UNIVERSITY OF CAMBRIDGE

Stephen Baker

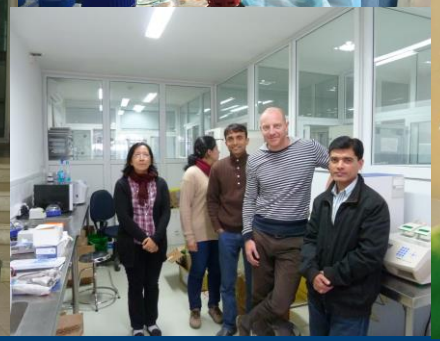
Where do we go next with AMR

Ho Chi Minh City

10th August 2024

Cambridge Institute for Therapeutic Immunology and Infectious Disease

2007-2019 (Vietnam)



The gold

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Research

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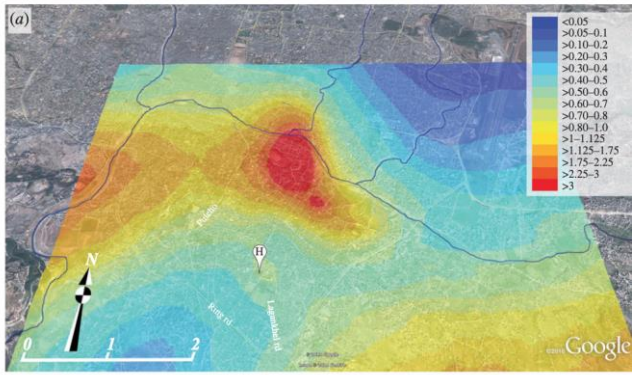
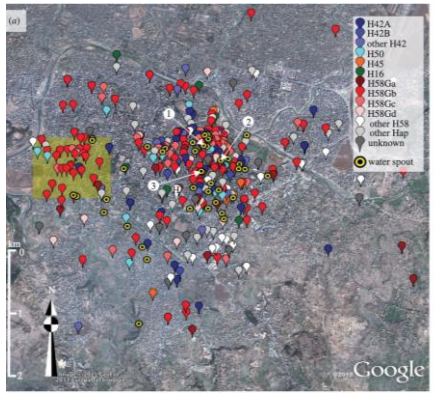
http://dx.doi.org/10.1098/rsob.110008

Combined high-resolution genotyping and geospatial analysis reveals modes of endemic urban typhoid fever transmission

Stephen Baker[1,2,*,†], Kathryn E. Holt[3,4,†], Archie C. A. Clements[5], Abhilasha Karkey[2], Amit Arjyal[2], Maciej F. Boni[1,6], Sabina Dongol[2], Naomi Hammond[4], Samir Koirala[2], Pham Thanh Duy[1], Tran Vu Thieu Nga[1], James I. Campbell[1], Christiane Dolecek[1,2], Buddha Basnyat[2], Gordon Dougan[4] and Jeremy J. Farrar[1,2]





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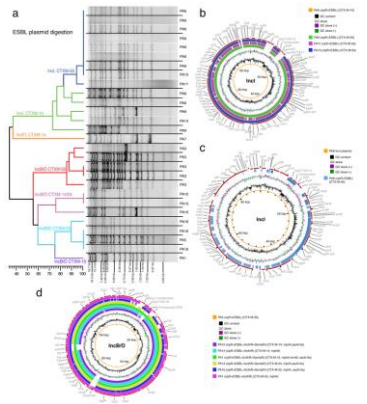
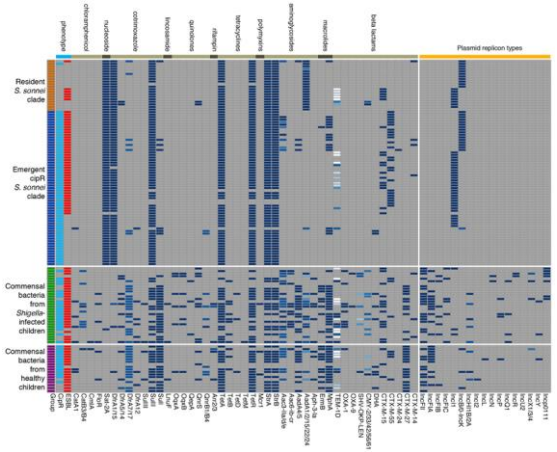
Letter | Published: 20 January 2020

Commensal *Escherichia coli* are a reservoir for the transfer of XDR plasmids into epidemic fluoroquinolone-resistant *Shigella sonnei*

Pham Thanh Duy, To Nguyen Thi Nguyen, Duong Vu Thuy, Hao Chung The, Felicity Alcock, Christine Boinett, Ho Ngoc Dan Thanh, Ha Thanh Tuyen, Guy E. Thwaites, Maia A. Rabaa & Stephen Baker

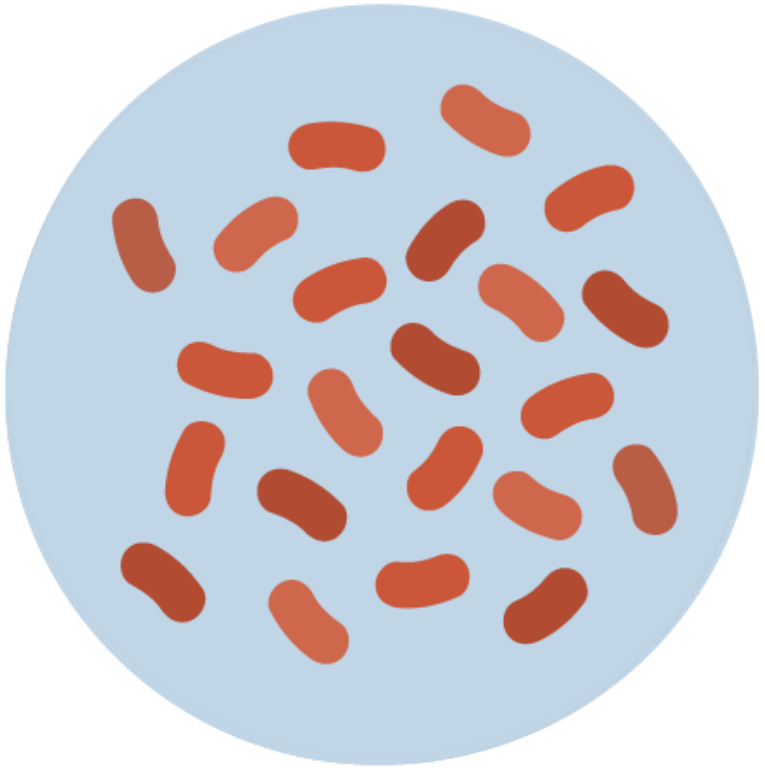




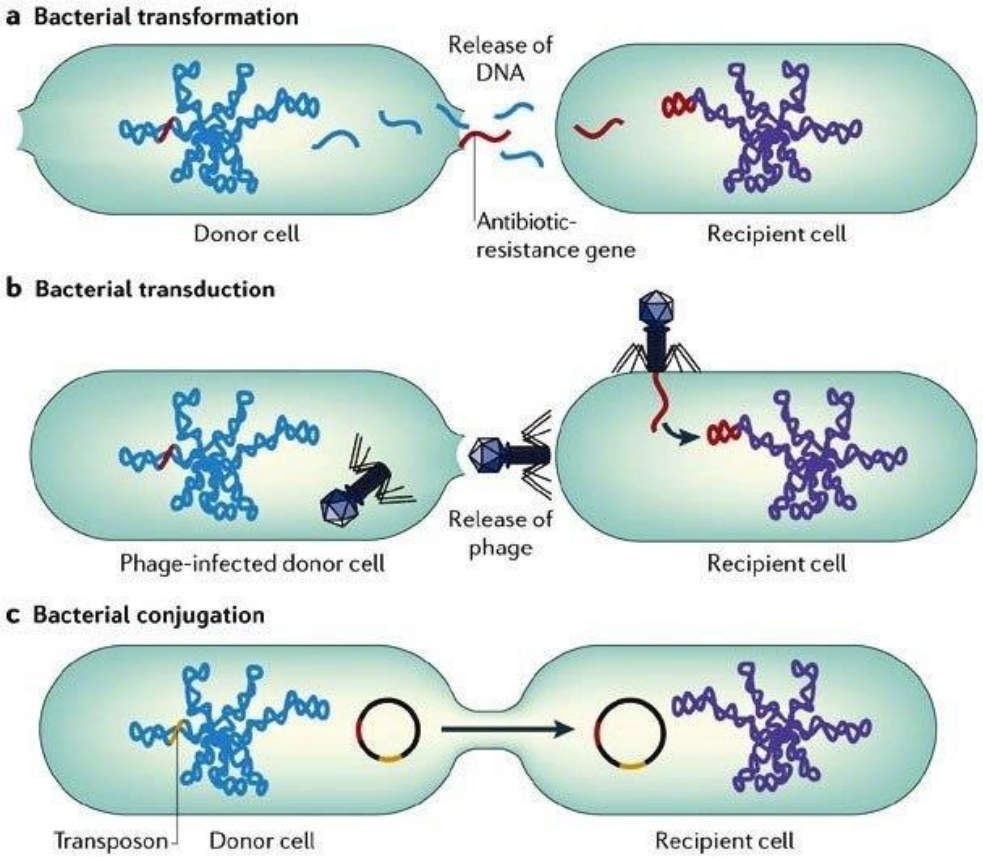
We live in a bacterial world

How do antimicrobials work?

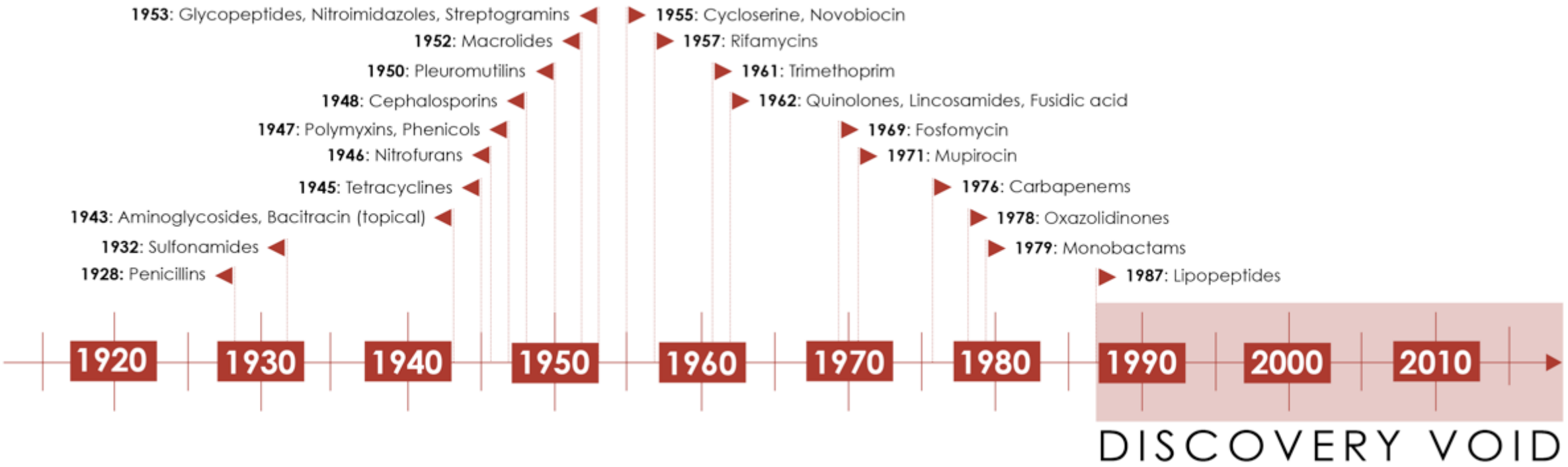
Resistance is inevitable (mutation)



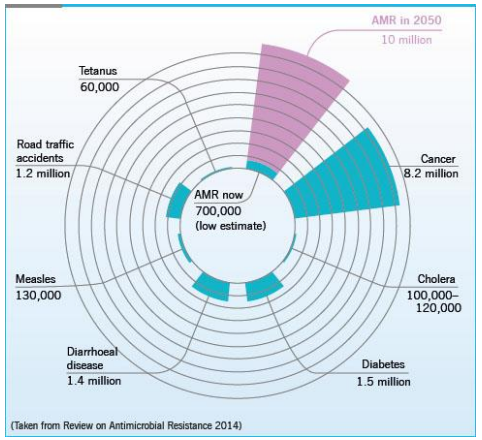
We need to talk about sex

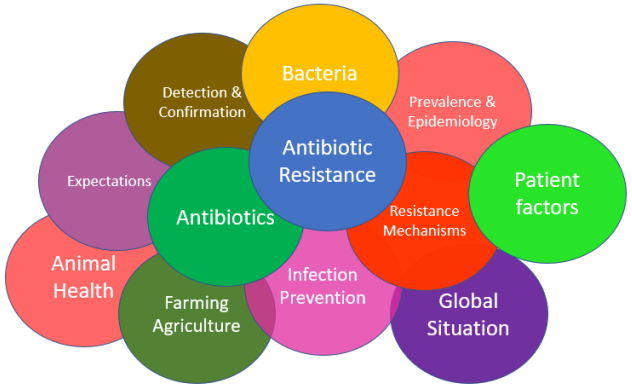


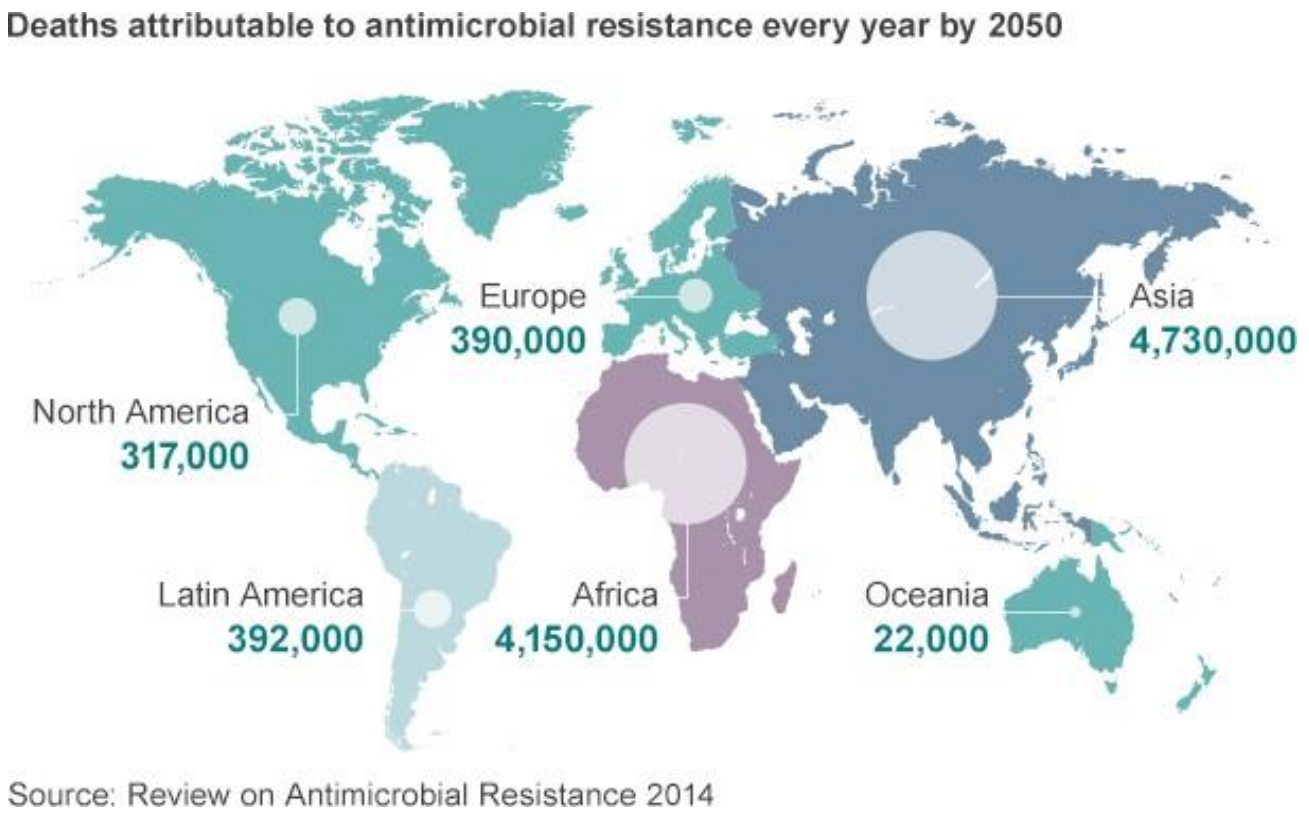
And we are running out of options



AMR

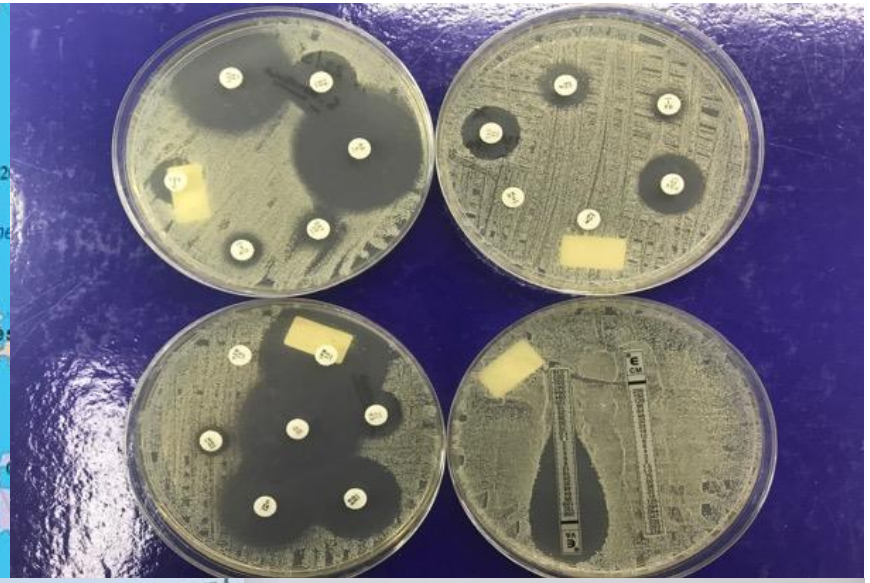






- The prevalence of AMR is increasing worldwide
- Seeing an increase in resistant infections that are untreatable
- 700,000 AMR related deaths per year globally, predicted to rise to 10 million by 2050
- Economic cost by 2050 could be up to $100 trillion USD

Almost all drug resistant bacteria come from Asia….



Why?

J Antimicrob Chemother 2018; **73**: 2546–2554
doi:10.1093/jac/dky231 Advance Access publication 4 July 2018

Journal of Antimicrobial Chemotherapy

Quantifying antimicrobial access and usage for paediatric diarrhoeal disease in an urban community setting in Asia

Le Thi Quynh Nhi[1,2], Ruklanthi de Alwis[1,3], Phung Khanh Lam[1], Nguyen Nhon Hoa[2], Nguyen Minh Nhan[2], Le Thi Tu Oanh[2], Dang Thanh Nam[2], Bui Nguyen Ngoc Han[2], Hoang Thi Thuy Huyen[2], Dinh Thi Tuyen[2], Vu Thuy Duong[1,4], Lu Lan Vi[5], Bui Thi Thuy Tien[6], Hoang Thi Diem Tuyet[6], Le Hoang Nha[7], Guy E. Thwaites[1,3], Do Van Dung[2] and Stephen Baker[1,3,8]*

[1]*The Hospital for Tropical Diseases, Wellcome Trust Major Overseas Programme, Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam;* [2]*University of Medicine and Pharmacy in Ho Chi Minh City, Ho Chi Minh City, Vietnam;* [3]*Centre for Tropical Medicine,*

Carrique-Mas *et al. Antimicrobial Resistance and Infection Control* (2020) 9:16
https://doi.org/10.1186/s13756-019-0671-7

Antimicrobial Resistance and Infection Control

SHORT REPORT Open Access

An estimation of total antimicrobial usage in humans and animals in Vietnam

Juan J. Carrique-Mas[1,2*], Marc Choisy[1,3,4], Nguyen Van Cuong[1], Guy Thwaites[1,2] and Stephen Baker[1,5]

International Journal of Antimicrobial Agents 54 (2019) 269–270

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journal homepage: www.elsevier.com/locate/ijantimicag

Letter to the Editor

Affordability of antimicrobials for animals and humans in Vietnam: A call to revise pricing policies

Sir,

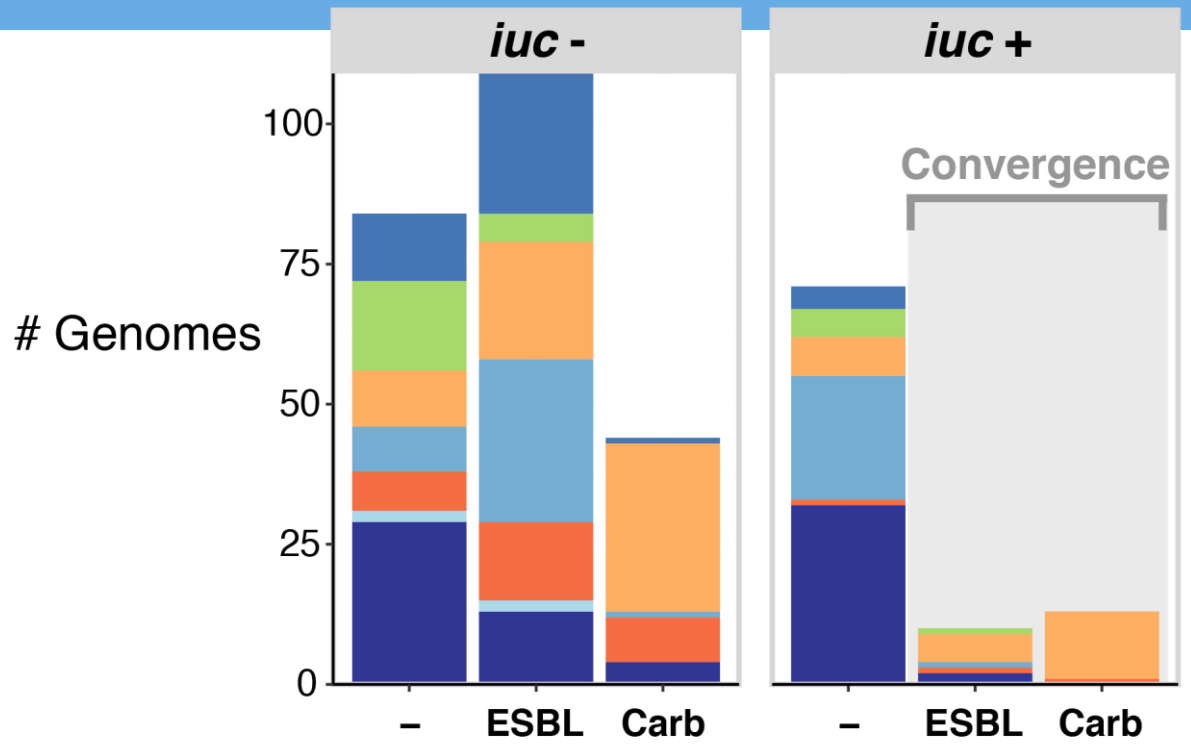
A recent review in the *International Journal of Antimicrobial* (0.55 US$ cents) and sulfamethoxazole (0.50 US$ cents). Vietnam is among the countries where AMU is expected to increase rapidly in the coming years [3]. It has been suggested that increasing user fees may deter excessive AMU in food animal production, and the increased revenues could be used to mitigate the consequences of antimicrobial resistance [4].

Table 1
The 10 most common antimicrobials used by a cohort of 112 farmers investigated over 270 cycles of production, and the prices of animal daily dose kg (ADD_{kg})

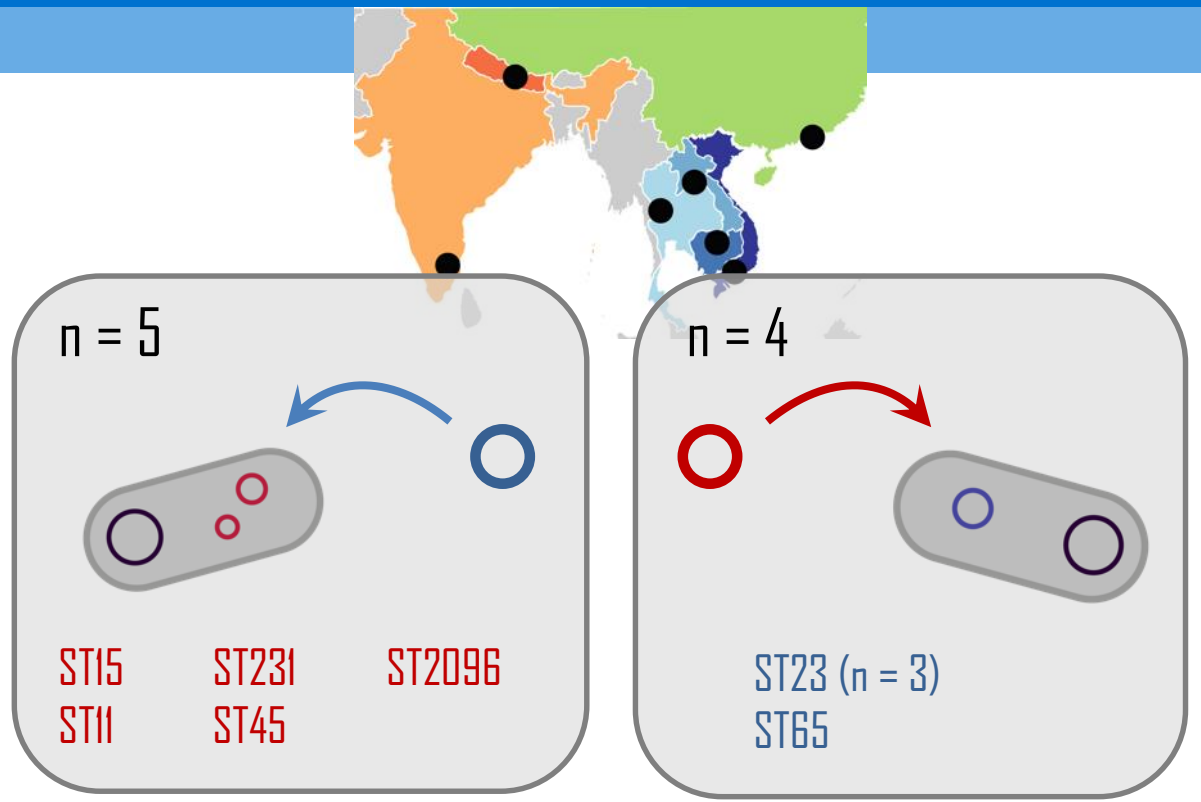
Product	Antimicrobial active principle	Volume (L) of antimicrobial solution prepared per sachet of product (prophylaxis/therapy)	No. of ADD_{kg} per sachet (prophylaxis/therapy)	Cost of 1 ADD_{kg} (range) (in US$ cents)	
				Prophylaxis	Therapeutic
1	Colistin + oxytetracycline	250/100	1111/444	0.07 (0.06–0.17)	0.19 (0.14–0.43)
2	Colistin + oxytetracycline	-/100	-/444	–	0.28 (0.10–0.48)
3	Colistin + gentamicin	-/50	-/222	–	0.44 (0.33–0.62)
4	Colistin + oxytetracycline	100/50	444/222	0.51 (0.29–0.58)	1.02 (0.58–1.16)
5	Oxytetracycline + streptomycin	-/50	-/222	–	0.42 (0.19–0.58)
6	Colistin + oxytetracycline	100/50	444/222	0.20 (0.15–0.43)	0.40 (0.29–0.97)
7	Sulphamethoxazole + thiamphenicol	67/33	296/148	0.51 (0.22–0.72)	1.03 (0.43–1.45)
8	Methenamine	100/67	444/296	0.53 (0.43–0.63)	0.79 (0.65–0.94)
9	Doxycycline + tylosin	400/200	1778/889	0.12 (0.04–0.16)	0.23 (0.07–0.31)
10	Gentamicin + tylosin	100/50	444/222	0.43 (0.14–0.58)	0.85 (0.29–1.15)

NI, not indicated.
Prices are expressed in US$ cents, based on an exchange rate of 1 US$=23 319 VND (23 September 2018)]. The products are sorted by frequency of use. All products were purchased as 100-g sachets.

MDR hypervirulent *Klebsiella* in India



Southeast Asia:	1% iuc + ESBL	0% iuc + Carb
South Asia:	16% iuc + ESBL	13% iuc + Carb
OR:	0.06	na
p-value:	0.001	0.0006



MDR clones acquire virulence plasmids

Hypervirulent clones acquire MDR plasmids

Genome Medicine
Medicine in the post-genomic era

The role of the microbiome

The Journal of Infectious Diseases

SUPPLEMENT ARTICLE

The Gut Microbiome of Healthy Vietnamese Adults and Children Is a Major Reservoir for Resistance Genes Against Critical Antimicrobials

Joana Pereira-Dias,[1,2] Chau Nguyen Ngoc Minh,[3] Chau Tran Thi Hong,[3] To Nguyen Thi Nguyen,[3] Tuyen Ha Thanh,[3] Caroline Zellmer,[1,2] Hao Chung The,[3] Lindsay Pike,[4] Ellen E. Higginson,[1,2] and Stephen Baker[1,2]

[1]University of Cambridge School of Clinical Medicine, Cambridge Biomedical Campus, Cambridge, United Kingdom, [2]Department of Medicine, University of Cambridge School of Clinical Medicine, Cambridge Biomedical Campus, Cambridge, United Kingdom, [3]Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam, and [4]The Wellcome Sanger Institute, Hinxton, Cambridge, United Kingdom

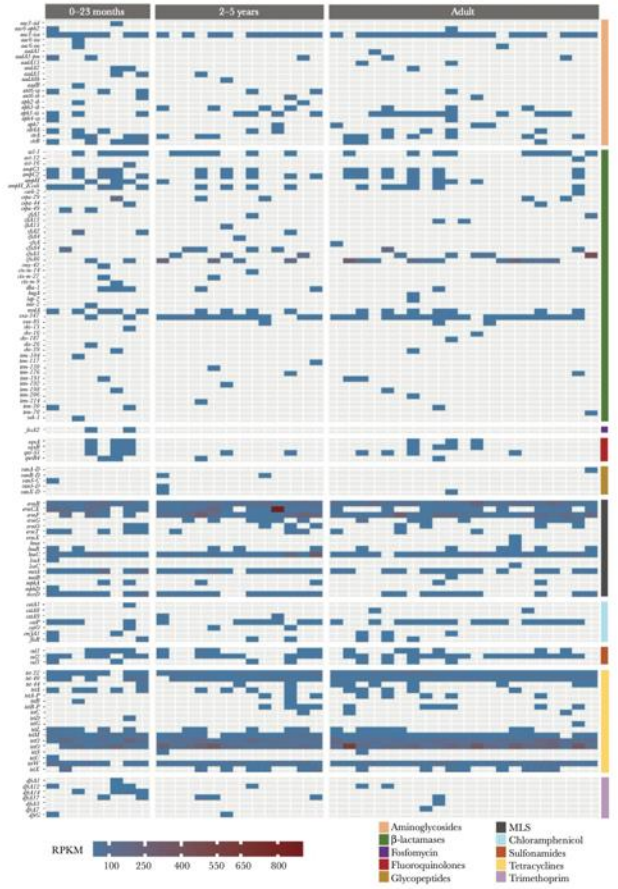
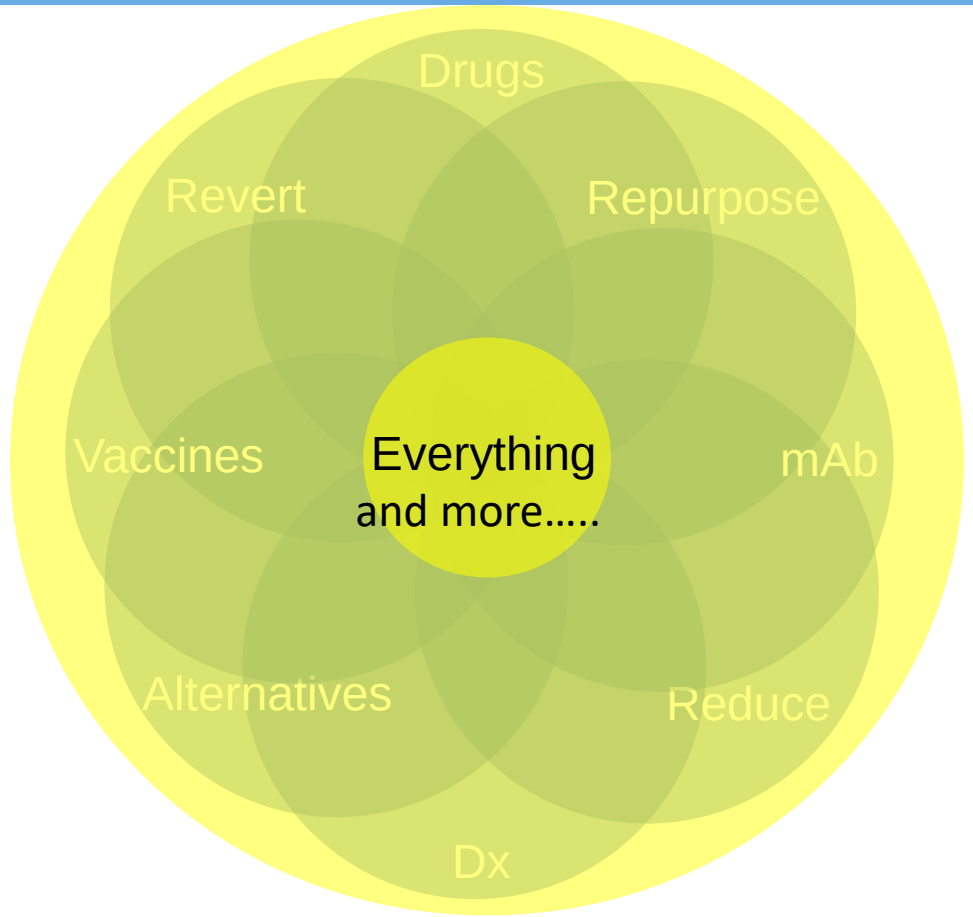


Figure 3. Relative abundance of antimicrobial resistance (AMR) genes in fecal samples from healthy Vietnamese participants. Plot generated by reads per kilobase per million mapped reads (RPKM). Samples are stratified by age group (0–23 months, 2–5 years, and adults), and each AMR gene (y-axis) is organize by antimicrobial class (aminoglycosides, β-lactamases, fosfomycin, fluoroquinolones, glycopeptides, MLS [macrolide, lincosamide, and streptogramin], chloramphenicol, sulfonamides, tetracyclines, and trimethoprim).

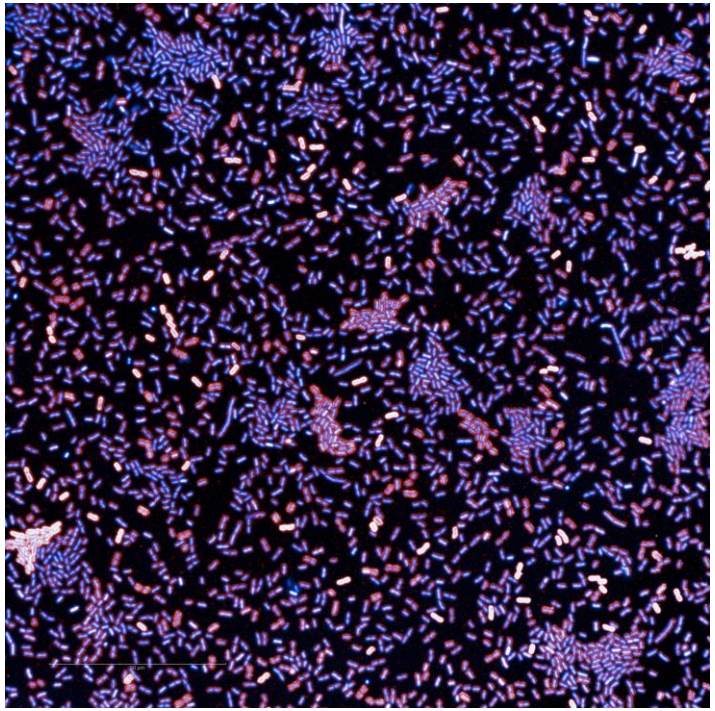
What can we do?

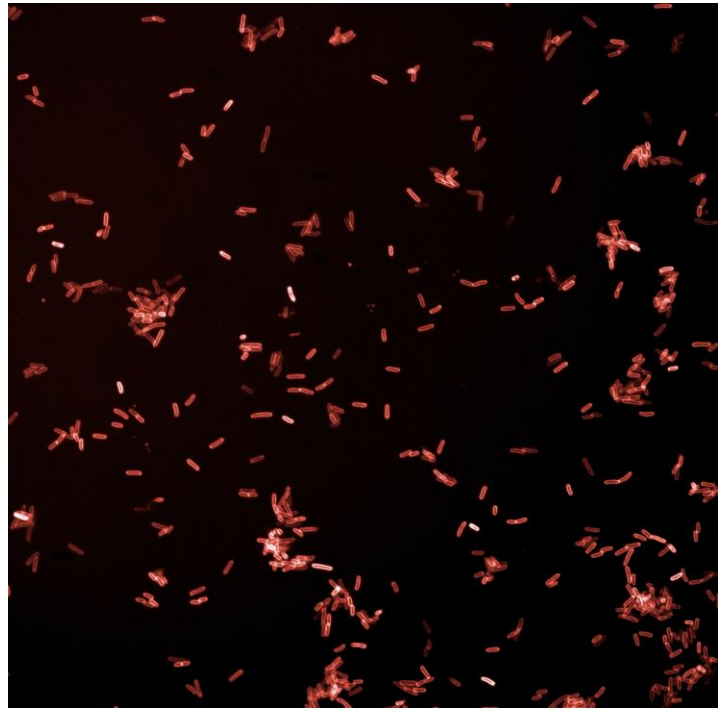
Nothing



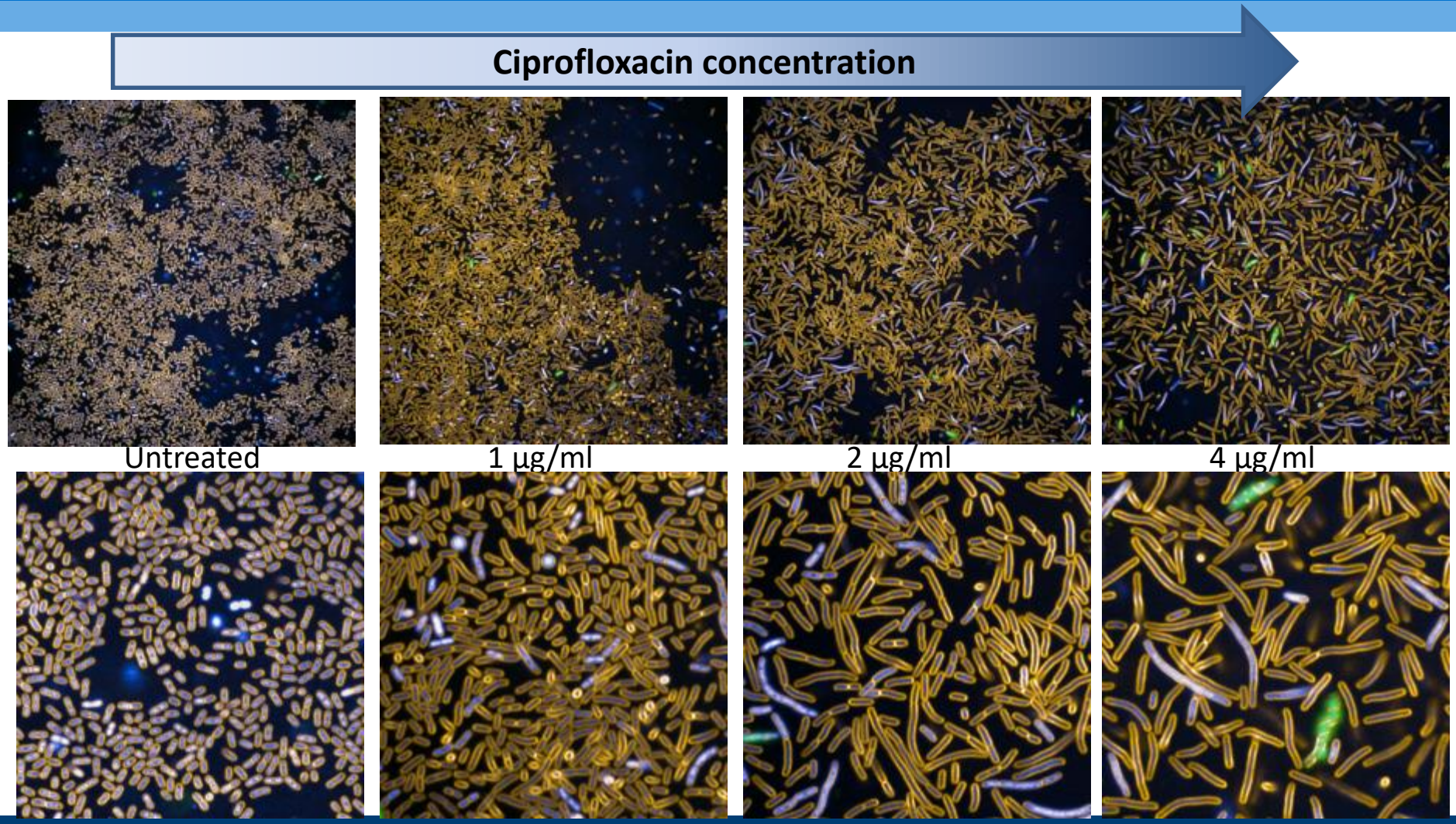
Collect data

New tools: The Opera Phenix

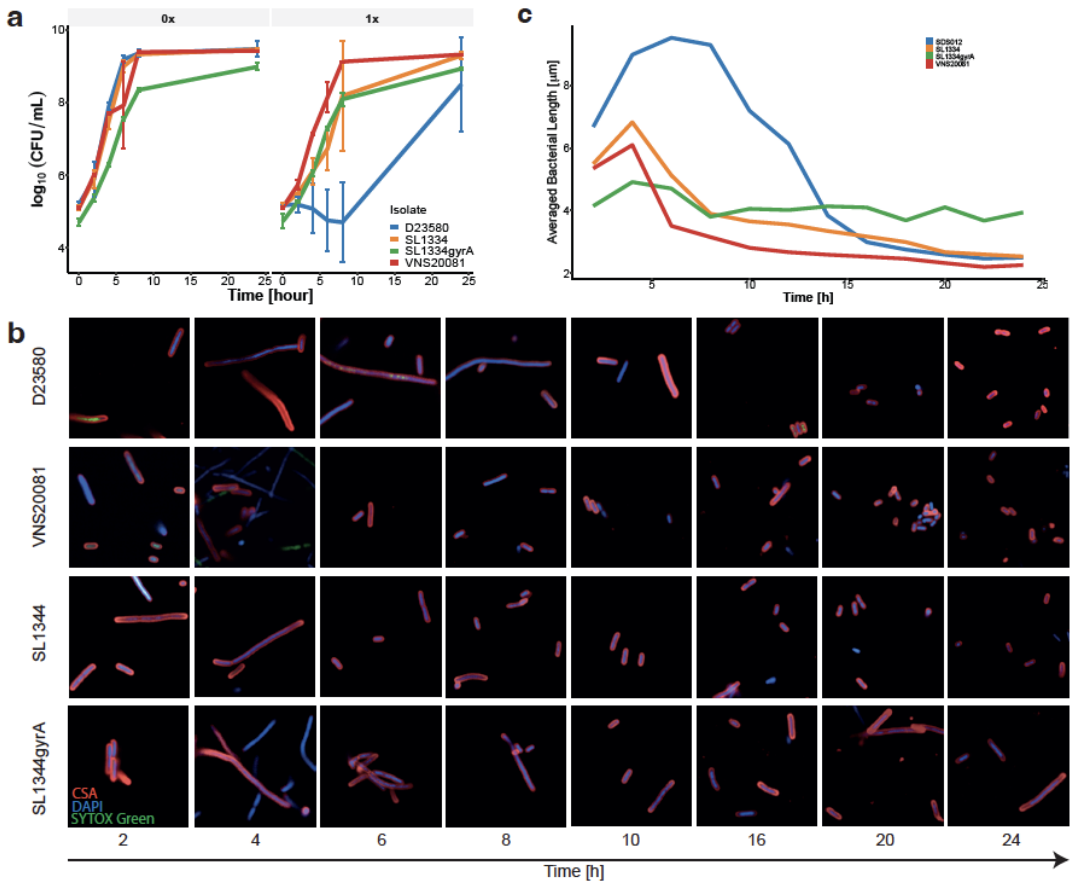


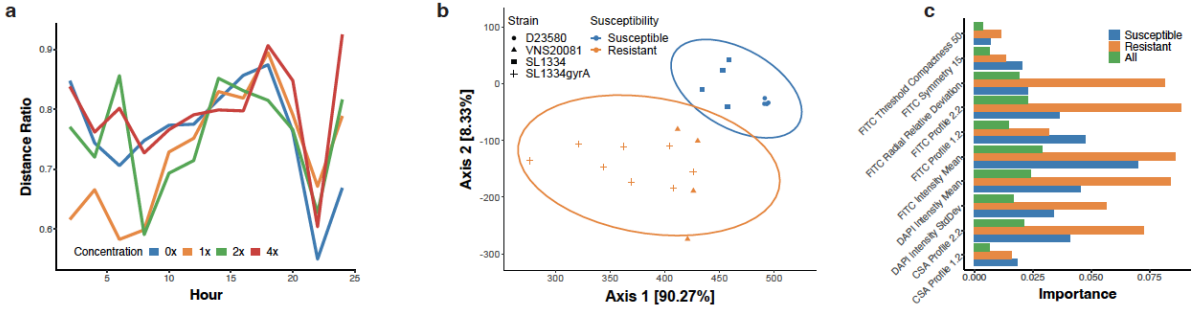


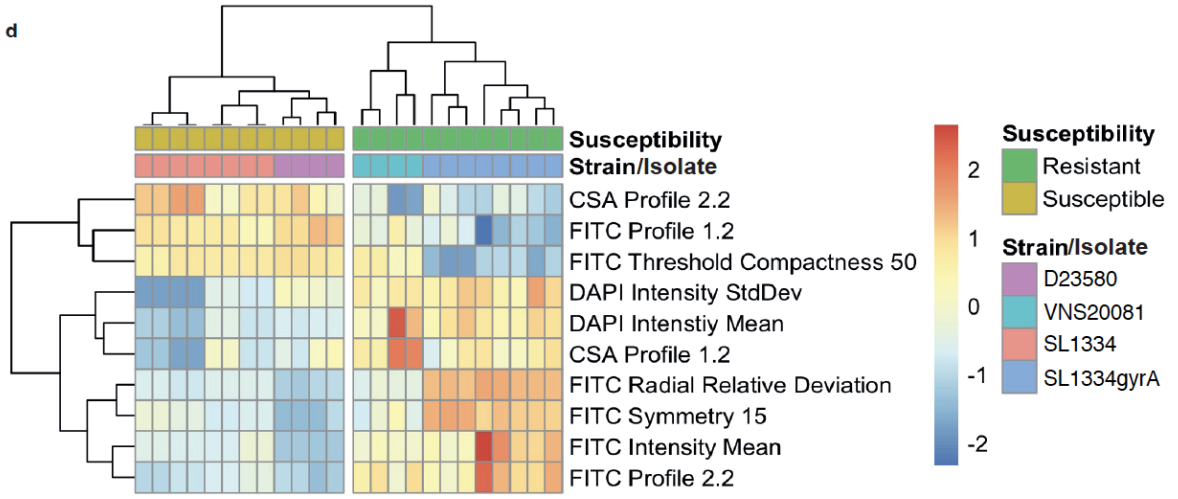
Clinical ESBL *Klebsiella pneumoniae* with ciprofloxacin



Predicting drug resistance via imaging and machine learning

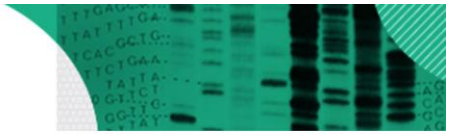






Monoclonal antibodies

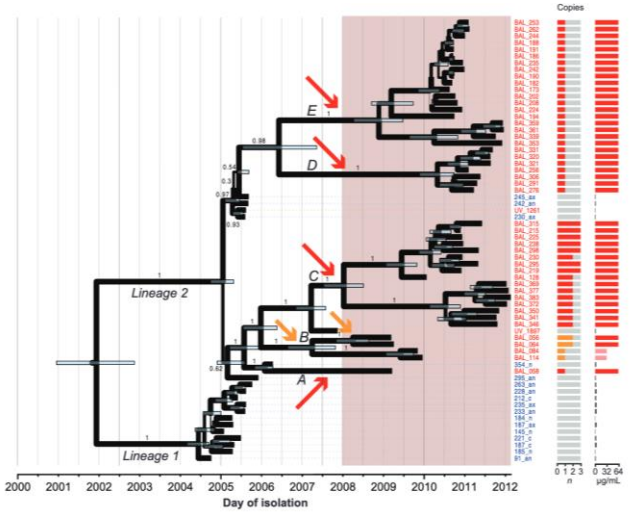
MICROBIAL GENOMICS
Bases to Biology

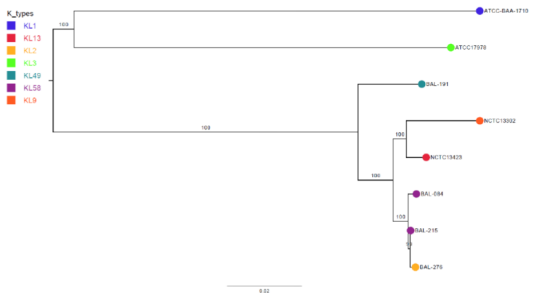


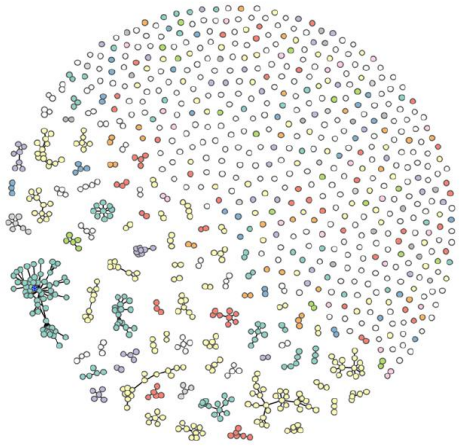
Research Paper

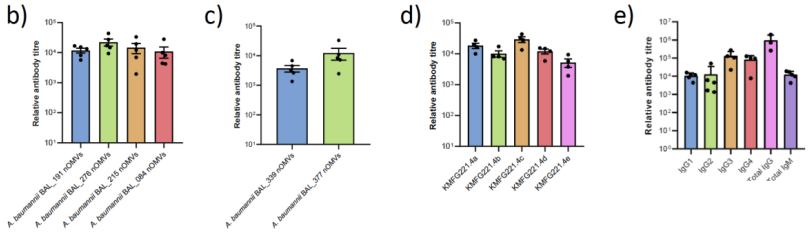
Repeated local emergence of carbapenem-resistant *Acinetobacter baumannii* in a single hospital ward

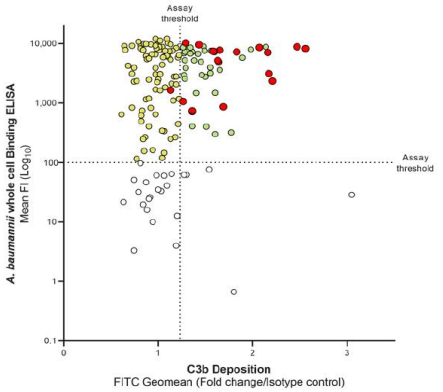
Mark B. Schultz,[1,2] Duy Pham Thanh,[3] Nhu Tran Do Hoan,[3] Ryan R. Wick,[1,2] Danielle J. Ingle,[1,2] Jane Hawkey,[1,2] David J. Edwards,[1,2] Johanna J. Kenyon,[4,5] Nguyen Phu Huong Lan,[3,6] James I. Campbell,[3] Guy Thwaites,[3] Nguyen Thi Khanh Nhu,[3,6] Ruth M. Hall,[4] Alexandre Fournier-Level,[7] Stephen Baker[3,6] and Kathryn E. Holt[1,2]



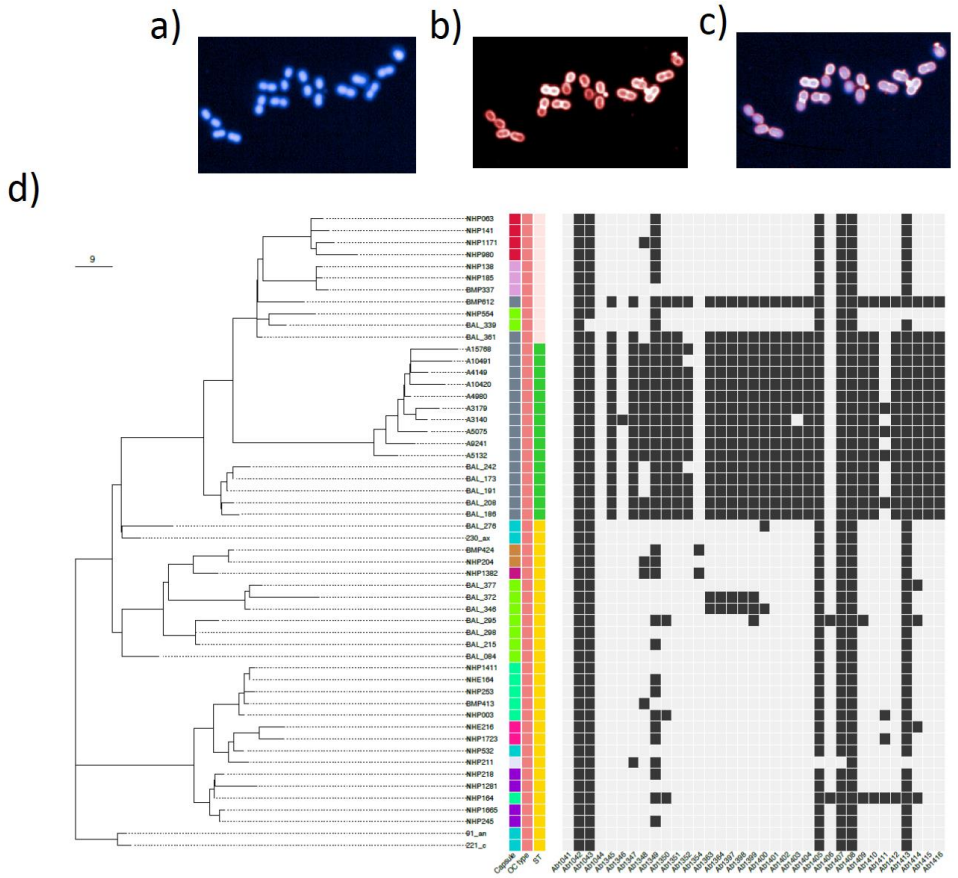


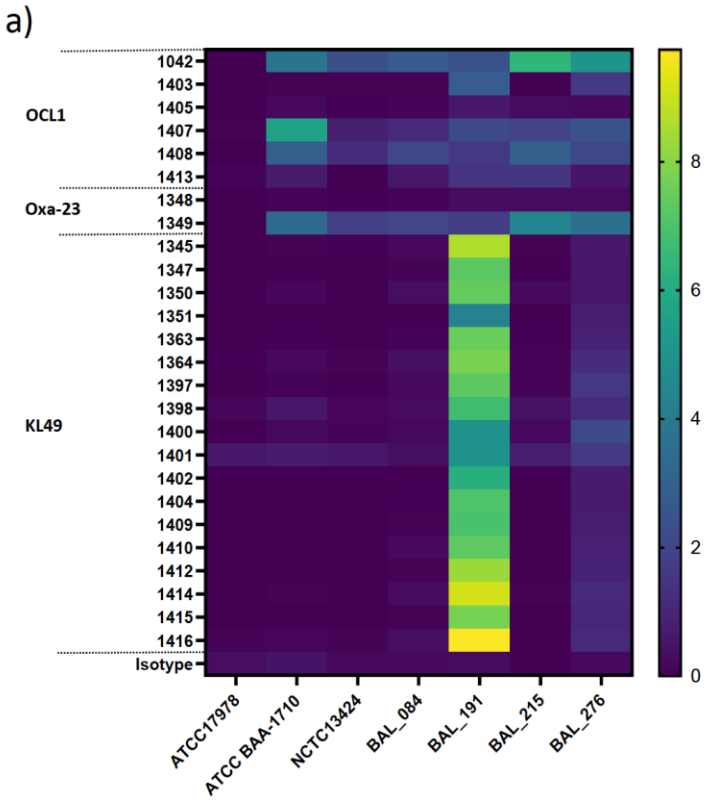


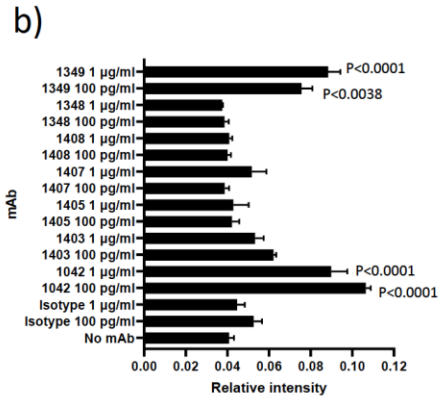




Monoclonal antibodies







Monoclonal antibodies

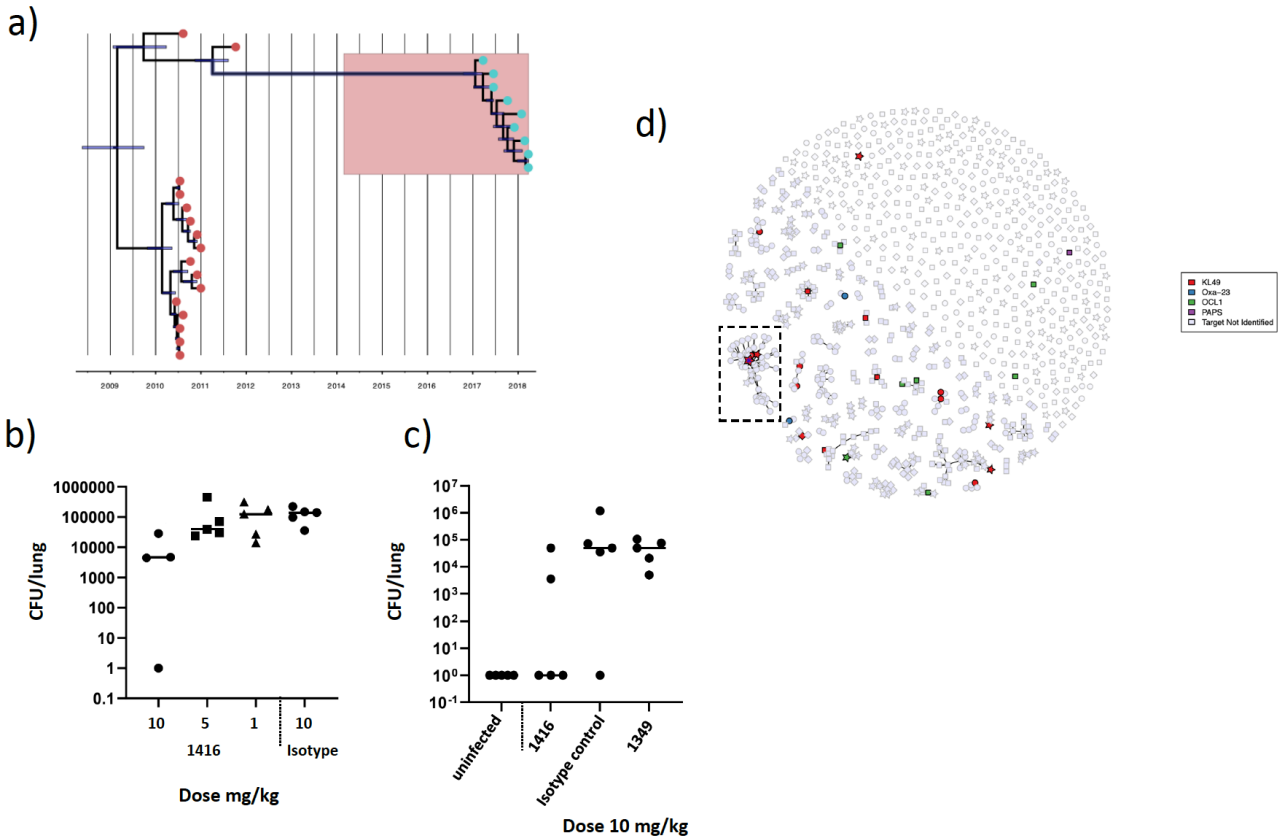
PLOS GLOBAL PUBLIC HEALTH

RESEARCH ARTICLE

Clinical and laboratory factors associated with neonatal sepsis mortality at a major Vietnamese children's hospital

Nguyen Duc Toan[1,2,3], Thomas C. Darton[4], Nguyen Hoang Thien Huong[1,5], Le Thanh Hoang Nhat[2], To Nguyen Thi Nguyen[2], Ha Thanh Tuyen[2], Le Quoc Thinh[1], Nguyen Kien Mau[1], Pham Thi Thanh Tam[2], Cam Ngoc Phuong[6], Le Nguyen Thanh Nhan[1,2], Ngo Ngoc Quang Minh[1], Ngo Minh Xuan[3], Tang Chi Thuong[3,7], Nguyen Thanh Hung[1,3,5], Christine Boinett[8], Stephen Reece[9], Abhilasha Karkey[10], Jeremy N. Day[2,11], Stephen Baker[12,13]*

1 Clinical Departments, Children's Hospital 1, Ho Chi Minh City, Vietnam, **2** Hospital for Tropical Diseases, Wellcome Trust Africa and Asia Programmes, Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam, **3** Department of Paediatrics, Pham Ngoc Thach University of Medicine, Ho Chi Minh City, Vietnam, **4** Department of Infection, Immunity and Cardiovascular Disease, University of Sheffield Medical School, Sheffield, United Kingdom, **5** Department of Paediatrics, Vietnam National University School of Medicine, Ho



The takeaways

- I am applied microbiologist working in global health
- AMR is a major global health care challenge
- We need new ideas in science, funding and policy
- We have access to a whole host of possibilities

- Some mechanisms to approach this

  - Repurpose
  - Diagnostics
  - Vaccines
  - New epidemiology
  - mAbs

- We really require some direction and some innovation that won’t be supplied by pharma

Collaboration, collaboration, collaboration

The group at University of Cambridge

OUCRU Vietnam

OUCRU Nepal

Oxford University UK

Kymab/Sanofi

The Sanger Institute

GSK Tres cantos

GSK Siena

LSHTM

Many UK collaborators

Many Overseas collaborators

And you for listening