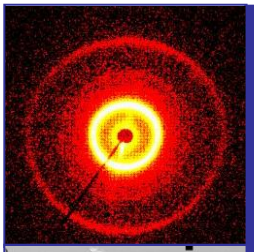
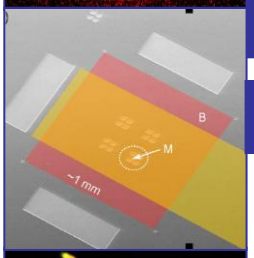
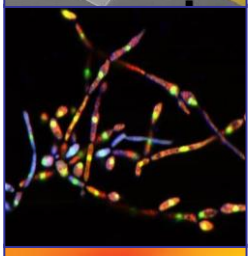
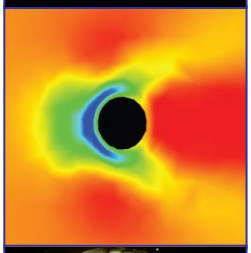
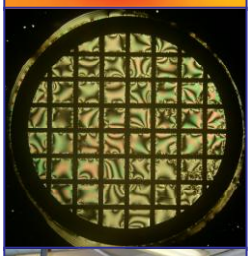
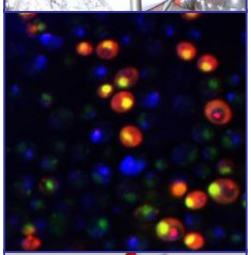
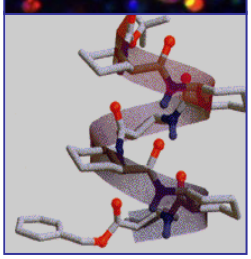



UWAMIC NEWSLETTER

Spring 2011, Volume 5, Issue 1

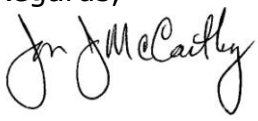
A Message from the Director

Welcome to the Spring 2011 UWAMIC Newsletter!

Dear Members,

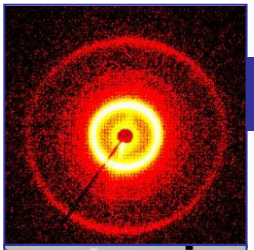
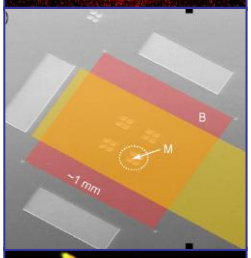
[MESSAGE FROM JON]

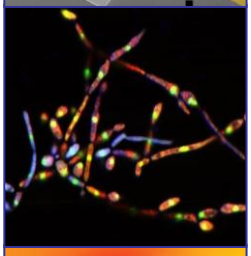
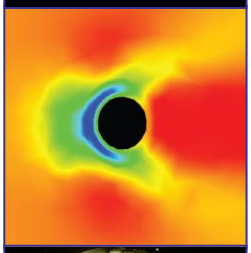
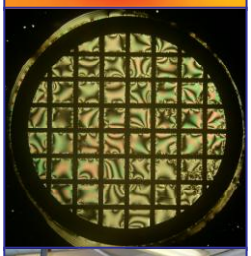
Regards,

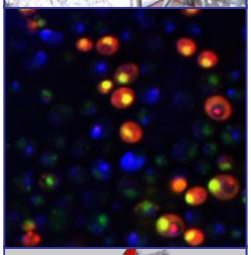
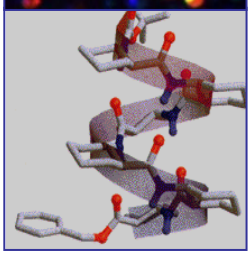


UWAMIC Co-Director, Development

Email:uwamic@mailplus.wisc.edu•Phone:(608)262-0112•Fax:(608)265-4036

UWAMIC in the News

Martin Zanni Wins Innovation Prize

University of Wisconsin-Madison Meloche-Bascom Professor of Chemistry **Martin Zanni** is being honored for contributions to the advancement of science within his laboratory and beyond.

In January, the National Academy of Sciences named Zanni the winner of the 2011 Award for Initiatives in Research, which "recognizes innovative young scientists and encourages research likely to lead toward new capabilities for human benefit," according to Zanni's citation.

The academy pointed out Zanni's "revolutionary advances in multidimensional spectroscopies, which are enabling discoveries in biological, medical and condensed matter chemical systems," in its award announcement.

Zanni has developed methods for studying the movement and development of complex molecules. His UW-Madison lab has applied the technology to diabetes research — for which he recently won a Presidential Early Career Award for Scientists and Engineers from the White House Office of Science and Technology — but it has spread to other fields as well.

To read more, visit: http://www.news.wisc.edu/18945

Embryonic Stem Cell Culturing Grows from Art to Science

Growing human embryonic stem cells in the lab is no small feat. Culturing the finicky, shape-shifting cells is labor intensive and, in some ways, more art than exact science.

Now, however, a team of researchers at the University of Wisconsin-Madison reports the development of a fully defined culture system that promises a more uniform and, for cells destined for therapy, safer product.

In the journal Nature Methods, a team led by UW-Madison Professor of Chemistry **Laura Kiessling** unveiled an inexpensive system that takes much of the guess work out of culturing the all-purpose cells.

"It's a technology that anyone can use," says Kiessling. "It's very simple."

The new culture system utilizes a synthetic, chemically made substrate of protein fragments, peptides, which have an affinity for binding with stem cells. Used in combination with a defined growth medium, the system devised by the Wisconsin team can culture cells in their undifferentiated states for up to three months and possibly longer. The system, according to the new report, also works for induced pluripotent stem cells, the adult cells genetically reprogrammed to behave like embryonic stem cells.

To read more, visit: http://www.news.wisc.edu/18664

New Technology Could Stamp Out Bacteria in Persistent Wounds

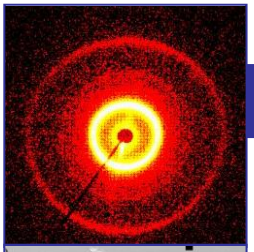
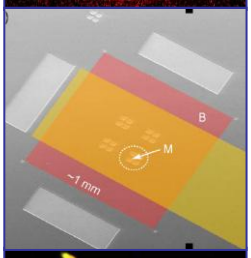
Using an advanced form of a rubber stamp, researchers have developed a way to adhere an ultra-thin antibacterial coating to a wound.

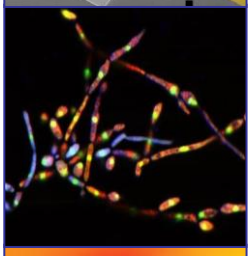
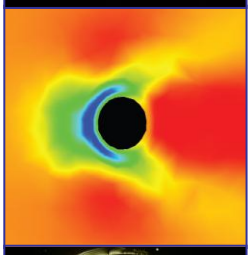
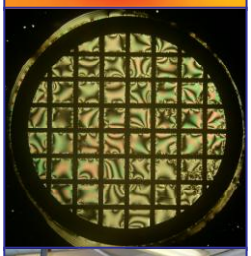
The active ingredient, silver, "has been used to prevent and treat infections for ages," says first author Ankit Agarwal, a postdoctoral fellow in chemical and biological engineering at the University of Wisconsin-Madison. "But silver can also kill skin cells, and therefore we need to develop materials that deliver antibacterial but nontoxic levels of silver to wounds."

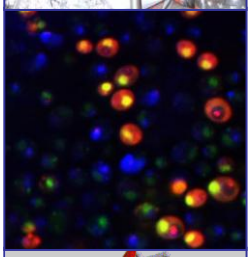
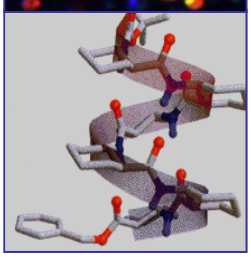
In a study just published in the journal Advanced Functional Materials, Agarwal, chemical and biological engineering professor **Nicholas Abbott**, and colleagues described a process for creating a transparent ultra-thin polymer coating carrying precise loads of extremely fine silver nanoparticles. The coating, just a few molecules thick, was assembled on a flexible piece of rubber and then rubber-stamped onto a piece of cadaver skin that simulated a wound in the experiment.

To test the activity against bacteria, the researchers treated skin samples with two bacteria that commonly infect wounds. Using a silver dosage that had not harmed skin cells in previous tests, the bacteria were undetectable within 12 hours, Agarwal says.

To read more, visit: http://www.news.wisc.edu/19204

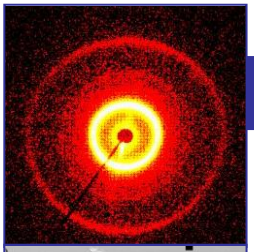
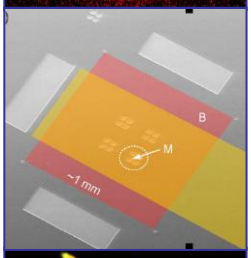




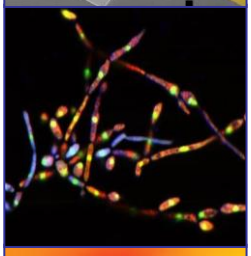
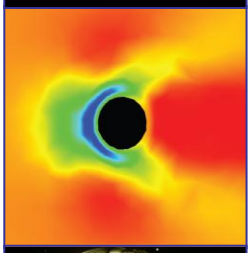
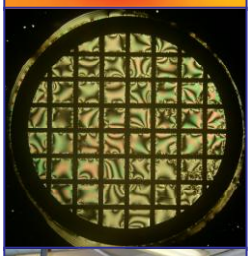



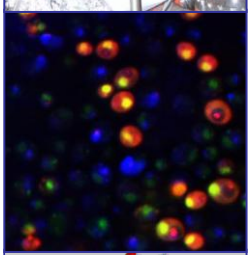
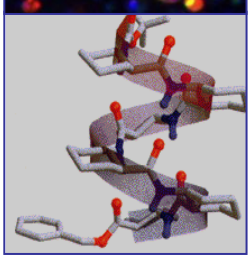
Instrumentation News

[GET FROM JON]

Email:uwamic@mailplus.wisc.edu•Phone:(608)262-0112•Fax:(608)265-4036

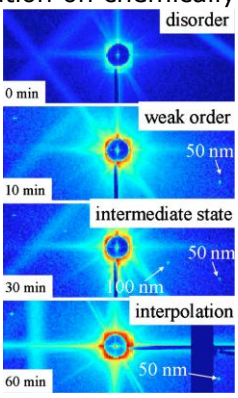
Recent Publications

Mechanism and Dynamics of Block Copolymer Directed Assembly with Density Multiplication on Chemically Patterned Surfaces

G.L. Liu, S. P. Delcambre, K. O. Stuen, G. S. W. Craig, J. J. de Pablo, P. F. Nealey, K. Nygard, D. K. Satapathy, O. Bunk, H. H. Solak

Journal of Vacuum Science & Technology B **28** (6), C6B13-C6B19 (2010)

Abstract: In this work, we used scanning electron microscopy (SEM), in situ coherent small angle x-ray scattering (SAXS), and Monte Carlo molecular simulation to gain insights into the dynamics of block copolymer directed assembly with density multiplication on chemically patterned surfaces. During directed assembly, it was observed with SEM that poly(styrene-block-methyl methacrylate) initially formed discrete polystyrene domains that lacked long-range order at the free surface. After further annealing, the polystyrene domains gradually coalesced into linear domains that were not registered fully with the underlying chemical pattern. The linear domains could be trapped in metastable morphologies. Finally, the linear polystyrene domains formed perpendicular lamellae in full registration with the underlying chemical pattern. It was revealed with SAXS that scattering peaks characteristic of the period of the chemical pattern appeared and disappeared at the early stages of assembly. Finally, the morphological evolution of directed assembly of block copolymer on chemically patterned surfaces was modeled by molecular simulations.



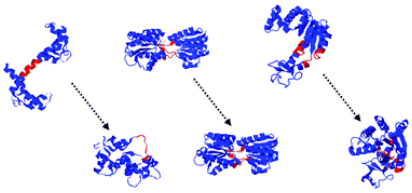
http://avspublications.org/jvstb/resource/1/jvtbd9/v28/i6/pC6B13_s1

Emerging Area: Biomaterials that Mimic and Exploit Protein Motion

W. L. Murphy

Soft Matter **7** (8), 3679-3688 (2011)

Abstract: Traditional dynamic hydrogels have been designed to respond to changes in physicochemical inputs, such as pH and temperature, for a wide range of biomedical applications. An emerging strategy that may allow for more specific "bio-responsiveness" in synthetic hydrogels involves mimicking or exploiting nature's dynamic proteins. Hundreds of proteins are known to undergo pronounced conformational changes in response to specific biochemical triggers, and these responses represent a potentially attractive toolkit for design of dynamic materials. This "emerging area" review focuses on the use of protein motions as a new paradigm for design of dynamic hydrogels. In particular, the review emphasizes early examples of dynamic hydrogels that harness well-known protein motions. These examples then serve as templates to discuss challenges and suggest emerging directions in the field. Successful early examples of this approach, coupled with the fundamental properties of nature's protein motions, suggest that protein-based materials may ultimately achieve specific, multiplexed responses to a range of biochemical triggers. Applications of this new class of materials include drug delivery, biosensing, bioactuation, and tissue engineering.



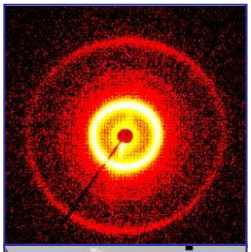
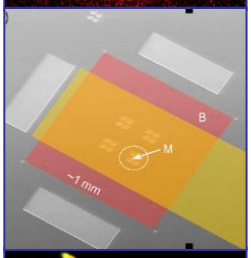
http://pubs.rsc.org/en/Content/ArticleLanding/2011/SM/C0SM01351J

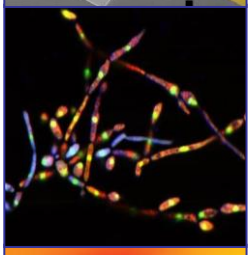
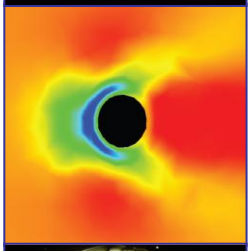
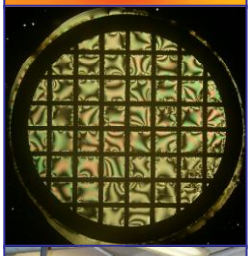
Ordering Transitions in Nematic Liquid Crystals Induced by Vesicles Captured through Ligand-Receptor Interactions

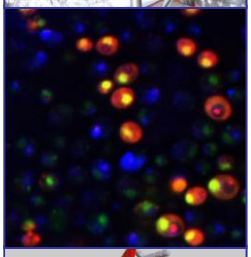
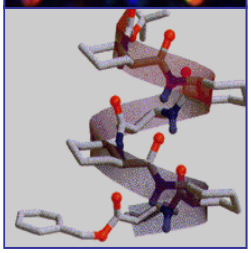
L. N. Tan, P. J. Bertics, N. L. Abbott

Langmuir **27** (4), 1419-1429 (2011)

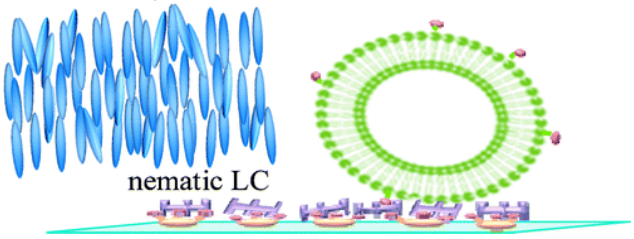
Abstract: We report that phospholipid vesicles incorporating ligands, when captured from solution onto surfaces presenting receptors for these ligands, can trigger surface-induced orientational ordering transitions in nematic phases of 4'-pentyl-4-cyanobiphenyl (5CB). Specifically, whereas avidin-functionalized surfaces incubated against vesicles composed of 1,2-dioleoyl-*sn*-glycero-3-phosphocholine (DOPC) were observed to cause the liquid crystal

(LC) to adopt a parallel orientation at the surface, the same surfaces incubated against biotinylated vesicles (DOPC and 1,2-dioleoyl-*sn*-glycero-3-phosphoethanolamine-*N*-(biotinyl) (biotin-DOPE)) caused the homeotropic (perpendicular) ordering of the LC. The use of a combination of atomic force microscopy (AFM), ellipsometry and quantitative fluorimetry, performed as a function of vesicle composition and vesicle concentration in solution, revealed the capture of intact vesicles containing 1% biotin-DOPE from buffer at the avidin-functionalized surfaces. Subsequent exposure to water prior to contact with the LC, however, resulted in the rupture of the majority of vesicles into interfacial multilayer assemblies with a maximum phospholipid loading set by random close packing of the intact vesicles initially captured on the surface (5.1 ± 0.2 phospholipid molecules/nm^2). At high concentrations of biotinylated lipid (>10% biotin-DOPE) in the vesicles, the limiting lipid loading was measured to be 4.0 ± 0.3 phospholipid molecules/nm^2, consistent with the maximum phospholipid loading set by the spontaneous formation of a bilayer during incubation with the biotinylated vesicles. We measured the homeotropic ordering of the LC on the surfaces independently of the initial morphology of the phospholipid assembly captured on the surface (intact vesicle, planar multilayer). We interpret this result to infer the reorganization of the phospholipid bilayers either prior to or upon contact with the LCs such that interactions of the acyl chains of the phospholipid and the LC dominate the ordering of the LC, a conclusion that is further supported by quantitative measurements of the orientation of the LC as a function of the phospholipid surface density (>1.8 molecules/nm^2 is required to cause the homeotropic ordering of the LC). These results and others presented herein provide fundamental insights into the interactions of phospholipid-decorated interfaces with LCs and thereby provide guidance for the design of surfaces on which phospholipid assemblies captured through ligand−receptor recognition can be reported via ordering transitions in LCs.



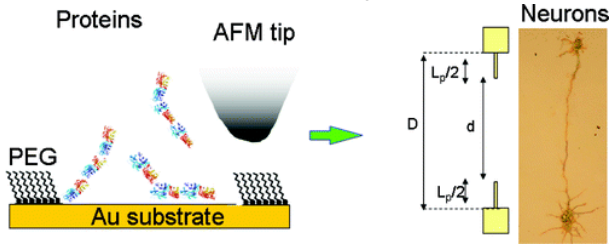
http://pubs.acs.org/doi/abs/10.1021/la103975s

Distance Dependence of Neuronal Growth on Nanopatterned Gold Surfaces

C. Staii, C. Viesselmann, J. Ballweg, J. C. Williams, E. W. Dent, S. N. Coppersmith, M. A. Eriksson

Langmuir **27** (1), 233-239 (2011)

Abstract: Understanding network development in the brain is of tremendous fundamental importance, but it is immensely challenging because of the complexity of both its architecture and function. The mechanisms of axonal navigation to target regions and the specific interactions with guidance factors such as membrane-bound proteins, chemical gradients, mechanical guidance cues, etc., are largely unknown. A current limitation for the study of neural network formation is the ability to control precisely the connectivity of small groups of neurons. A first step in designing such networks is to understand the "rules" central nervous system (CNS) neurons use to form functional connections with one another. Here we begin to delineate novel rules for growth and connectivity of small numbers of neurons patterned on Au substrates in simplified geometries. These studies yield new insights into the mechanisms determining the organizational features present in intact systems. We use a previously reported atomic force microscopy (AFM) nanolithography method to control precisely the location and growth of neurons on these surfaces. By examining a series of systems with different geometrical parameters, we quantitatively and systematically analyze how neuronal growth depends on these parameters.



http://pubs.acs.org/doi/abs/10.1021/la102331x