Antibiotic resistance: strategy and activities of the Institut Pasteur

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STOA working breakfast
Solving Antibiotic Resistance
Antibiotic resistance (AMR) towards a dangerous situation

70 Years ago

Today

⇒ Some microbial infections are resistant to all currently used antibiotics
AMR is a global issue

Digestive carriage of ESBL Producing *Enterobacteriaceae*

- WHO area
  - Africa
  - America
  - Eastern Mediterranean
  - Europe
  - South East Asia
  - Western Pacific

- Study size
  - 1,000
  - 500
  - 100

Rate of bacteraemia with carbapenem resistant *Enterobacteriaceae*

- Percentage resistance
  - < 1%
  - 1 to < 5%
  - 5 to < 10%
  - 10 to < 25%
  - 25 to < 50%
  - ≥ 50%
  - No data reported or less than 10 isolates
  - Not included

⇒ Increased risk of AMR infections or colonisations acquired overseas
Needs for research on antibiotics

• Policy to slow the development and spread of AMR
  – Reduce consumption in humans and in animals
  – Use the right Ab combination
⇒ Understanding the evolution, the dynamic and the ecology of antibiotic resistance
⇒ Smart surveillance in the hospital, the community
⇒ Improving diagnostic

• New antibiotics
⇒ Identification and characterisation of new targets
⇒ Identification and synthesis of active molecules
⇒ Testing promising candidates
⇒ Vaccines and alternative strategies
The Institut Pasteur in Paris

- A private non-for-profit foundation in Paris
- 2,436 Persons 653 scientists
- 1,000/year students Master PhD postdoc
- 130 Research units
Institut Pasteur International Network
33 Institutes in 26 countries
Four core missions of public interest

• Research
  – Fundamental and clinical research

• Education
  – Courses
  – Student training

• Public health
  – Epidemiology
  – National reference centres

• Valorisation of scientific research
  – technology transfer and industrial partnerships
  – Creation of start-up

=> The four missions contribute to the research on antibiotics
Understanding the emergence of antibiotic resistance

• Dissemination of antibiotic resistance results of
  – Dissemination of clones
  – Dissemination of antibiotic resistance genes

Emergence of GBS neonatal infection

- U. Bacterial Genomic Plasticity
- U. Ecology and Evolution of Antibiotic Resistance
- U. Microbial Evolutionary Genomics
Public health and clinical research

- National reference centres: *Salmonella*, *Escherichia coli*, *Neisseria* ... (also WHO centres)
- Implementing new technologies for molecular epidemiology and surveillance
- Partnership with APHP (Assistance Publique – Hopitaux de Paris): from bed to bench
  - Carbapenem resistant *Enterobacteriaceae* (NRC)
  - Antibiotic locks on catheters
- Epidemiological studies with the International Network
- A one health approach of AMR
New antimicrobial strategies and new antibiotics

• Characterization of new targets and design of new antibiotics
  – Structural biology units
  – Research on the bacterial cell wall:
    • U. Microbial Morphogenesis and Growth
    • U. Biology and Genetics of Bacterial Cell Wall

• Development of alternative strategies
  – Vaccines
  – Phagotherapy
  – CRISPR-cas9 targeting MDR strains
Teaching and training

• Long lasting tradition in teaching fundamental and clinical microbiology

• Two courses on antibiotics:
  – Pasteur-Mérieux Course: Advanced Course on Antibiotics.
  – Résistance bactérienne aux antibiotiques

• Epidemiology and public health courses
Institut Pasteur as a Centre for antimicrobial research

- Fundamental microbiology, Immunology
- Public health clinics and epidemiology
- National and international collaborations, industrial partnerships
- Technology transfers
- Courses and training

International network
Institut Pasteur