Antibiotic (accelerated) discovery and (more) rational use: a change in (accepted) paradigms based on economics?

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Emeritus Professor of Pharmacology
Invited Professor
(Drug Discovery & Development / Rational) therapeutic choices)

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DRIVE-AB 2015 General Assembly Meeting, October 15-16, 2015
Disclosures and slides availability

• **Research grants**
  – Theravance, Astellas, Targanta, Cerexa/Forest, AstraZeneca, Bayer, GSK, Trius, Rib-X, Eumedica
  – Belgian Science Foundation *(F.R.S.-FNRS)*, Ministry of Health *(SPF)*, and Walloon and Brussels Regions

• **Speaking fees**
  – Bayer, GSK, Sanofi, Johnson & Johnson, OM-Pharma, AstraZeneca

• **Decision-making and consultation bodies**
  – General Assembly (current) and steering committee (part) of the European Committee for Antibiotic Susceptibility Testing [EUCAST]
  – European Medicines Agency (external expert)
  – US National Institutes of Health (grant reviewing)
  – Belgian Antibiotic Policy Coordination Committee (BAPCOC)

• **Past competing interest**
  – applicant to IMI call for “ND4BB TOPIC 4: DRIVING RE-INVESTMENT IN R&D AND RESPONSIBLE USE OF ANTIBIOTICS” (application: NEM4AB (New Economic Model for AntiBiotics)).

**Slides:** [http://www.facm.ucl.ac.be](http://www.facm.ucl.ac.be) → Lectures
What shall I talk you about? (*)

- Do we all know about the issues?
- What is true and not true in antibiotic crisis?
- Money available for discovery?
- Where is the real problem for developed countries?
- The situation in developing countries …
- A bunch of proposals

* not necessarily in that order…
Resistance: the current situation

- Bacterial resistance has now reached the point where it has become difficult to be controlled including in several European Countries
  - Witnessed by the yearly surveys from the E-CDC (EARSS network)…
  - Making the choice of antibiotics often hazardous…
  - Causing failures and/or difficult readjustments in situations where early effective therapy is essential …
Are we going to hit the wall? (*)

* taken from a slide presented at ECCMID in 2002
Two examples of people who should not have died…

This man discovered the mode of action of penicillin

and died from invasive pneumococcal infection … caused by a resistant bacteria

Dr. Craig was renowned as a clinician-scholar in the fields of antimicrobial therapy and infectious disease. His early work on quantifying the relationship between antimicrobial dosing and treatment effect led to the development of the field of antimicrobial pharmacodynamics.

He died from infectious complications of anticancer therapy
Resistance: the problems we are facing

- Difficulties for the clinician to adjust his/her therapy
  - “Forced use” of combination of antibiotics (increase of the costs and the of the risk of toxicities)
  - need to develop sophisticated PK-PD-based therapeutic monitoring methods to make sure that we do not undertreat patients
  - Moving to older, more toxic antibiotics in order to cope with the levels of resistance to current antibiotics (creating new risks)

In some areas, including in Europe, “last resource” antibiotics that would never be registered for large hospital use using the so far “classical” regulatory approval system are now used on a wide scale (e.g., colistin)
Resistance: what are the implications

- increased morbidities (longer treatments…)
- Increased mortalities (failures…)
- Increased costs (more hospitalizations, multiples antibiotics, …)
- Difficulties or even impossibility to use therapies that cause a weakening of the host defenses or to undertake many chirurgical acts…

The clinicians may largely return to pre-antibiotic era and/or will need to resort to other less established therapies (phage, immunotherapies, …)
For developing countries, the situation may become dramatic

Deaths attributable to AMR every year by 2050

http://amr-review.org/
Resistance in Vietnam: Hospital


Original Article

Drug-resistant pneumococci in children with acute lower respiratory infections in Vietnam

Kiwao Watanabe,1 Dang Duc Anh,2 Phan Le Thanh Huong,2 Nguyen Thu Nguyet,3 Nguyen Thu Hien Anh,2 Ngo Thi Thi,3 Nguyen Tien Dung,4 Doan Mai Phuong,4 Olivia S. Rusizoka,1 Tsuyoshi Nagatake,1 Hiroshi Watanabe1,4 and Kazunori Oishi1,5

Departments of 1Internal Medicine and 5Special Pathogen, International Research Center for Infectious Diseases, Institute of Microbial Diseases, Osaka University, Japan and 2National Institute of Hygiene and Epidemiology, 3Department of Laboratory, National Pediatric Hospital and 4Department of Laboratory, Bach Mai Hospital, Hanoi, Vietnam
Resistance for *S. pneumoniae* at Bach Mai, Hanoi, Vietnam

Susceptibility to penicillin G

**EUCAST breakpoints**

![Graph showing susceptibility to penicillin G with MIC (µg/mL) on the x-axis and No. strains on the y-axis.](image)

**Intermediate** and **Resistant**

*Watanabe et al. Ped. Int. 2008; 50:514-518*
Isolates from sputum and endotracheal fluid
unpublished data from Bach Mai hospital, 2014

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<thead>
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<th>TT</th>
<th>Vi khuẩn</th>
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<td>9</td>
<td><em>Burkholderia cepacia</em></td>
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Pham Hong Nhung, MD, PhD Dept. Microbiology, Hanoi Medical University and Bach Mai hospital
<table>
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<tr>
<th>Antimicrobial drug</th>
<th>MIC, mg/L</th>
<th>EUCAST brakpoint</th>
<th>Site X</th>
<th>Site Y</th>
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<td>64–&gt;256</td>
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<td>384–&gt;1,024</td>
<td>256–384</td>
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<td>0.125–0.38</td>
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<td>R &gt; 2</td>
<td>1.5–3</td>
<td>0.5–1.5</td>
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Resistance: Why is this happening?

Antibiotic therapy will always create resistance …

… but this is accelerated by an inappropriate use

A correct use of antibiotic is essential!

But at the same time, we need to vary the environment to which bacteria are exposed…

- Reviving old but good antibiotics
- Designing new ones

A strong discovery and reassessment pipeline is essential!
But new antibiotics have long been few to reach registration

No new antibiotics: is it true?

• In 2013, an article in Genetic Engineering & Biotechnology News identified 66 companies involved in antibiotic research, 86% of which are either small or medium-sized.

• A paper published in 2013 in Journal of Antibiotics (Tokyo)\(^2\) lists 22 new antibiotics launched since 2000 and discusses the development status, mode of action, spectra of activity, historical discovery and origin of the drug pharmacophore (natural product, natural product derived, synthetic or protein/mammalian peptide) of 49 compounds and 6 β-lactamase/β-lactam combinations in active clinical development are discussed.

1. Genetic Engineering and Biotechnology News 14 Aug 2013
   Last accessed: 8 May 2014
New antibiotics: up to phase I – II...

As of December 2014, an estimated 37 new antibiotics that have the potential to treat serious bacterial infections are in clinical development for the U.S. market. The success rate for drug development is low; at best, only 1 in 5 candidates that enter human testing will be approved for patients. This snapshot of the antibiotic pipeline will be updated periodically as products advance or are known to drop out of development.

The PEW Charitable Trusts (Health Initiatives)
http://www.pewhealth.org/other-resource/antibiotics-currently-in-clinical-development-85899541594
Last accessed: 26 May 2015
2009 EU-US Summit Declaration called for the establishment of “…a transatlantic task force on urgent antimicrobial resistance issues focused on appropriate therapeutic use of antimicrobial drugs in the medical and veterinary communities, prevention of both healthcare- and community associated drug-resistant infections, and strategies for improving the pipeline of new antimicrobial drugs, which could be better addressed by intensified cooperation between us.”
Concerted actions…

HORIZON 2020

AMR RESEARCH AND INNOVATION LANDSCAPE

- Health, Demographic Change And Wellbeing
  - Food, Security, Sustainable Agriculture, Marine and Maritime Research and the Blue Economy

- Innovation in SMEs

- Access to risk finance

- Research infrastructures

- Marie Skłodowska-Curie actions

- European Research Council

From van Hengel and D. Dixon, Meet the Experts: Antimicrobial resistance research, supported by funding from the EU and the US NIH/NIAID, ECCMID 2014, 13 May 2014.
EU in action … (one example)

- €2 billions euro budget…
- collaborative research projects and networks of industrial and academic experts…
- collaborative ecosystem for pharmaceutical research and development (R&D)…
- increase Europe's competitiveness globally…
- establish Europe as the most attractive place for pharmaceutical R&D
But additional changes have been brought in the US

- **GAIN Act** (Generating Antibiotics Incentives Now) - 2012
  - priority FDA review
  - **additional five years of market exclusivity** for breakthrough antibiotics that target serious or life-threatening pathogens
  - relaxed its criterion for non-inferiority to within 10%, making it easier to show comparability to drugs already on the market

- **BARDA**: Biomedical Advanced Research and Development Authority
  [within the Office of the Assistant Secretary for Preparedness and Response in the U.S. Department of Health and Human Services]
  - provides an integrated, systematic approach to the **development and purchase of the necessary vaccines, drugs, therapies, and diagnostic tools** for public health medical emergencies.

- Genetic Engineering and Biotechnology News 14 Aug 2013
  Last accessed: 8 May 2014
- Biomedical Advanced Research and Development Authority
  [http://www.phe.gov/about/barda/Pages/default.aspx](http://www.phe.gov/about/barda/Pages/default.aspx)
  Last accessed: 26 May 2015
New antibiotics: newly approved (or close to) *

• anti-Gram-positive
  – lipoglycopeptides: telavancin, oritavancin, dalbavancin
  – oxazolidinones: tedizolid, …
  – anti-MRSA cephalosporins: ceftaroline, ceftobiprole
  – kétolides: solithromycin
  – tetracyclines: omadacycline, saracycline
  – fluroquinolones: ozenoxacin, delafloxacin, …
  – …

• anti-Gram-negative
  – ceftozolane (+ tazobactam)
  – new β-lactamase inhibitors: avibactam, RPX7009, relebactam, …
  – aminoglycosides: plazomycin, …
  – …

* not an exhaustive list
So what is the real reason?

With the current system, antibiotics are not profitable.

The "QALY" of antibiotics ¹

- The **quality-adjusted life year (QALY)** ² is a measure of **disease burden**, including both the quality and the quantity of life lived. It is used in assessing the **value for money of a medical intervention**.

- If antibiotics **prolong your life of 2 to 10 years**, and the cost of one year of your life is **20,000 euros**, then the value of the "QALY" of an antibiotic treatment should be **40,000 to 200,000 euros**

- But the real cost and reimbursement of an antibiotic treatment is **MUCH less**

- For comparison, the cost of an anticancer treatment for 1 year survival is…. **up to 20,000 to 70,000 euros**… (and the accepted "QALY" is close to that)

- Find where the problem is …

---

A too simple example from Belgium?

- For **antibiotics** and **antifungals**, if a medical doctor or a dentist prescribes for an **acute treatment**:
  - under the name of the active compound: the rules of prescription under INN (*) are of application → **delivery of the cheapest preparation available**
  - under a trade name: as from 1st Mai 2012, the pharmacist must deliver the product available in the group of « **the cheapest drugs** ».


  (last accessed: 7 November 2013)

- The drug acquisition cost for the treatment of a **community acquired pneumonia** following the **recommendations of BAPCOC** (**) (amoxicillin [3 g per day in 3 administrations for 5 to 7 days] is only **13-14 €** … (ex-factory price: ~7 €)


  (last accessed: 7 November 2013)

* INN: International Nonproprietary Name
** BAPCOC: Belgian Antibiotic Policy Coordination Committee
A spiral to death (in Belgium) ?

- For **antibiotics** and **antifungals**, if a medical doctor or a dentist prescribes for an **acute treatment**:
  - under the name of the active compound: the rules of prescription under INN (*) are of application (delivery of the cheapest preparation available)
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** BAPCOC: Belgian Antibiotic Policy Coordination Committee

This infernal spiral (to low prices) make innovators to leave the field
But what about the consumption of antibiotics

- we all wish to reduce the overconsumption of antibiotics because we know it creates resistance…

Logodds of resistance to penicillin among invasive isolates of Streptococcus pneumoniae regressed against outpatient sales of beta-lactam antibiotics in 11 European countries; (resistance data are from 1998 to 1999; antibiotic sales data 1997. DDD = defined daily dose)

But what about the consumption of antibiotics

- and we launch campaigns at all levels… (*)

Belgium

* yearly public campaigns were launched in Belgium since 2001 together with other activities directed to the professionals
But what about the consumption of antibiotics

- and we launch campaigns at all levels… (*)

* quinolones were especially targeted especially for actions directed towards professionals
Actually, low prices favor consumption

A sour Danish experience

Figure 1. (a) Comparison of the number of ciprofloxacin trade names for oral use (thick line) and the median price per DDD registered monthly in PHC in Denmark (thin line), and the influence of the introduction of generics. The arrow marks the time of introduction of generic versions of ciprofloxacin. (b) The influence of removal of 50% reimbursement and of the introduction of generics on the total use of ciprofloxacin and median price per DDD registered monthly in PHC in Denmark (thin line). Consumption (thick line) is expressed in terms of DDDs per 1000 inhabitants per day. The arrows mark the times of removal of reimbursement of ciprofloxacin and the introduction of generic versions, respectively. 100 DDK≈13 EUR.

And generic producers only think about sales

Something you should not have seen … (*)

*Moxifloxacin Sandoz*

Choisissez les antibiotiques Sandoz, choisissez pour la sécurité et la qualité!

*quinolones were especially targeted (for consumption reduction) by the authorities with "direct" actions towards professionals*
Is the market broken?

- The final price of antibiotics is driven to VERY low prices, which makes new antibiotics unprofitable … unless sold widely… **which is NOT what we would like to see (but what generic producers do)!**

- In parallel, the EU and the USA have taken useful initiatives to foster the **discovery of new antibiotics**, which is now **gaining momentum**

- But the process of **development** and **effective and safe availability for the public** still need to be addressed … with **a view on low scale sales**
Towards proposals?

1. Dissociate the discovery/development process from the commercialization

   - Private/public partnership (PPP) on a competitive basis ("grant application" type)
   - After approval (EMA), select only the best and most needed candidates for actual commercialization
   - Keep the other ones on the shelf but rewards the discoverers/developers

PPP empowers the public authority
Towards proposals?

2. For new antibiotics allowed for commercialization, define selected and limited indications and allow for "life-saving" drugs prices with

– reversion of part of the profits to the discovery process, and

– control by the Public Services in an ethical way
Towards proposals?

3. For "older" antibiotics, propose a tender to best offering for linked

- responsible and prudent use (accepted limits in volume and active participation to public initiatives limiting the inappropriate use)

- price (but this will not be the only consideration) and respect of antibiotic "value" as an important public health commodity
Towards proposals?

None of these proposals are for all situations!

Each of them (and others) must be tested in the appropriate environment.
But others may have similar ideas…

The European Parliament Resolution of May 19, 2015, on Safer Healthcare in Europe (Improving Patient Safety and Fighting Antimicrobial Resistance)¹ provides some hints:

“62. Calls on the Member States and the Commission to start a reflection process to develop a new economic model, that de-links the volume of sales from the reward paid for a new antibiotic, which would reflect the societal value of a new antibiotic and allow for sufficient return on investment for the company, while the purchaser would gain the right to use the product and have full control over volumes;”

“63e: encourage the development of new revenue models whereby economic returns for companies are de-linked from prescribed volumes of antibiotics, while encouraging pharmaceutical innovation and balancing it with the sustainability of health systems;


The real question is to know who will pay for the de-linking ….

• The Public Authorities (by purchasing the compounds)
• The Industry by obtaining a reasonable price for the efforts made and the low-scale sales
Summary / Discussion / Food for thought

- Antibiotics have been a "gold treasure" for Industry for many years until the late 90's

- The decision to "go for generics" made by many countries, the restrictive policies of health authorities, the regulatory hurdles, the rapid attrition of molecules due to emergence of resistance and the short courses of antibiotics have, altogether, discouraged Big Pharma with reorientation towards more profitable businesses, even in infectious diseases (think about anti-HIV and, more, recently about the novel anti-Hepatitis C drugs)

we must change!
Summary / Discussion / Food for thought

• In face of the vacuum of renewed commercialization, public authorities have decided (i) to ease the registration process; (ii) to give incentives to companies for discovery; (iii) invest large amounts of money into development programmes

• But we also DO need to secure a limited use of antibiotics while rewarding those who find and develop them (empowering the public service)

• This will lead us to a new paradigm that has never been observed so far in which public and private companies cooperate, but where also a large part of the expenses are covered by the tax-payers, supplying what social security does not want to pay (thus, moving from a Bismark to a Beveridge model for health support)
So, it a nutshell...

While strolling through Rotterdam and seeing the building of a Dutch High School …
But the equilibrium may be difficult to reach, although the Dutch may have suggestions….

While continuing my stroll through Rotterdam….
To conclude…

We are here to change the world of antibiotics by dissecting out its parts (science and economy) to find how they can work together… but we are in good company or can get help in Uppsala!
Back-up
Public/Private shares in Europe

Public-private partnerships

- Pooling expertise, knowledge and resources
- Developing incentives to address major unmet medical needs
- Providing a neutral trusted platform to align public and private interests

An opportunity to combine public and private resources for new antimicrobials
TATFAR Recommendations

• **Issue:** Investigators should consider funding sources and research resources on both sides of the Atlantic to support antimicrobial research and antibacterial product development efforts

• **Recommendation 14:** Publicise funding opportunities to the EU and US research communities
DMID Resources for Researchers

Microbiology and Infectious Diseases Resources
The Division of Microbiology and Infectious Diseases (DMID) supports extramural research to control and prevent diseases caused by virtually all human infectious agents except HIV.

Funding Opportunities
Apply for grants and contracts to conduct basic research, preclinical development, or clinical evaluation.
- NIH-Wide Funding Opportunity Announcements
- NIAID Funding Opportunity Announcements and Requests for Proposals

Product Development Services and Research Tools and Biological Materials
Request development by DMID-funded contractors of critical information needed to move a product through the product development pathway. Note: Services are contingent upon availability of required preliminary data.

Click on labels below to view information on services.

Web Search Term: DMID Resources
DMID Resources for Researchers

Resources for Researchers

NIAID resources for researchers offers product development resources, cooperative research and materials licensing agreements, computational biology tools, global research and development projects, and more. Browse the links below for more information.

**Bioinformatics**
- Genomics and DNA Analysis
- Proteomics and Protein Analysis
- Gene Expression and Transcriptome Analysis
- Systems Biology
- View All...

**Biological Materials**
- Cell, Tissue and Organism Repositories
- Model Animals
- Reagents

**Translational Research Tools and Services**
- Biosafety Facilities
- Preclinical Research Resources
- Clinical Research Resources
- Vaccines, Diagnostics, and Therapeutics

**Partnerships and Technology Development**
- Partnering With NIAID
- Technology Development

**Research Feature**
Microbiome Cloud Helps Researchers Explore Microbial Genomic Data. Read more.

Website Tools
- Print this page
- Get email updates
- Order publications

Additional Information From NIAID
All microbiology and infectious diseases resources (non HIV)
Monnies from "Big Bother"

MCM Procurements and Grants

Medical Countermeasures Advanced Research, Development and Acquisition Contract and Grant Awards

October 21, 2013: New blood test would provide fast results for medical care after anthrax attack

September 26, 2013: BARDA boosts global ability to respond to pandemics

September 20, 2013: HHS funds development of freeze-dried platelets for disaster response

September 19, 2013: BARDA funds development of device to aid burn patients in disasters

September 19, 2013: HHS replenishes nation’s supply of anthrax antitoxin

September 18, 2013: HHS explores new emergency response use for approved steroid

September 17, 2013: BARDA funds study of therapy for thermal burns

September 16, 2013: BARDA evaluates burn dressing for radiation, sulfur mustard burns

August 23, 2013: BARDA Contract Supports Evaluation of Therapy for Severe Thermal Burns

August 22, 2013: BARDA Supports Proof-Of-Concept Studies for Small Molecule Development

July 30, 2013: BARDA contract supports the development of a more effective skin graft to help burn patients after a radi/nuke event

June 25, 2013: BARDA supports new broad-spectrum antibiotic against glanders, melioidosis

May 24, 2013: BARDA supports new broad-spectrum antibiotic to treat anthrax, tularemia

May 22, 2013: HHS forms strategic alliance to develop new antibiotics

April 3, 2013: HHS awards contract to create test to identify resistant influenza viruses

http://www.phe.gov/newsroom/Pages/mcm-procurements.aspx

Last accessed: 8 May 2014

This page last reviewed: January 03, 2014
When Big Brother helps Big Pharma…

May 22, 2013: HHS forms strategic alliance to develop new antibiotics

Date: May 22, 2013
Company: GlaxoSmithKline of North Carolina

Contract amount: This agreement is not a contract; other transactional authority was used to create a strategic alliance. BARDA will contribute $40 million over 18-months. The agreement can be extended up to five years and up to a total of $200 million.

About the contract: The agreement is the first in which BARDA has taken a portfolio approach with a private sector company instead of contracting to develop a single medical countermeasure. The agreement is flexible, allowing drug candidates to be moved in or out of the portfolio, based on advanced development stage and technical considerations, during joint semi-annual portfolio reviews. Under the agreement, GSK researchers will conduct safety and toxicology testing, clinical pharmacology studies, clinical studies, and non-clinical studies to support approval to treat illnesses caused by bioterrorism agents like anthrax, plague, and tularemia, as well as address antibiotic resistance. One of the antibiotics to be further developed under this agreement is GSK944, the first in class of drugs that targets bacterial DNA replication in a unique fashion. GSK has conducted studies in which GSK944 protected or successfully treated animals suffering from anthrax, plague, or tularemia.

Additional information: The partnership with GSK is funded by BARDA’s Broad Spectrum Antimicrobials Program. BARDA is seeking additional proposals for broad-spectrum antimicrobials that could potentially treat or prevent illness due to biological threat agents. Proposals are accepted through the Broad Agency Announcement BARDA-BAA-12-100-SOL-00011 at www.fbo.gov.

Press Release: HHS forms strategic alliance to develop new antibiotics

Anthrax, plague, tularemia … and resistance
and also helps small pharma for a new ketolide ... 

May 24, 2013: BARDA supports new broad-spectrum antibiotic to treat anthrax, tularemia

**Date:** May 24, 2013

**Company:** Cempra Pharmaceuticals of Chapel Hill, N.C.

**Contract amount:** $17.7 million for two years

**About the contract:** The contract supports studies needed to request FDA approval of a drug called solithromycin to treat adults and children infected with anthrax, tularemia or community-acquired bacterial pneumonia. If approved, the drug would be the first orally administered antibiotic approved in decades to treat children who develop community acquired bacterial pneumonia. Studies of the drug's use in treating anthrax or tularemia will be conducted under the FDA's Animal Efficacy Rule.

**Additional information:** BARDA is seeking additional proposals for broad-spectrum antimicrobials that could potentially treat or prevent illness due to biological threat agents. Proposals are accepted through a Broad Agency Announcement BARDA-BAA-12-100-SOL-00011 at www.fbo.gov

**Press Release:** HHS funds drug development for bioterror infections

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PHE.GOV - Leading a Nation Prepared HHS/ASPR

http://www.piersystem.com/go/doc/3803/1863410/

Last accessed: 8 May 2014
And even for an aminoglycoside ...

Achaogen Awarded $60M Contract Option by BARDA for the Clinical Development of Plazomicin
April 24, 2013

- Contract to fund Phase 3 superiority study of plazomicin in patients with carbapenem-resistant Enterobacteriaceae (CRE) infections -

South San Francisco, CA. April 24, 2013 – Achaogen, Inc. today announced the award of a $60M contract option from the Biomedical Advanced Research and Development Authority (BARDA). The option supports the conduct of a global Phase 3 superiority study that will evaluate the efficacy and safety of plazomicin in treating patients with serious gram-negative bacterial infections due to CRE. This pathogen-specific clinical study represents a new development approach to address unmet medical needs for multi-drug resistant bacterial infections. The study is expected to start in fourth quarter of 2013.

“We are excited and honored to continue the development of plazomicin in partnership with BARDA,” said Kenneth J. Hillan, M.B. Ch.B., Chief Executive Officer and Chief Medical Officer of Achaogen. “The growing prevalence of CRE infections poses a substantial public health threat, given the high mortality rates associated with CRE infections. Plazomicin’s strong potential to address this public health issue and to contribute to the global effort to guard against bacterial biothreats makes it a critically important agent in the antibacterial pipeline.”

Achaogen Inc
Last accessed: 8 May 2014
Big Brother in Switzerland…

June 25, 2013: BARDA supports new broad-spectrum antibiotic against glanders, melioidosis

**Date:** June 25, 2013

**Company:** Basilea Pharmaceutica International Ltd., Basel, Switzerland

**Contract amount:** BARDA will provide $16.8 million in the first phase of the contract. The contract can be extended up to a total of six years with BARDA contributing up to a total of $89 million

**About the contract:** This contract is a cost-sharing public-private partnership. The partnership supports Basilea in conducting studies to evaluate the safety and efficacy of the antibiotic BAL30072 to treat Gram-negative infections including melioidosis, glanders, hospital-acquired pneumonia, and complicated urinary tract infections. Results from these studies will support the eventual filing of a new drug application with the FDA. In addition to showing promise in treating melioidosis and glanders, earlier studies of BAL30072 have demonstrated the drug's potential in treating a broad range of multidrug-resistant Gram-negative bacteria commonly found in hospitals.

**Additional information:** BARDA is seeking additional proposals for broad-spectrum antimicrobials that potentially could treat or prevent diseases caused by bacterial and viral threat agents, and clinically relevant emerging and drug resistant pathogens that through the Broad Agency Announcement BARDA CBRN BAA-12-100-SOL-00011 at www.fbo.gov.

**Press Release:** BARDA supports new broad-spectrum antibiotic

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