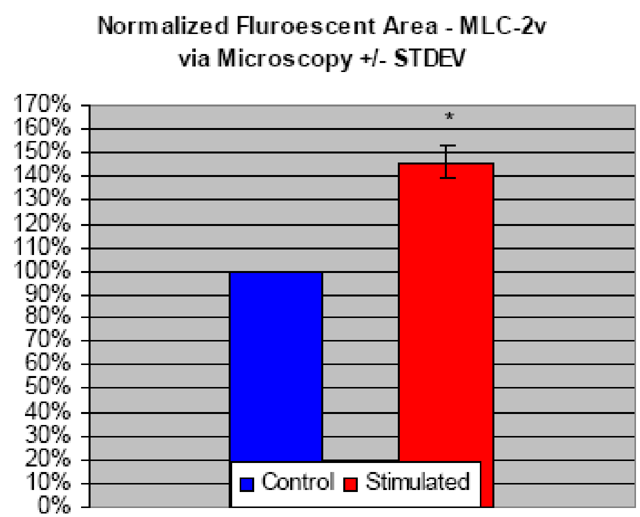


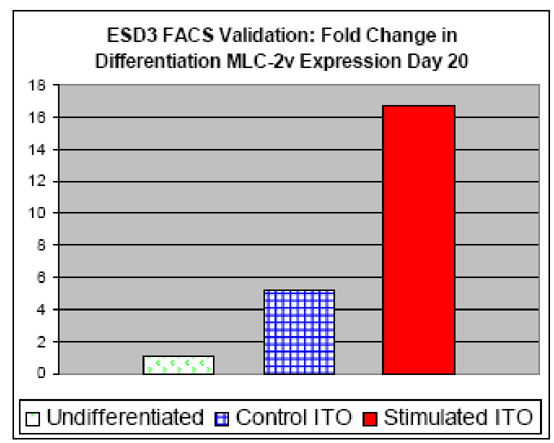


Control Condition 3 = 2+4



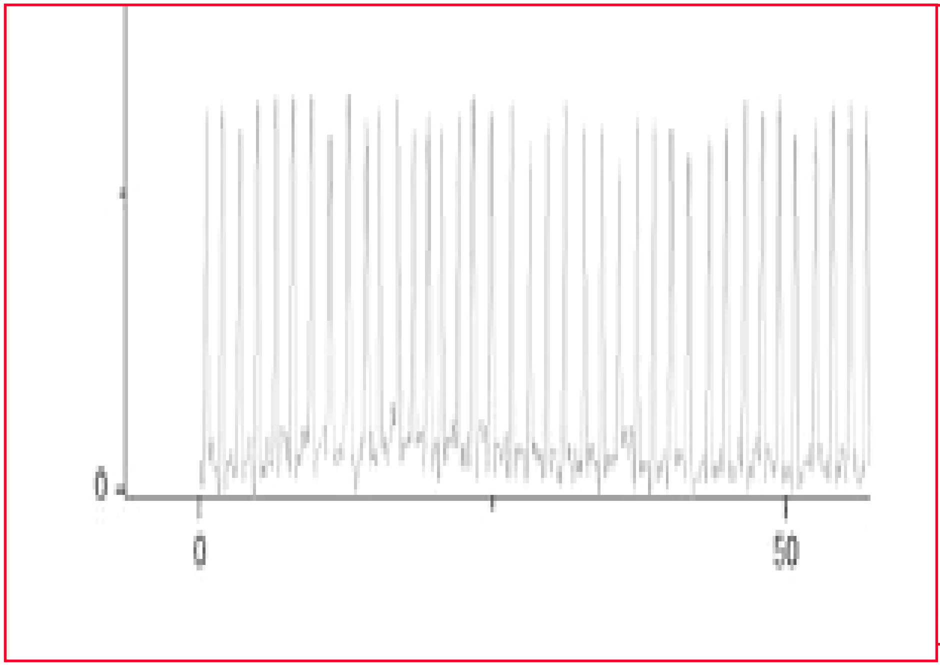
Stimulated Condition 3 = 2+4

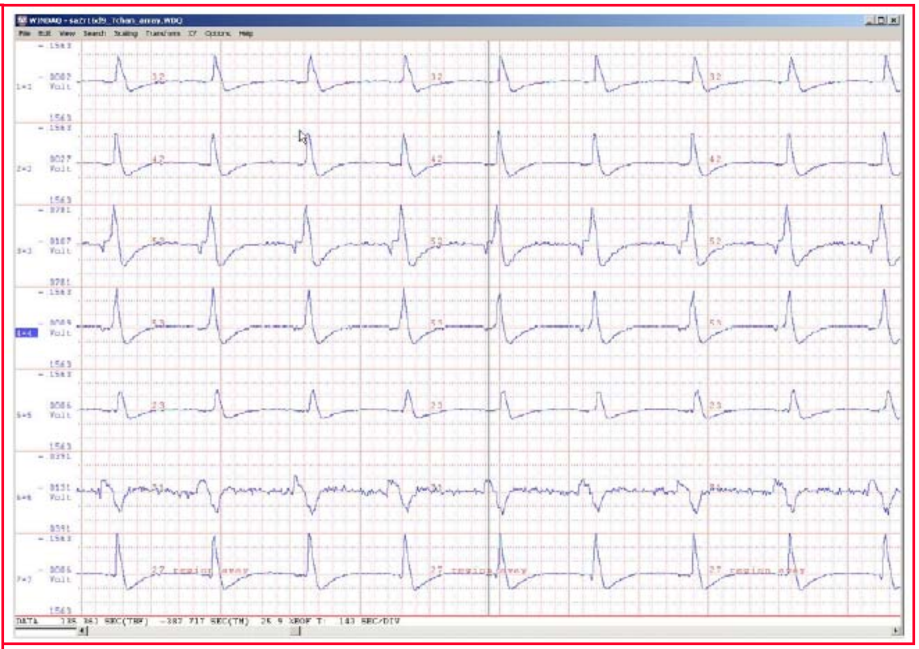




- **Top panel: Embryoid body growing on nonstimulated control ITO.**
- **Lower panel: Embryoid body growing on stimulated control ITO.**
- **Note the increase in <u>red area</u>.**

Spontaneous Contractility / Electrical Activity in mES – Derived Myocardiac Constructs





Optical recording

multiple electrical recording

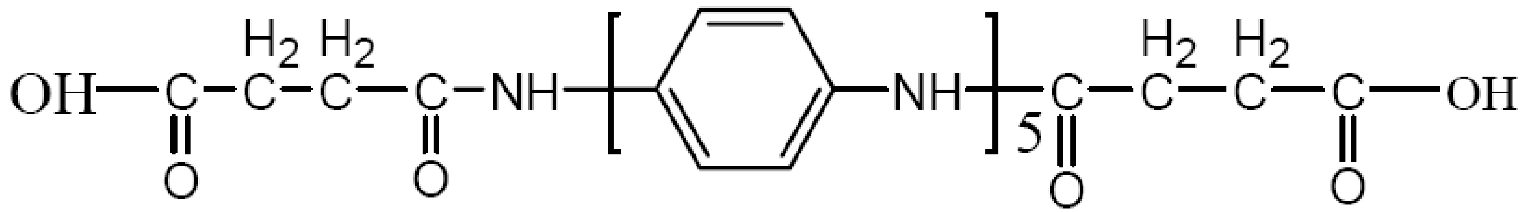
Paul R. Bidez, Alan G. MacDiarmid, Yen Wei and Peter I. Lelkes, **May, 2007**

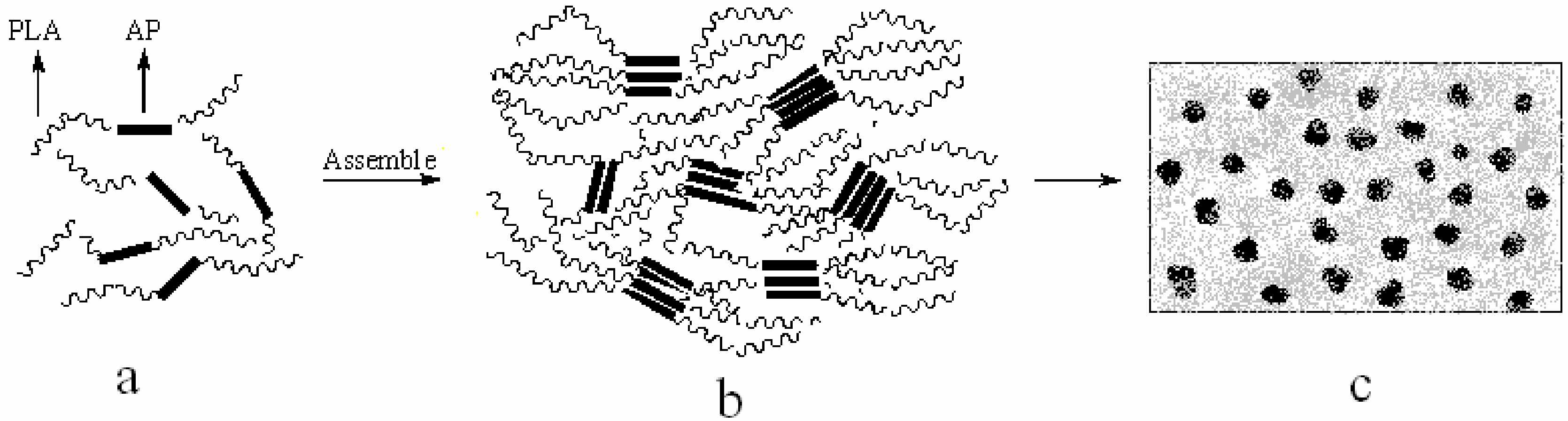
The First Biodegradable Electroactive Polymer

电活性可生物降解材料－聚乳酸与苯胺五聚体嵌段共聚物的合成与表征

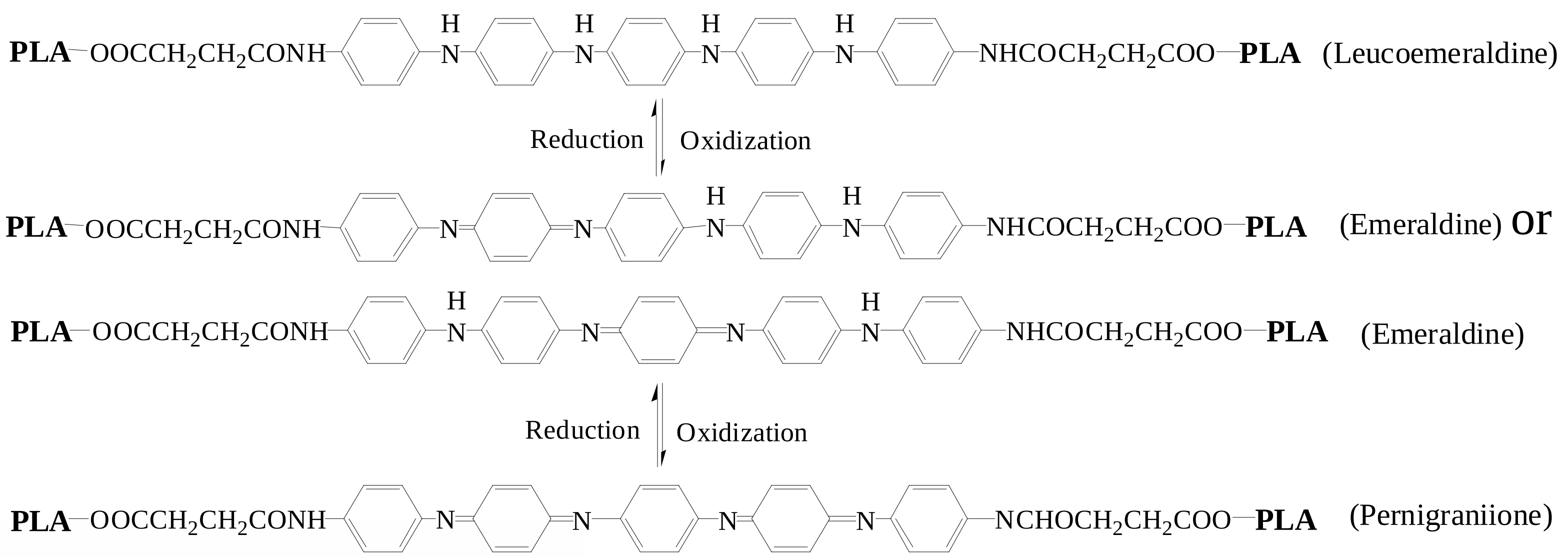
黄利红，胡军，庄秀丽，马嘉，陈学思*，景遐斌，郭毅，M. Li, P. Lelkes, 危岩*

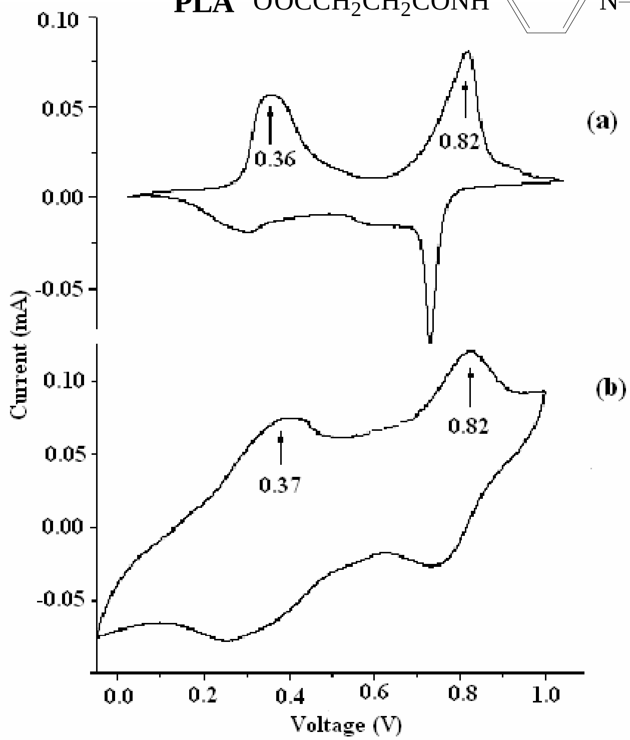
Chem J Chinese Univ, 26, 1171, **2005**. Huang et al. *Biomaterials*, 28, 1741, **2007**.

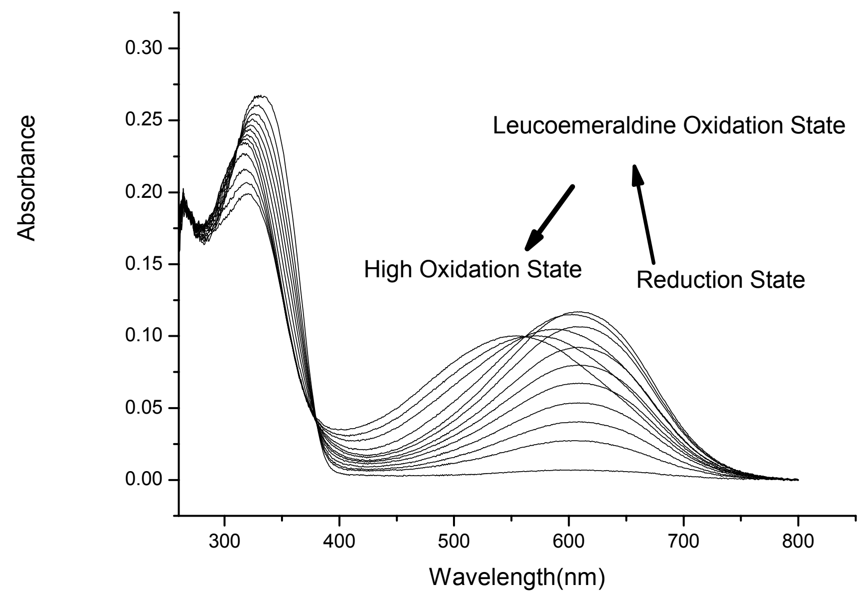




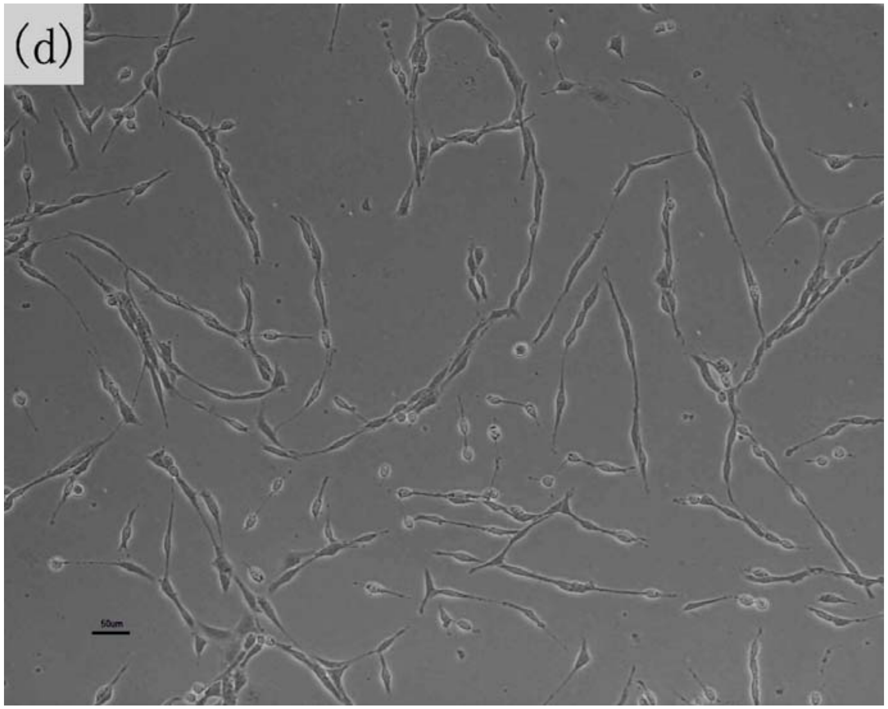
Electroactivity

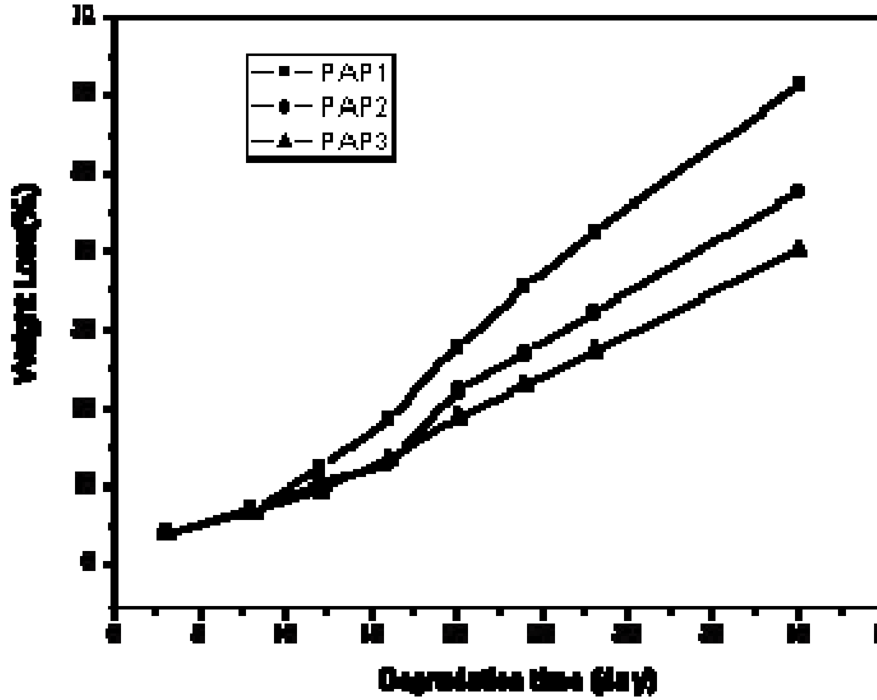






Cell Growth and Degradability





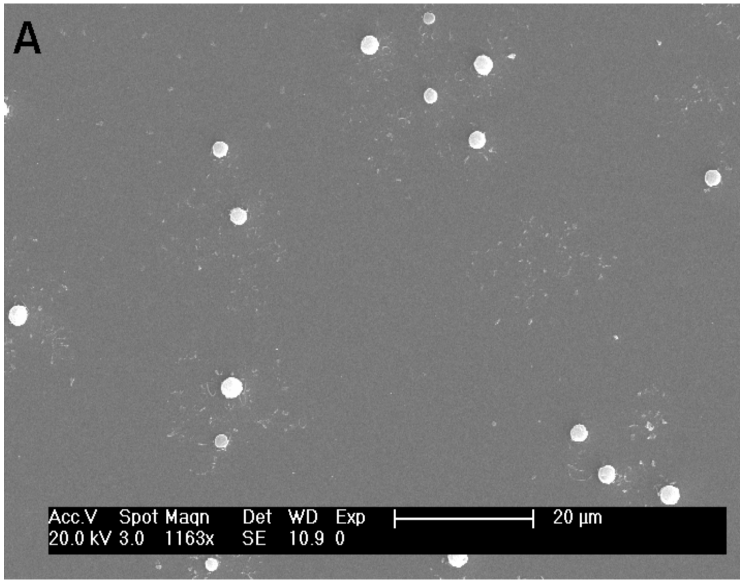
Rat C6 glioma cells on the PAP2 copolymer film. 6 days.

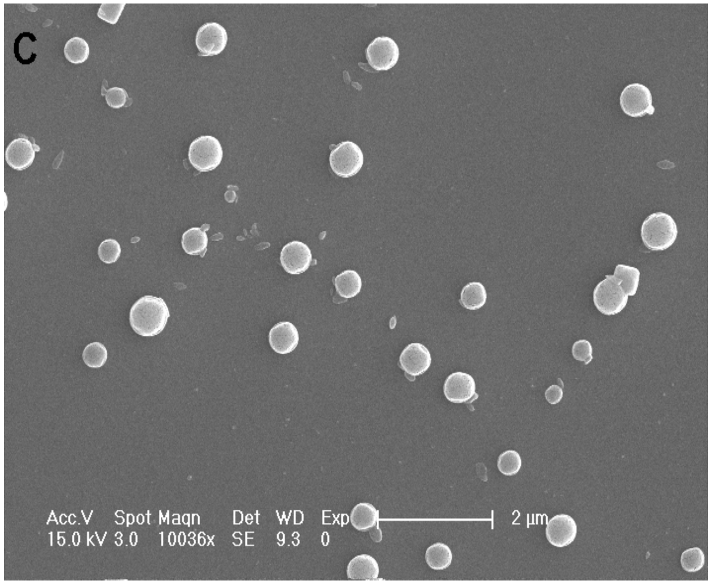
Figure 8. Degradation of the PAP copolymers. Degradation studies of PAP films (10×10×0.4 mm) were performed in PBS (pH=7.4) at 37℃.

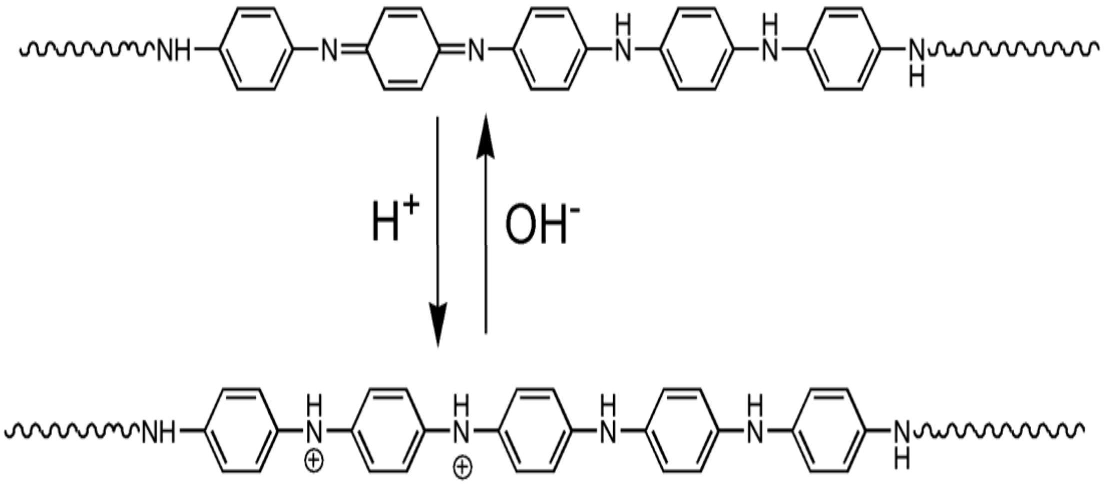
L Huang, J Hu, L Lang, X Wang, P Zhang, X Jing, X Wang, X Chen*, PI Lelkes, AG MacDiarmid, and Y Wei*, *Biomaterials*, 28(10), 1741-1751, **2007**.

Smart Assembly: Controllable "Surfactants"

The self-assembly controlled by pH or change potential.



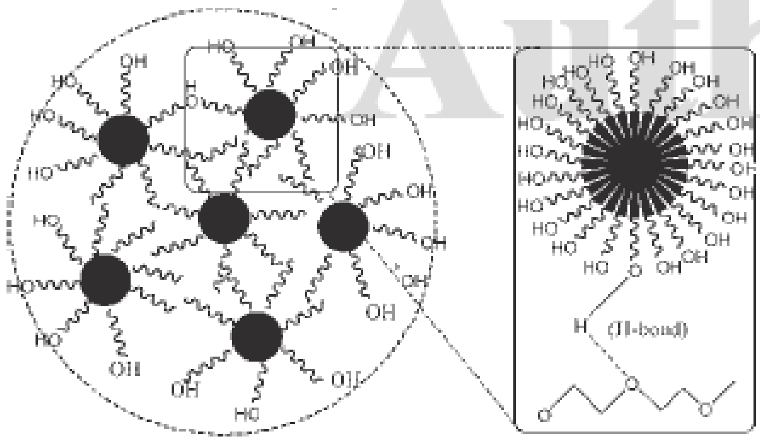




hydrophobic

$\downarrow$ H+

hydrophilic

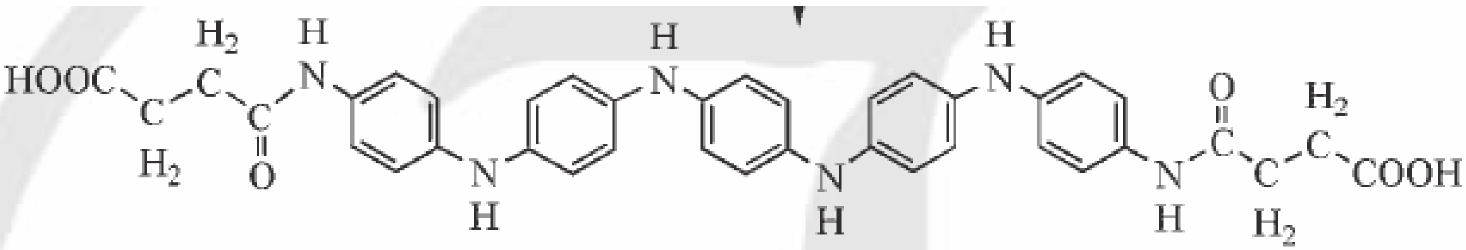


Synthesis of a Novel Electroactive ABA Triblock Copolymer and its Spontaneous Self-Assembly in Water

L. Huang, J. Hu, L. Lang, X. Chen,*
Y. Wei,* X. Jing

Macromol. Rapid Commun. **2007**, *28*, 1559-1566.

PEG-Oligoaniline-PEG: The first electrochemically switchable surfactants.



(LM AP)

$$\text{LM AP} + \text{2PEG(1500)} \xrightarrow[\text{NMP}]{\text{DCC,DMAP}} \underset{\text{(LM PAP)}}{\text{LM PEG-AP-PEG}} \xrightarrow{\text{HCl/O}_2} \underset{\text{(EM PAP)}}{\text{EM PEG-AP-PEG}}$$

PEG-Oligoaniline-PEG elctroactive polymer:
Self-assembly controlled by electrochemical potential or pH.

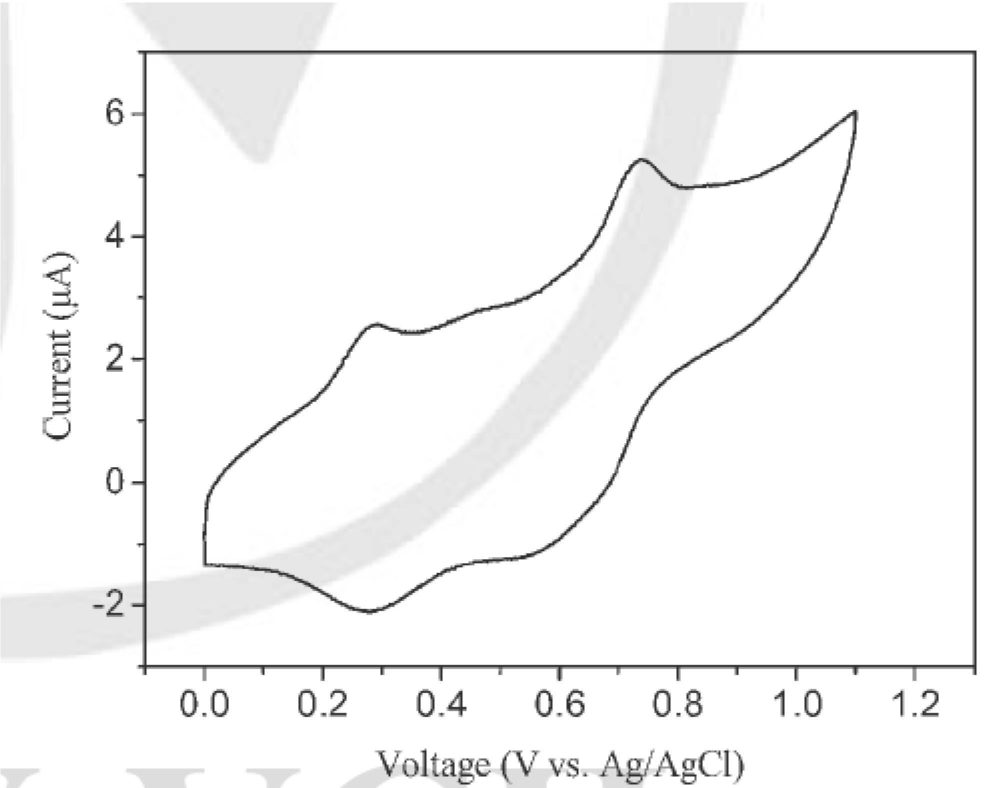
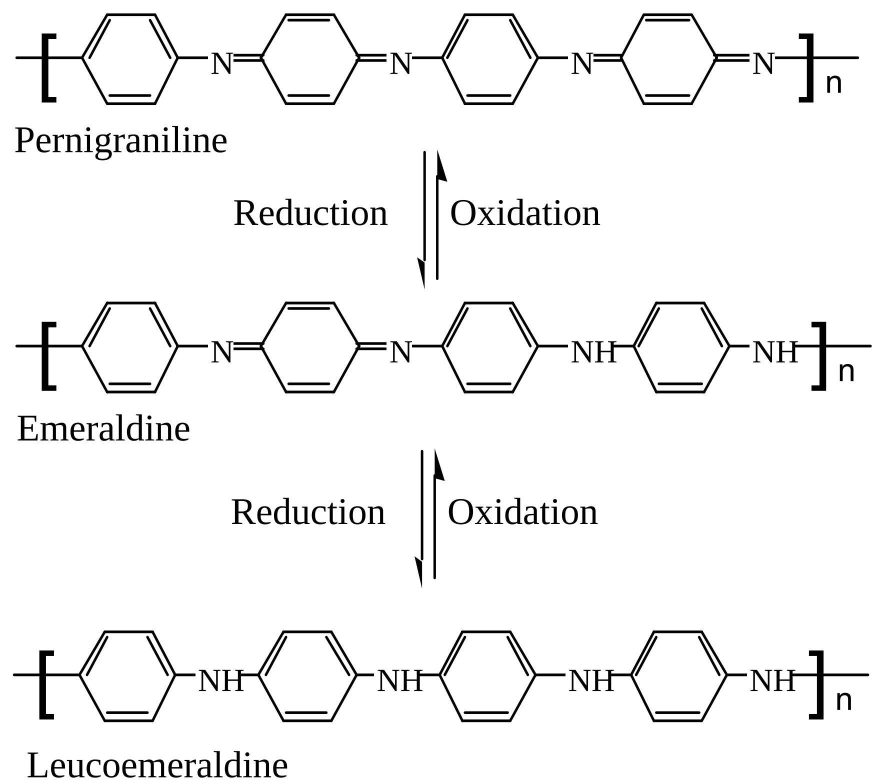
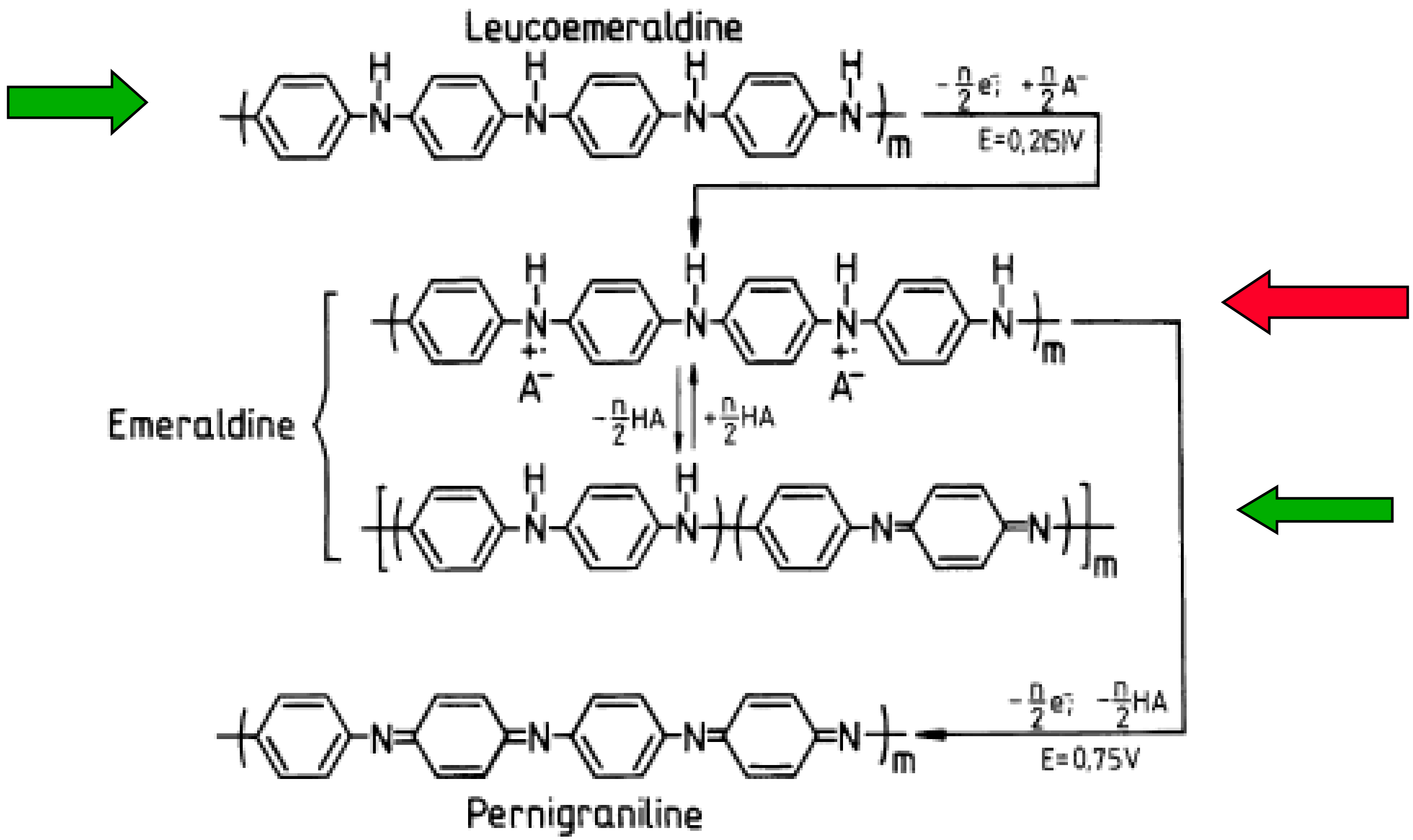


Figure 4. Cyclic voltammetry of the PAP copolymer obtained in 1.0 M HCl aqueous solution using Ag/AgCl as the reference electrode at a scan rate of 50 $mV \cdot s^{-1}$.



PEG-Oligoaniline-PEG polymer:

Hydrophobic oligoaniline becomes hydrophilic upon oxidation or protonation. Controllable nanostructures.



Generalized scheme of the oxidative and non-oxidative (protonic acid) doping of polyaniline: n, number of aniline units, $m = 4n$.

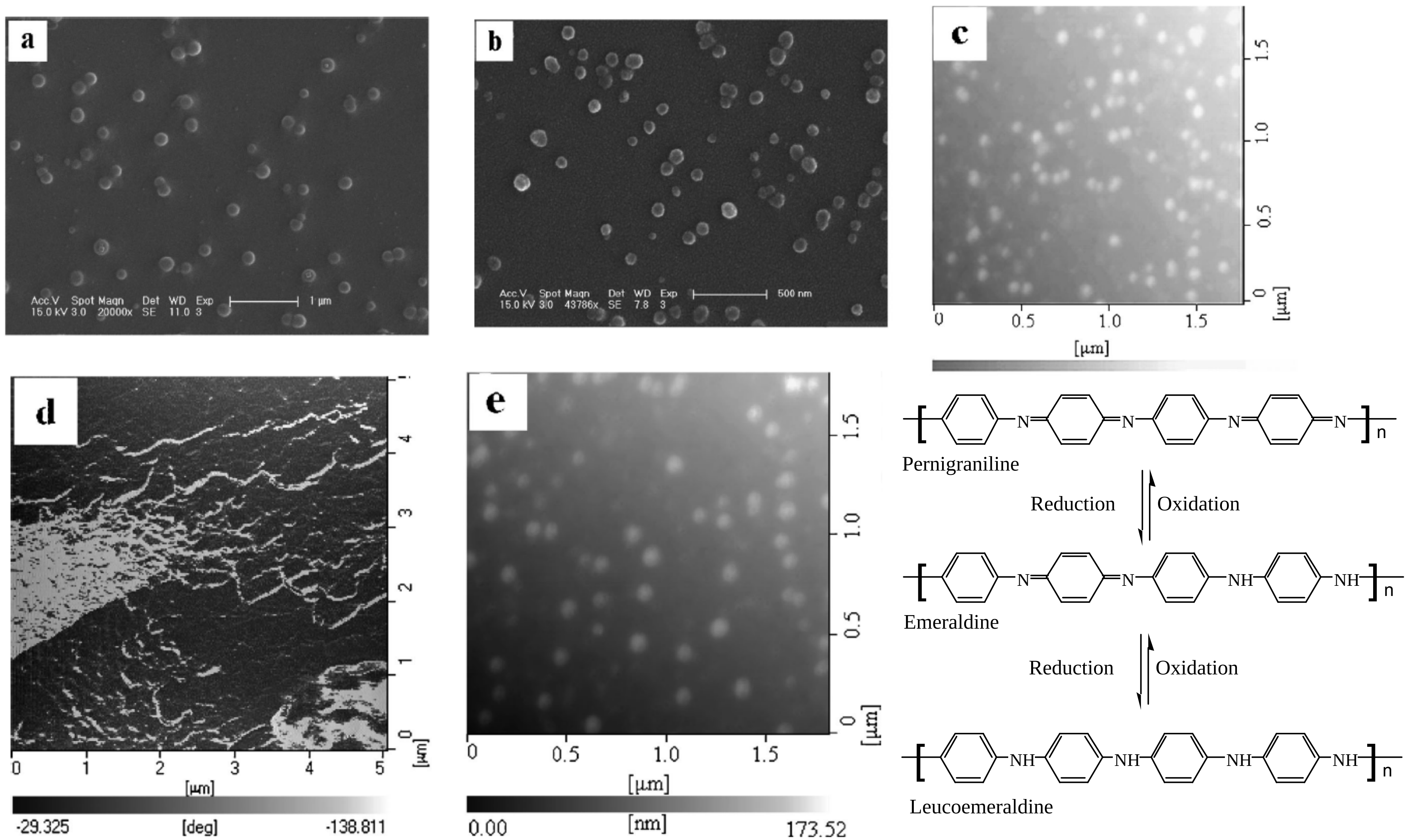
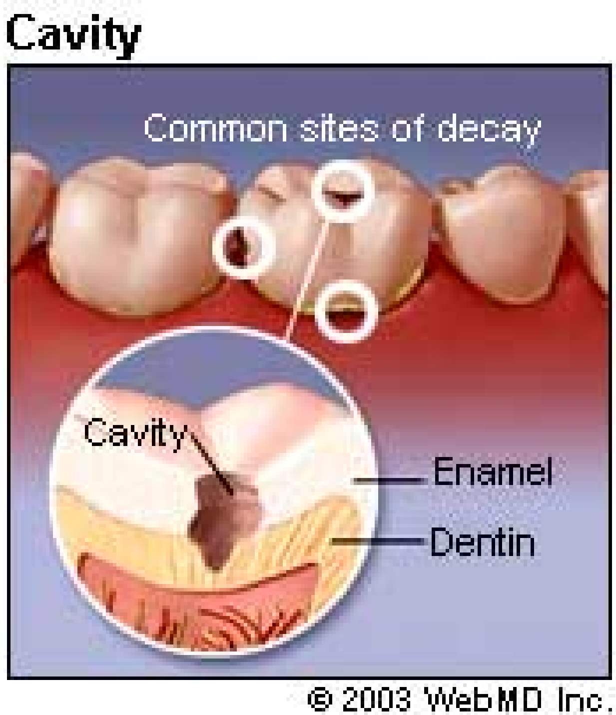
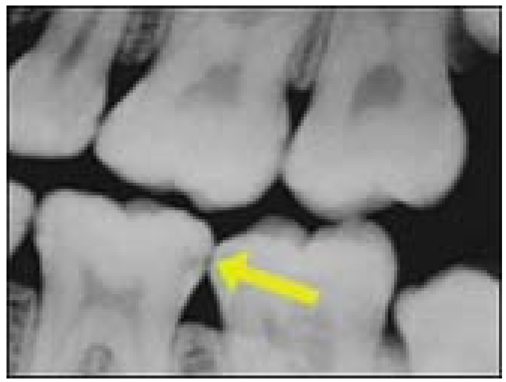


Figure 5. (a) SEM images of large, spherical aggregates of the LM PAP copolymer in water; (b) SEM image of large, spherical aggregates of the EM PAP copolymer in water; (c) AFM image of large, spherical aggregates of the EM PAP copolymer in neutral water; (d) AFM image of the EM PAP copolymer crystal salt in acid water (pH = 2.2); and (e) AFM image of large, spherical aggregates of the EM PAP copolymer in alkaline water (pH = 10.1). The concentration of all the solutions is 0.5 mg · mL^{-1}.

Implications: e.g., Smart delivery systems!

Dental cavity and restoration





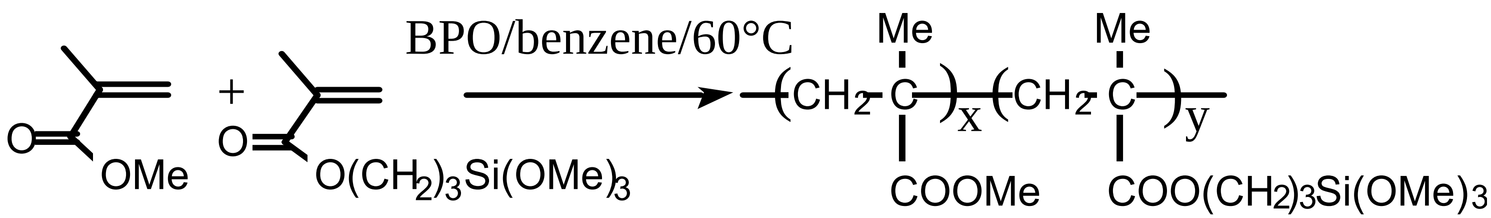
Amalgam (Hg/Ag)

Polymer composites

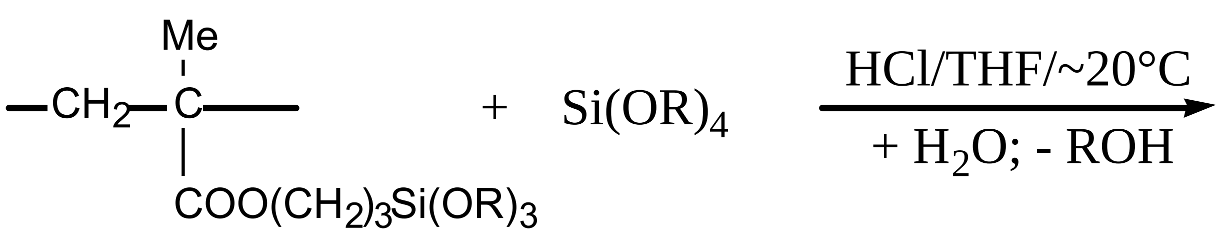
Novel Vinyl Polymer-Metal Oxide Hybrid Materials

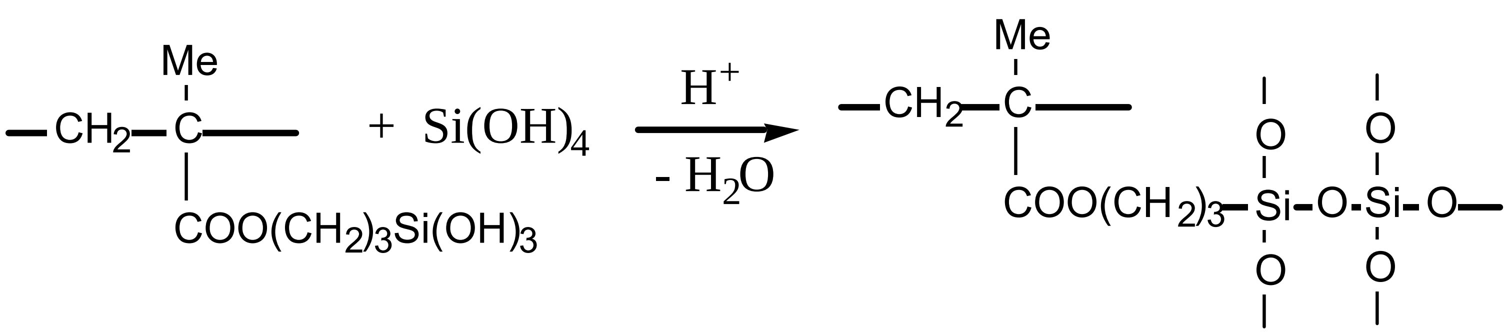
(e.g., Polyacrylics-silica hybrids)

Wei et al. *Chem. Mater*. 1990.

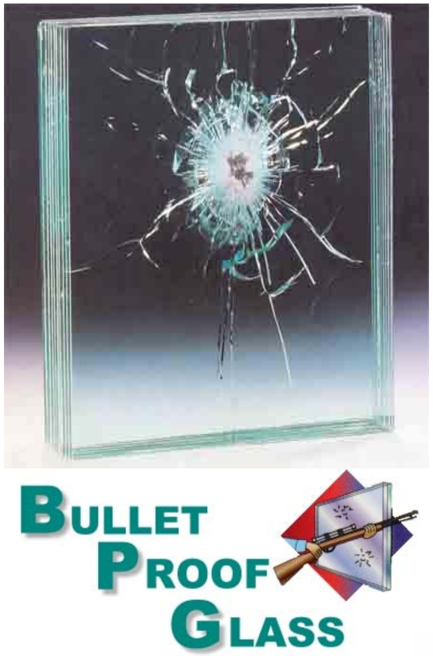


PMSMA (x=0) or PMS-MMA

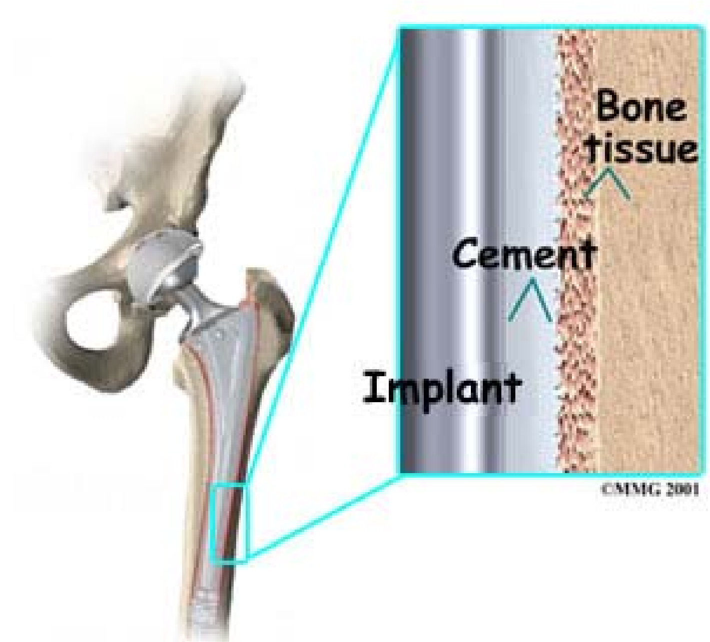




Other potential applications



Optical waveguides



Bone implants and **bone cements**
(with drug-delivery functions)

Structural composites

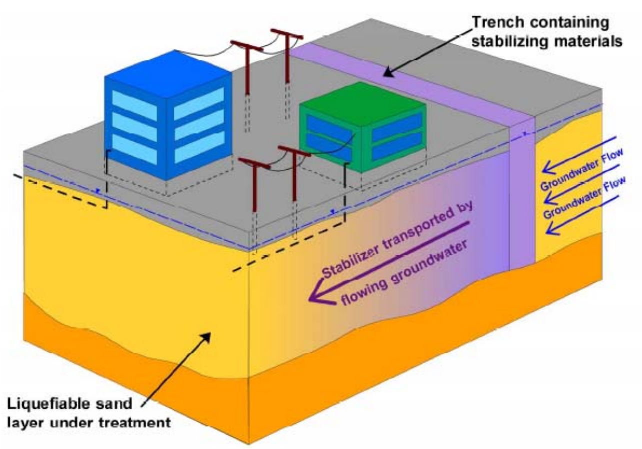
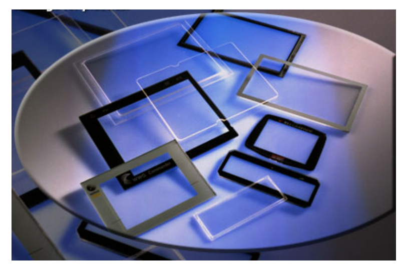


Fig. 5 Passive site remediation for mitigation of liquefaction risk.

Earthquake:
strengthen foundations



Anti-scratch hard coatings

DREXEL UNIVERSITY

Summary

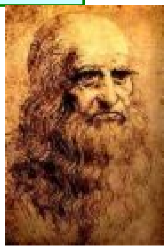
- (1) Novel electroactive nanoporous molecular sieves made. A smart "Nano"delivery system.
- (2) Nanostructured electroactive polymers for neural, cardiovascular and stem cell tissue engineering.
- (3) Biodegradable electroactive scaffold materials developed.
- (4) PEG-Oligoaniline-PEG polymer: Self-assembly controlled by electrochemical potential or pH: Another smart drug delivery systems.
- (5) Look forward: *Imagination is the only limit!*

Materials chemistry + Biology = Bright future!

Current Major Research Projects in Wei Lab

- **Electroactive and electronically conductive polymers (anticorrosion, sensors, electronics, scaffolds).**
- **Polymer chemistry: New theory of polymerization.**
- **Vinyl polymer-inorganic hybrid materials** (**dental**, optics, ballistics).
- **Supramolecular assemblies and nanostructured materials (mesoporous materials, self-assembled organics, dendrimers).**
- **Enzyme immobilization (biocatalysis, drug-delivery, biosensors**).
- **Protein folding/unfolding and rigid-matrix artificial chaperones**.
- **Tissue engineering; Neurosciences** (P. Lelkes, J. Tsien).
- **DNA modification (organic-soluble nucleic acids, etc.).**
- **Nanoscaled /molecular magnetic materials (M. Wan, Z. Yang, T. Zhao)**
- **Molecular imprinting and chiral cavities.**
- **Synthetic receptors** (antibody mimics), a**poptosis.**
- **Anti-tumor agents and gene delivery**.

An Aspiration: "Renaissance man" -"a person who has wide interests and is expert in several areas" Webster Dictionary. Or "Aspirin Scientist".



Current Wei Group in June 2007

*@Drexel University**

<u>Visiting Prof.</u>

G. Baran; X. Jia; S. Dai; R. Yin; J.H. Dong; C. Wang; X.S. Chen; L. Jiang; Y.H. Sun

<u>Res. Prof. & Res. Assoc.</u>

Prof. S. Li; Dr. S. Praveen; Dr. Zongtao Zhang

***<u>Graduate Students</u>*.**

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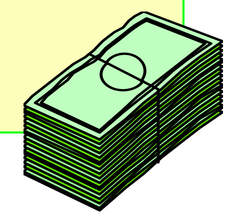

More than a dozen collaborators in USA, e.g.:

Drs. P. Lelkes, J.M. Yuan, F. Ko, A. Nath, et al. (<u>Drexel</u>)
Dr. A. MacDiarmid (<u>Penn</u>)
Drs. S. Jansen, G. Baran (<u>Temple</u>)
Drs. G. McLendon, H. Rabitz, J. Tsien, T. Spiro (<u>Princeton</u>)
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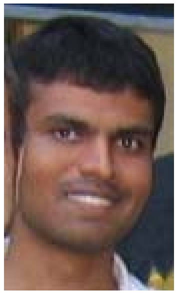
Part of Wei group at Drexel University on June 8, 2005.

PhD granted: Alpa Patel, Zhengfei Sun, Houping Yin, Man-Chien Chao.

Part of Wei group at Drexel Univ. on May 15, 2006 when **Kate Ong** passed her PhD defense; Later **Mike Ellzy** (my "honorary student") also passed defense on May 30, 2006.

Wei group meeting at Drexel, 2:00-11:50 pm, May 18, 2007.



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NASA Atlantis Sept. 2006 mission.

Thank you!

Drexel Law School, est. 2006