

28 May 2009

This supplement has been prepared to present scientific and technical news items that may be of more interest to technical personnel at RDT&E activities and the labs, or the medics rather than the broader readership of the basic CB Daily. Due to the nature of the material, the articles, if available online, are usually only available through subscription services thus making specific links generally unavailable. Thus, usually only the bibliographic citation is available for use by an activity's technical library.

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Chem-Bio News – S&T Edition

1. INTRINSIC THERMAL SENSING CONTROLS PROTEOLYSIS OF YERSINIA VIRULENCE

REGULATOR RovA: *"Our results establish RovA as an intrinsic temperature-sensing protein in which thermally induced conformational changes interfere with DNA-binding capacity, and secondarily render RovA susceptible to proteolytic degradation."*

2. INSTANT INSIGHT: AGENTS OF DESTRUCTION: *"To kill microbes on contact, scientists have developed two new coatings. Both use light to activate materials within them."*

3. DEVELOPMENT AND EVALUATION OF TWO SIMPLE, RAPID IMMUNOCHROMATOGRAPHIC TESTS FOR THE DETECTION OF YERSINIA PESTIS ANTIBODIES IN HUMANS AND

RESERVOIRS: *"The SIgT test is of importance for surveillance because it can detect Ig antibodies in a range of reservoir species. The HIgM test could facilitate the diagnosis of plague during outbreaks, particularly when only a single serum sample is available."*

4. SCIENTISTS UNLOCK MYSTERY OF POTENTIALLY FATAL REACTION TO SMALLPOX

VACCINE: *"The La Jolla Institute's Toshiaki and Yuko Kawakami, M.D.s, Ph.D.s., a husband and wife scientific team, led the research group which found that activity levels of Natural Killer (NK) cells played a pivotal role in the development of eczema vaccinatum in the mice."*

5. BIRD FLU VIRUS REMAINS INFECTIOUS UP TO 600 DAYS IN MUNICIPAL LANDFILLS:

"Amid concerns about a pandemic of swine flu, researchers from Nebraska report for the first time that poultry carcasses infected with another threat – the 'bird flu' virus – can remain infectious in municipal landfills for almost 2 years."

6. DEAD OR ALIVE - NANOTECHNOLOGY TECHNIQUE TELLS THE DIFFERENCE: *"A major concern in microbiology is to determine whether a bacterium is dead or alive."*

CB Daily Report

Chem-Bio News

INTRINSIC THERMAL SENSING CONTROLS PROTEOLYSIS OF YERSINIA VIRULENCE

REGULATOR RovA

By Katharina Herbst, Matthias Bujara, Ann Kathrin Heroven, Wiebke Opitz, Martin Weichert, Ariane Zimmermann, Petra Dersch

PLos Pathogens

May 15, 2009

"Temperature is one of the most crucial environmental signals sensed by pathogens to adjust expression of their virulence factors and host survival programs after entry from a cold external environment into a warm-blooded host. Thermo-induced structural changes in bent or supercoiled DNA or mRNA secondary structures are frequently used to modulate virulence gene transcription or translation. Here we introduce a unique alternative mechanism, in which a central regulator of Yersinia

virulence (RovA) uses an in-built thermosensor to control its activity in order to modulate virulence gene expression. According to our results, small thermo-induced structural alterations reduce the DNA-binding capacity of the virulence regulator and render the protein more susceptible to proteolytic degradation by ATP-dependent proteases. Amino acids in the vicinity of the DNA-binding region appear to comprise the information required for proteolysis. We therefore postulate a model in which proteolytic degradation is in direct competition with the thermo-sensitive DNA-binding function of the regulator. This regulatory concept constitutes a new example of how microbial pathogens are able to rapidly adjust virulence-associated processes in the course of an infection.”

The full article can be found at: <http://www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1000435;jsessionid=63D357A0BA3433DF8331A2F85CFA918E>
[Return to Top](#)

INSTANT INSIGHT: AGENTS OF DESTRUCTION

Chemical Science
May 20, 2009

“MRSA (methicillin-resistant *Staphylococcus aureus*), *Clostridium difficile*, *Acinetobacter* and *Enterococcus* species - these microorganisms are now virtually household names, and with good reason. The organisms are responsible for hospital-acquired infections that lead to over 5000 deaths in the UK alone each year. They are an enormous burden on the healthcare system - around 10 per cent of admitted hospital patients in the UK develop an infection.”

“To kill microbes on contact, scientists have developed two new coatings. Both use light to activate materials within them. The first is a hard ceramic based on titanium dioxide. When sunlight is focused on the surface, it generates reactive radical species that kill the microbes. The second is a soft polymer containing light-activated antimicrobial agents. The advantage of these light-activated coatings is that they kill microbes rapidly and are very effective with any form of visible light - including indoor lighting. Also, as these new coatings can kill microbes by many pathways using reactive oxygen species as the agents of destruction, it is unlikely that microbes will be able to develop resistance.

Surprisingly, going back to more traditional methods could also be very effective. Since the 1980s, it's been known that copper is toxic to microbes. Clinical trials revealed that brass, a copper-based metal, reduced microbes in a test against stainless steel. Despite its hygienic image and widespread use in hospitals, the stainless steel had no antimicrobial activity. So an act as simple as replacing stainless steel fixtures and fittings in hospitals, such as push plates on doors, with brass ones could have an effect.”

The full article can be found at:
http://www.rsc.org/Publishing/ChemScience/Volume/2009/06/Destroying_agents.asp

The original article can be found at: <http://www.rsc.org/Publishing/Journals/JM/article.asp?doi=b818698g>
[Return to Top](#)

DEVELOPMENT AND EVALUATION OF TWO SIMPLE, RAPID IMMUNOCHROMATOGRAPHIC TESTS FOR THE DETECTION OF YERSINIA PESTIS ANTIBODIES IN HUMANS AND RESERVOIRS

By Minoarisoa Rajerison, Sylvie Dartevelle, Lalao A. Ralafiarisoa, Idir Bitam, Dinh Thi Ngoc Tuyet, Voahangy Andrianaivoarimanana, Faridabano Nato, Lila Rahalison
PloS Neglected Tropical Diseases
April 28, 2009

“Background: Tools for plague diagnosis and surveillance are not always available and affordable in most of the countries affected by the disease. *Yersinia pestis* isolation for confirmation is time-

consuming and difficult to perform under field conditions. Serologic tests like ELISA require specific equipments not always available in developing countries. In addition to the existing rapid test for antigen detection, a rapid serodiagnostic assay may be useful for plague control.

Methods/Principal Findings: We developed two rapid immunochromatography-based tests for the detection of antibodies directed against F1 antigen of *Y. pestis*. The first test, SIgT, which detects total Ig (IgT) anti-F1 in several species (S) (human and reservoirs), was developed in order to have for the field use an alternative method to ELISA. The performance of the SIgT test was evaluated with samples from humans and animals for which ELISA was used to determine the presumptive diagnosis of plague. SIgT test detected anti-F1 Ig antibodies in humans with a sensitivity of 84.6% (95% CI: 0.76–0.94) and a specificity of 98% (95% CI: 0.96–1). In evaluation of samples from rodents and other small mammals, the SIgT test had a sensitivity of 87.8% (95% CI: 0.80–0.94) and a specificity of 90.3% (95% CI: 0.86–0.93). Improved performance was obtained with samples from dogs, a sentinel animal, with a sensitivity of 93% (95% CI: 0.82–1) and a specificity of 98% (95% CI: 0.95–1.01). The second test, HIgM, which detects human (H) IgM anti-F1, was developed in order to have another method for plague diagnosis. Its sensitivity was 83% (95% CI: 0.75–0.90) and its specificity about 100%.

Conclusion/Significance: The SIgT test is of importance for surveillance because it can detect Ig antibodies in a range of reservoir species. The HIgM test could facilitate the diagnosis of plague during outbreaks, particularly when only a single serum sample is available.”

The full article can be found at:

<http://www.plosntds.org/article/info:doi/10.1371/journal.pntd.0000421>

[Return to Top](#)

SCIENTISTS UNLOCK MYSTERY OF POTENTIALLY FATAL REACTION TO SMALLPOX VACCINE

Physorg.com

May 25, 2009

“Researchers from the La Jolla Institute for Allergy & Immunology have pinpointed the cellular defect that increases the likelihood, among eczema sufferers, of developing eczema vaccinatum, a severe and potentially fatal reaction to the smallpox vaccine. The research, conducted in mouse models, was funded under a special research network created by the National Institutes of Health in 2004. The network is working toward the development of a new smallpox vaccine that could be administered to the millions of Americans who suffer from atopic dermatitis, a chronic, itchy skin condition commonly referred to as eczema.

The La Jolla Institute's Toshiaki and Yuko Kawakami, M.D.s, Ph.D.s., a husband and wife scientific team, led the research group which found that activity levels of Natural Killer (NK) cells played a pivotal role in the development of eczema vaccinatum in the mice. The activity of the NK cells, which are disease fighting cells of the immune system, was significantly lower in the mice that developed eczema vaccinatum than in normal mice that also received the smallpox vaccine. This knowledge opens the door to one day developing therapies that could potentially boost NK cell activity in eczema sufferers.”

The full article can be found at: <http://www.physorg.com/news162449872.html>

[Return to Top](#)

BIRD FLU VIRUS REMAINS INFECTIOUS UP TO 600 DAYS IN MUNICIPAL LANDFILLS

Physorg.com

May 27, 2009

“Amid concerns about a pandemic of swine flu, researchers from Nebraska report for the first time that poultry carcasses infected with another threat — the 'bird flu' virus — can remain infectious in municipal landfills for almost 2 years. Their report is scheduled for the June 15 issue of ACS' semi-monthly journal Environmental Science & Technology.

Shannon L. Bartelt-Hunt and colleagues note that avian influenza, specifically the H5N1 strain, is an ongoing public health concern. Hundreds of millions of chickens and ducks infected with the virus have died or been culled from flocks worldwide in efforts to control the disease. More than 4 million poultry died or were culled in a 2002 outbreak in Virginia, and the carcasses were disposed of in municipal landfills. Until now, few studies have directly assessed the safety of landfill disposal."

The full article can be found at: <http://www.physorg.com/news162666620.html>

[Return to Top](#)

DEAD OR ALIVE - NANOTECHNOLOGY TECHNIQUE TELLS THE DIFFERENCE

By Michael Berger

Nanowerk.com

May 26, 2009

"A major concern in microbiology is to determine whether a bacterium is dead or alive. This crucial question has major consequences in food industry, water supply or health care. While culture-based tests can determine whether bacteria can proliferate and form colonies, these tests are time-consuming and work poorly with certain slow-growing or non-culturable bacteria. They are not suitable for applications where real-time results are needed, e.g. in industrial manufacturing or food processing.

A team of scientists in France has now discovered that living and dead cells can be discriminated with a nanotechnology technique on the basis of their cell wall nanomechanical properties. This finding is totally new and has been made possible thanks to an interdisciplinary approach which mixes physics, biology and chemistry. This work is a key stone in the understanding of bacterial cell wall behavior.

"We have developed a method to probe the mechanical properties of living and dead bacteria via atomic force microscope (AFM) indentation experimentations," Aline Cerf tells Nanowerk. ". Indeed, we provide a new way to probe bacterial cell viability based on cell wall nanomechanical properties, independently from cell ability to grow on a medium or to be penetrated by a fluorescent dye."

The full article can be found at: <http://www.nanowerk.com/spotlight/spotid=10816.php>

[Return to Top](#)

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