

Phagothérapie : Où en est-on en Europe et en France ?

Tristan Ferry,^{1,2,3,4}  
tristan.ferry@univ-lyon1.fr

¹Infectious and Tropical Diseases Unit, Croix-Rousse Hospital, Hospices Civils de Lyon, ²Claude Bernard Lyon 1 University,
³Centre International de Recherche en Infectiologie, ⁴Centre de Référence des IOA complexes de Lyon (CRIOAc Lyon),

Clinical Officer of the



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FOR NON-TRADITIONAL
ANTIBACTERIAL THERAPY

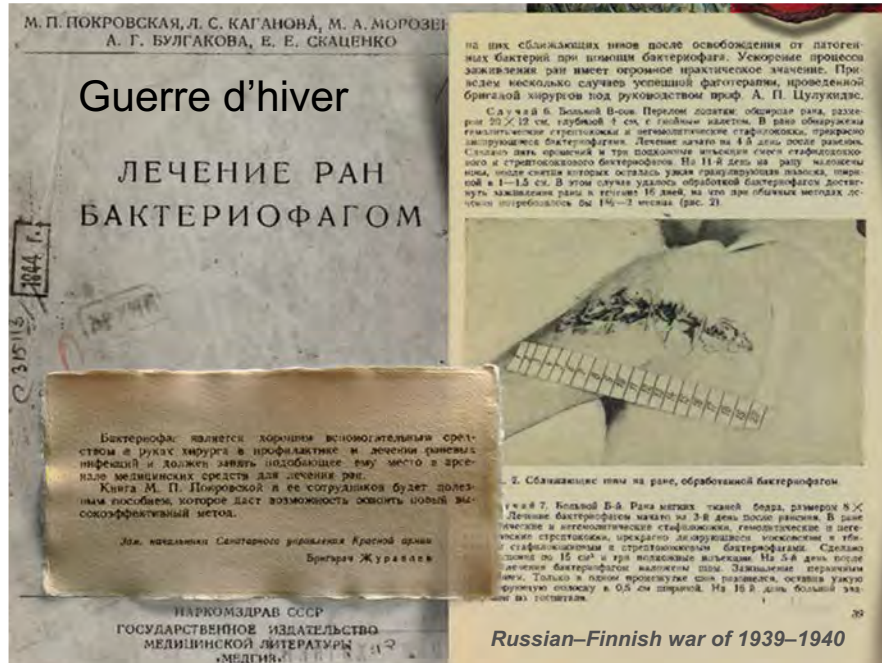
European Society of Clinical Microbiology and Infectious Diseases



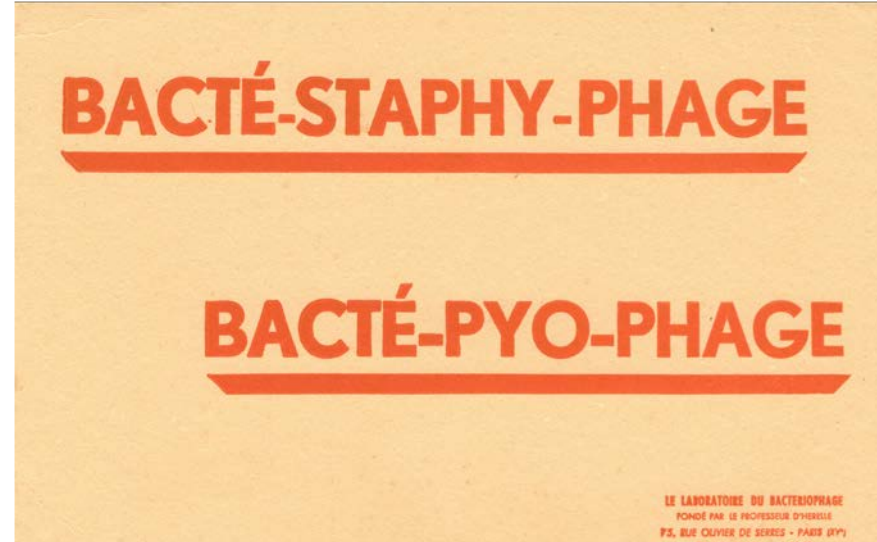
PHAGE_{in}LYON



Thérapie phagique



Russian-Finnish war of 1939-1940





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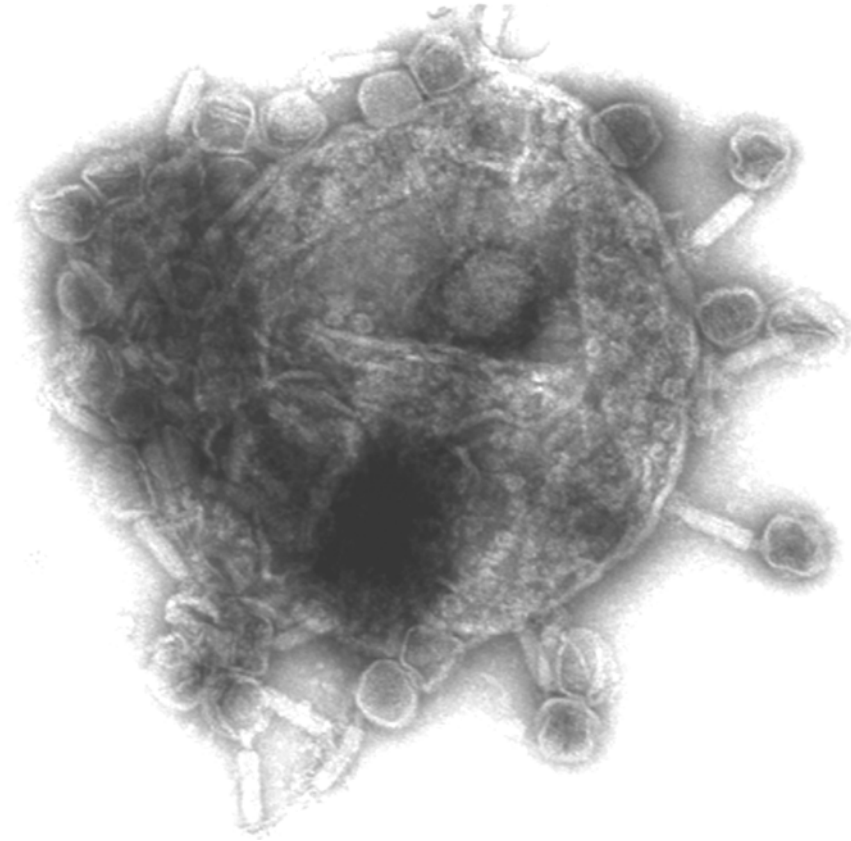


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- PYO Bacteriophage
- FERSIS Bacteriophage
- STAPHYLOCOCCAL Bacteriophage
- SES Bacteriophage
- INTESTI Bacteriophage
- ENKO Bacteriophage

Bacteriophage (*Myoviridae*) targeting *S. aureus*



Merabishvili et al. PloS ONE 2009





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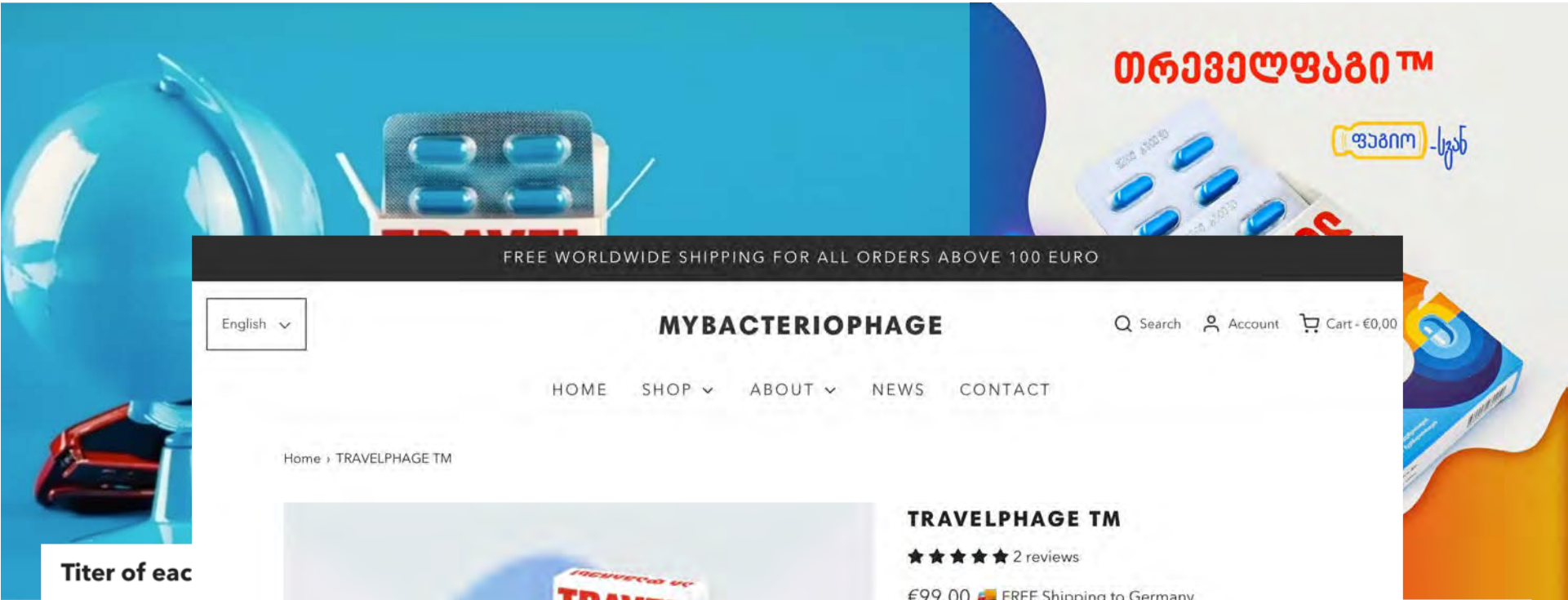




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L'Institut d'Immunologie et de Thérapie expérimentale Ludwig Hirszfeld de Wrocław



The Institute of Immunology and Experimental Therapy PAS in Wrocław (IIET PAS) has been conducting research on the biological properties and the application of bacteriophages for several decades. It has at its disposal methods for isolating bacteriophages and for preparing phage formulations which have been provided for different hospitals in Poland for phage therapy coordinated by the institute since the 1970s.





RESULTS OF BACTERIOPHAGE TREATMENT
OF SUPPURATIVE BACTERIAL INFECTIONS*
III. DETAILED EVALUATION OF THE RESULTS
OBTAINED IN FURTHER 150 CASES

by

STEFAN ŚLOPEK, IRENA DURLAKOWA, BEATA WEBER-DĄBROWSKA, MAREK DĄBROWSKI
and ALINA KUCHARWICZ-KRUKOWSKA

Institute of Immunology and Experimental Therapy, Polish Academy of Sciences, Czerska 12,
53-114 Wrocław

Wrocław clinic uses 'super viruses' to battle rebellious bacteria

JOANNA JASIŃSKA MARCH 22, 2020



Professor Andrzej Górski



Doctor Ryszard Młyński with Anna Kubalska, one of the Medical Unit's patients.
Kolbar/TFN



The Institute of Immunology and Experimental Therapy's Medical Centre has been looking for a cure for patients who have lost all hope that their ailments could disappear.
Kolbar/TFN



"Our centre treats antibiotic-resistant infections. The great problem in medicine today is that we are becoming defenceless against the bacteria that cause them," says Professor Andrzej Górski.
Kolbar/TFN

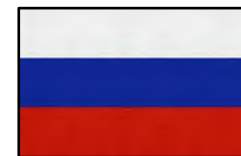


The Institute is supported by the Bacteriophage Laboratory, which stores over 600 different phages.
Kolbar/TFN



We carry phages in our bodies says Doctor Beata Weber-Dąbrowska.
Kolbar/TFN

Bactériophages Russes



Production « GMP »

1 000 000 000 (un milliard) de boîtes/an



*И. Д. Канорский, А. Г. Ханин, З. Ф. Василькова, З. В. Смолина,
Г. С. Осенина*

ТЕЧЕНИЕ РАНЕВОГО ПРОЦЕССА НА ФОНЕ ФАГОТЕРАПИИ ХРОНИЧЕСКОГО ОСТЕОМИЕЛИТА

Клиника общей хирургии (зав. — акад. АМН СССР В. И. Стручков) и кафедра микробиологии (зав. — акад. АМН СССР П. Н. Косяков) I ММИ им. И. М. Сеченова

препарата в возрастающих дозах — 0,5—1—1,5—2 и 2 мл через день в течение 1½—2 нед. У 12 больных осуществлено введение стафилококкового бактериофага в артерию, снабжающую кровью пораженную нижнюю конечность.

За динамикой регенеративных процессов под влиянием фаготерапии вели наблюдения как клинически, так и с помощью цитологических исследований отпечатков с поверхности ран, язв и мазков со стенки свищей по М. П. Покровской и М. С. Макарову. Одновременно проводили оценку состояния обмена веществ в клетках экссудата с помощью цитохимических методик. Течение хирургической инфекции и процессов фагоцитоза изучали с помощью микроскопического исследования препаратов.

В процессе лечения стафилококковым бактериофагом отпечатки с поверхности ран и язв и мазки со стенки свищей готовили в следующие сроки: до начала лечения, на 3, 6, 10, 15, 18-й дни лечения. Отпечатки и мазки изучены у 72 больных. Препараты окрашивали для общего цитологического исследования по Гимзе—Романовскому в модификации Лилли, на гликоген применяли ШИК-реакцию по Мак Манусу, нуклеиновые кислоты выявляли окраской галлоцианином по Эйнарсону. Количественное содержание гликогена в цитоплазме и ДНК в ядрах нейтрофилов (100 клеток) оценивали следующим образом: + малое содержание, ++ умеренное содержание, +++ высокое содержание. Содержание гликогена в 100 клетках оценивали в условных единицах Кеплоу.

*И. Д. Канорский, А. Г. Ханин, З. Ф. Василькова, З. В. Смолина,
Г. С. Осенина*

ТЕЧЕНИЕ РАНЕВОГО ПРОЦЕССА НА ФОНЕ ФАГОТЕРАПИИ ХРОНИЧЕСКОГО ОСТЕОМИЕЛИТА

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COURSE OF WOUND PROCESS IN PHAGOTHERAPY OF CHRONIC OSTEOMYELITIS

I. D. Kanorsky, A. G. Khanin, Z. F. Vasilkova, Z. V. Smolina, G. S. Osenina

The authors employed staphylococcal bacteriophage locally and parenterally in 117 patients with chronic osteomyelitis, pre- and postoperatively, in whom their pathogenic antibiotics-resistant microflora remained sensitive to the staphylococcal bacteriophage. As clinical, microbiological, cytological and histochemical examinations have demonstrated, phagotherapy produced a distinct antibacterial effect, resulted in a significant activation of the regenerative processes in the purulent wounds and persisting ulcers, which accelerated the healing of the wounds.



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Bacteriophage Pseudomonas Aeruginosa 4 x 20ml



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Bacteriophage Pseudomonas Aeruginosa, vial of 100 ml



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\$29⁰⁰

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Complex pyobacteriophage, vial of 100 ml



\$29⁰⁰

E.coli-Proteus bacteriophage liquid, vial of 100 ml



\$29⁰⁰

Intesti-bacteriophage liquid, bottles of 20 ml, 4 pcs.



\$29⁰⁰

Intesti-bacteriophage liquid, vial of 100 ml



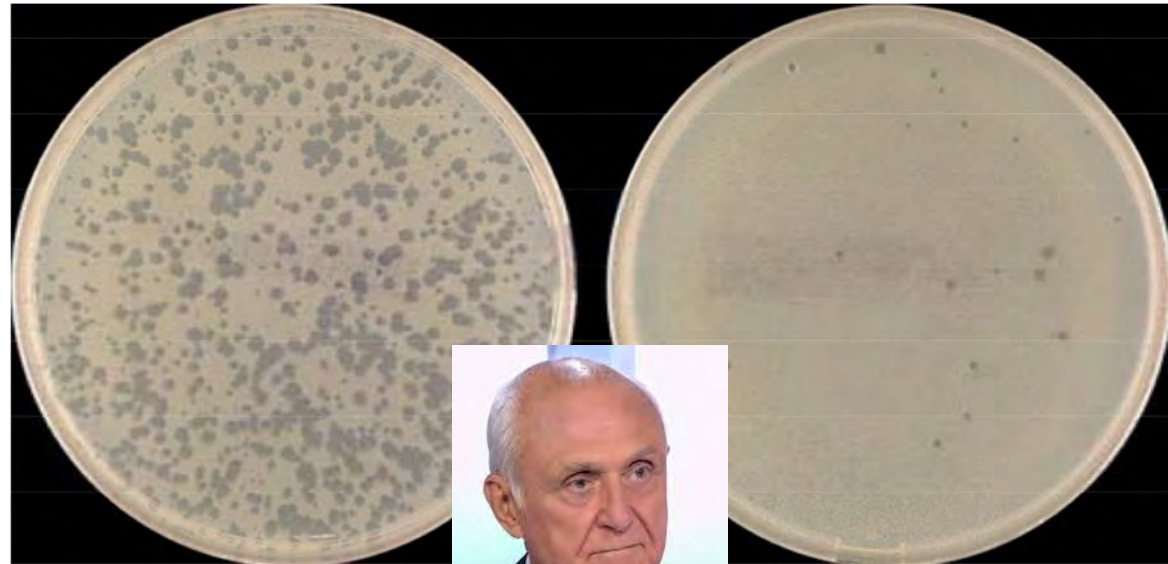
\$29⁰⁰

Klebsiella pneumoniae Bacteriophage purified liquid, bottles of 20 ml, 4 pcs.

CH Villeneuve Saint-Georges



O. Patey



A. Dublanquet



Opinion

Clinical Indications and Compassionate Use of Phage Therapy: Personal Experience and Literature Review with a Focus on Osteoarticular Infections

Olivier Patey ¹, Shawna McCallin ², Hubert Mazure ³, Max Liddle ⁴, Anthony Smithyman ⁵ and Alain Dublanchet ^{1,*}

N	Age; Sex	Symptom Onset; PT Start	Clinical Symptoms	Bacteria	Phage Therapy	Outcome
1	20; F	2004; 2006	Suppurating chronic otitis; intense pain	<i>S. aureus</i>	Commercial anti- <i>S. aureus</i> suspension; ear drop instillations (15 days)	2006 Complete cure
2	44; M	2005; 2008	Accidental fall; multiple fractures (<i>n</i> = 37); amputation considered	<i>S. aureus</i>	Commercial anti- <i>S. aureus</i> and Pyophage suspensions; administered peroperatively over several weeks	2009 Wound closure and complete cure
3	25; M	2007; 2008	Road accident causing multiple trauma; uncontrolled pelvic bone infection	<i>S. aureus</i> <i>P. aeruginosa</i>	Anti- <i>S. aureus</i> and anti- <i>P. aeruginosa</i> phage suspension; administered peroperatively and via catheter in days following operation (Belgium).	2010 Complete cure
4	40; F	1995; 2009	Fall leading to complex fracture of the right foot; Planned amputation	<i>S. aureus</i>	Commercial anti- <i>S. aureus</i> suspension administered peroperatively and via catheter in the days following operation	2009 Wound closure and complete cure
5	60; M	2008; 2009	Fistulised abdominal plaque infection; continuous suppressive antibiotic administration	Methicillin resistant <i>S. aureus</i> (MRSA)	Commercial anti- <i>S. aureus</i> suspension administered via fistula	2010 No recurrence without any antibiotic over 4 years
6	80; F	2008; 2010	Knee prosthesis infection unsuitable for surgery	<i>P. aeruginosa</i>	Commercial broad spectrum multi-bacteriophage suspension; Knee joint injection	2012 <i>P. aeruginosa</i> clearance, but appearance of <i>Enterococcus</i> sp.

...

15 patients (2008-2018)

Hôpital Militaire Reine Astrid

Bruxelles (Belgique)



Maia Merabishvili

Queen Astrid Military Hospital



Jean-Paul Pirnay

Daniel de Vos

Serge Jennes

Sarah Djebara



Declaration of Helsinki

Medical Research Involving Human Subjects



WMA

WORLD
MEDICAL
ASSOCIATION

Special Communication

World Medical Association Declaration of Helsinki
Ethical Principles for Medical Research
Involving Human Subjects

World Medical Association

JAMA 2013

The Journal of the
American Medical Association

- **Unproven Interventions in Clinical Practice**
- 37. In the treatment of an **individual patient, where** proven interventions do not exist or other **known interventions have been ineffective, the physician**, after seeking expert advice, **with informed consent from the patient** or a legally authorised representative, **may use an unproven intervention** if in the **physician's judgement** it offers **hope of saving life, re-establishing health** or alleviating suffering.



A phage application at the Queen Astrid Military Hospital under the umbrella of the Helsinki declaration and patients informed consent



Courtesy JP. Pirnay

Communication

Processing Phage Therapy Requests in a Brussels Military Hospital: Lessons Identified

Sarah Djebara ^{1,*}, Christiane Maussen ¹, Daniel De Vos ², Maya Merabishvili ² , Benjamin Damanet ¹, Kim Win Pang ¹ , Peggy De Leenheer ¹, Isabella Strachinaru ¹, Patrick Soentjens ¹  and Jean-Paul Pirnay ² 

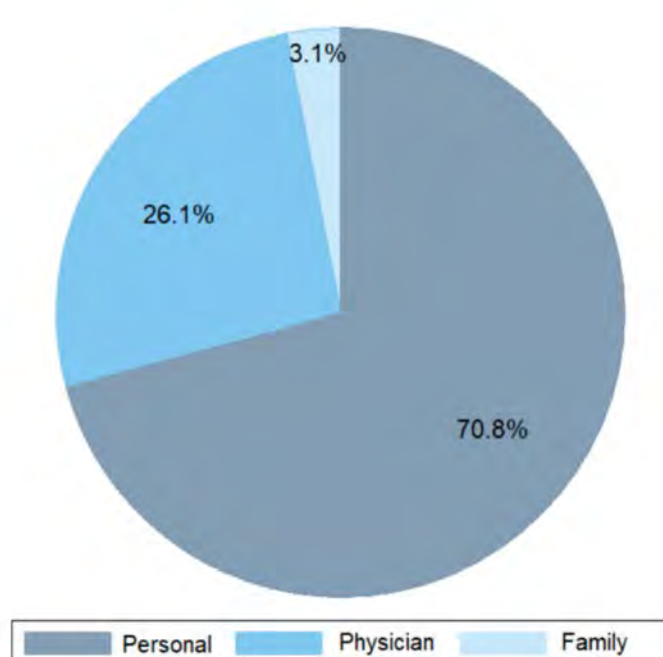


Figure 2. Initiators of the 260 phage therapy requests.

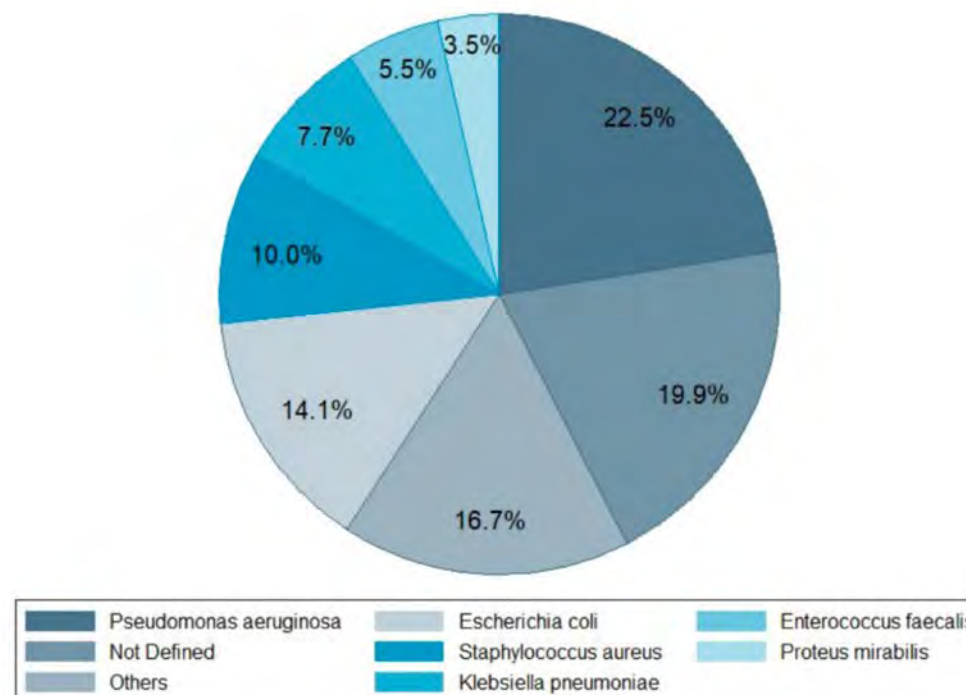


Figure 3. Relative prevalence of 311 reported bacterial pathogens (Table 1).

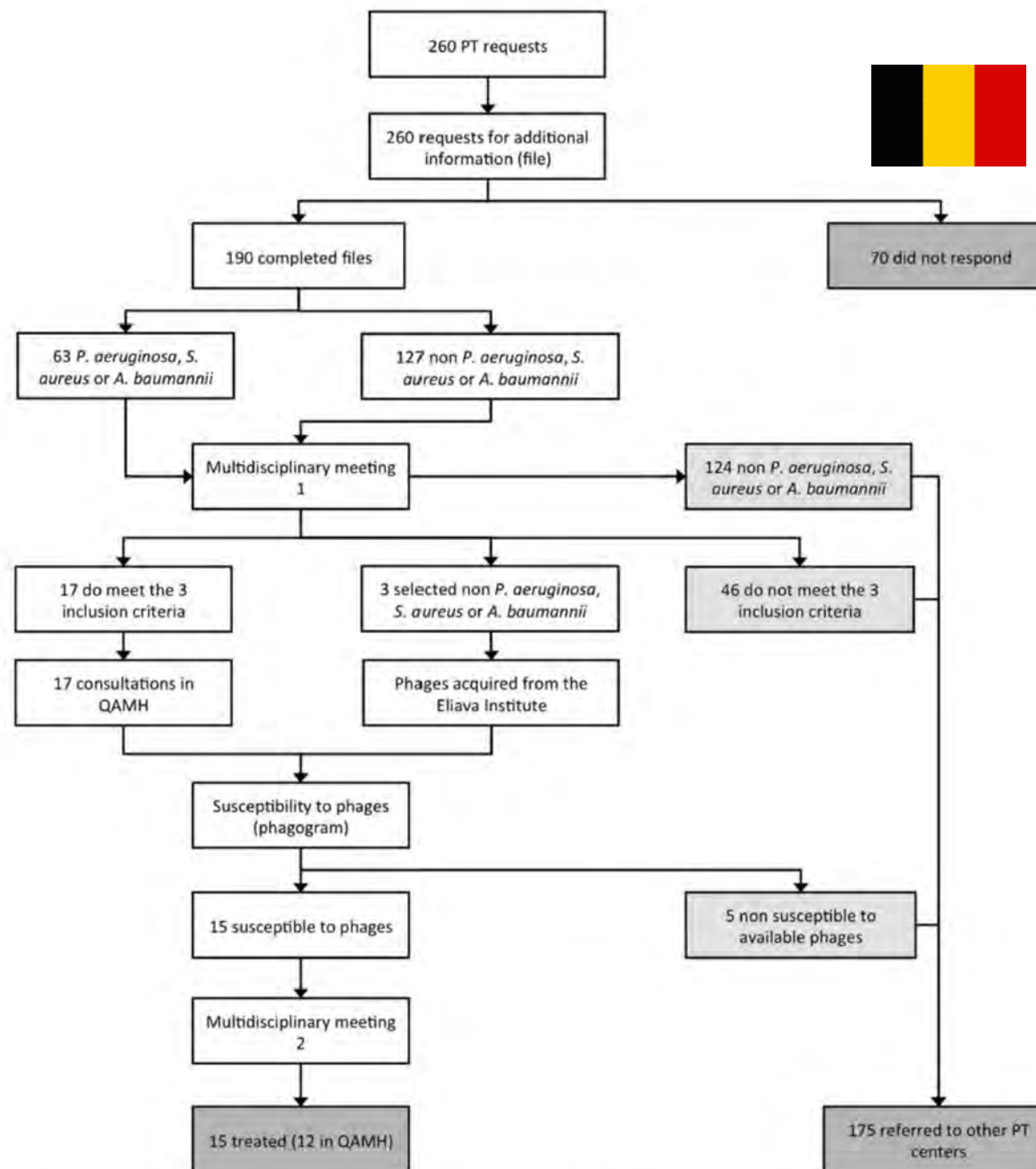


Figure 1. Patient care workflow in phage therapy at the Queen Astrid military hospital in Brussels (Belgium). PT, phage therapy; QAMH, Queen Astrid military hospital.

[Home](#)

Bacteriophage therapy

Bacteriophage therapy can be used as a treatment for bacterial infections and is an alternative for a treatment with antibiotics.

Bacteriophages are the natural enemies of bacteria. They recognise and infect their target bacteria, enabling the bacteria to produce new bacteriophages. Ultimately the bacteria will burst and release new bacteriophages in the area, which in turn can infect other bacteria, restarting the process.

On this page

- ↓ [How does bacteriophage therapy work?](#)
- ↓ [Who is eligible?](#)
- ↓ [Referral procedure](#)
- ↓ [Want to find out more?](#)



Who is eligible?

The following strictly defined infection disease qualify for bacteriophage therapy:

- Chronic rhinosinusitis
- Pulmonary infections: bronchiectasis and cystic fibrosis
- Musculoskeletal infections
- Sepsis (blood poisoning)

Coordination group for Bacteriophage therapy Leuven (CBL)

The Coordination group for Bacteriophage therapy Leuven (CBL) plays a crucial part in establishing and monitoring a structured care path for bacteriophage therapy within UZ Leuven.

General coordination

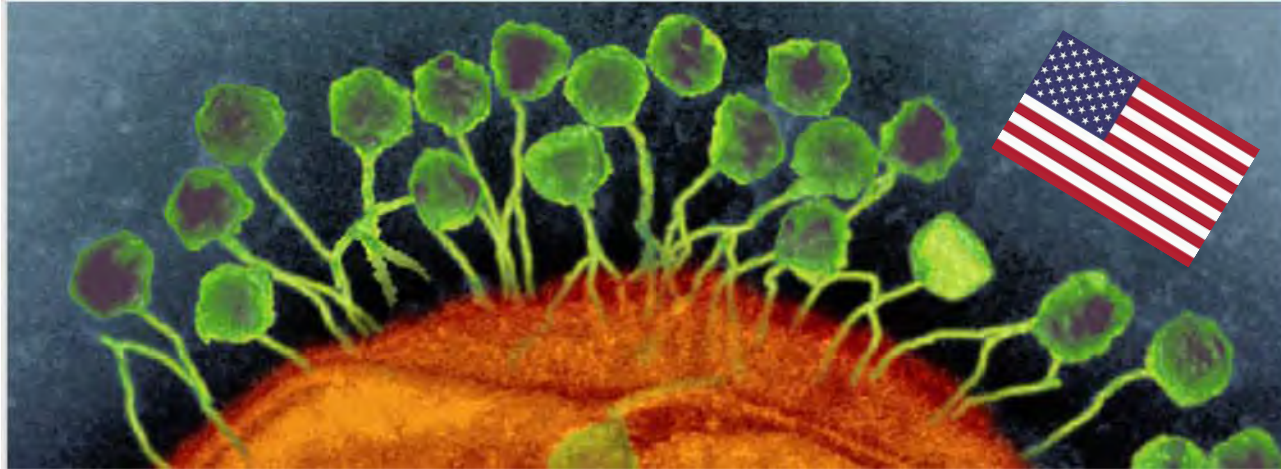


**Metsemakers Wilhelmus,
prof. dr.**
Surgeon-traumatologist



Onsea Jolien
Clinical support manager





Welcome to IPATH

Center for Innovative Phage Applications and Therapeutics

We are the first dedicated phage therapy center in North America, bringing innovative research and clinical practice to the field of medicine. Join us on our journey and witness a revolutionary wave of solutions to combat antibiotic resistance.



Lessons Learned From the First 10 Consecutive Cases of Intravenous Bacteriophage Therapy to Treat Multidrug-Resistant Bacterial Infections at a Single Center in the United States



Saima Aslam,^{1,2} Elizabeth Lampley,² Darcy Wooten,¹ Maile Karris,¹ Constance Benson,^{1,2} Steffanie Strathdee,^{1,2} and Robert T. Schooley^{1,2}

¹Division of Infectious Diseases and Global Public Health, University of California, San Diego, La Jolla, California, USA, and ²Center for Innovative Phage Applications and Therapeutics, University of California, San Diego, La Jolla, California, USA

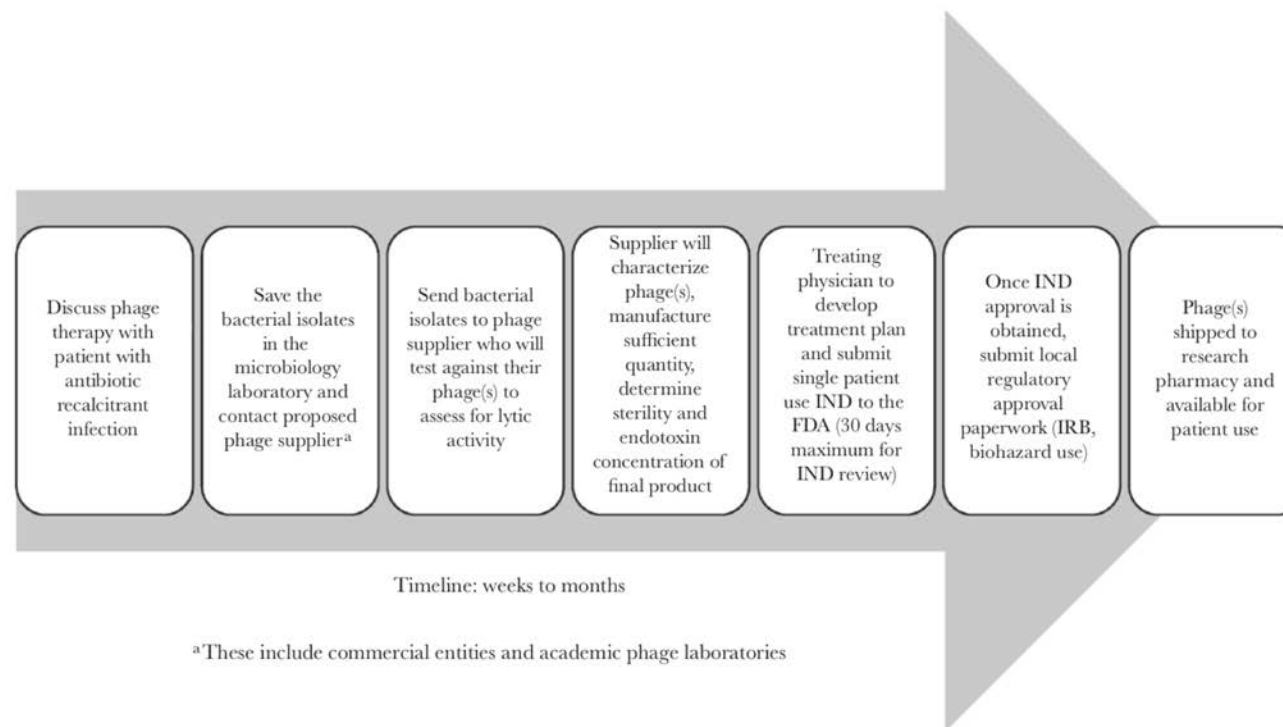


Figure 2. Timeline of the process to initiate bacteriophage therapy for a patient on a compassionate use basis in the United States. Abbreviations: FDA, Food and Drug Administration; IND, Investigational New Drug; IRB, institutional review board.

Lessons Learned From the First 10 Consecutive Cases of Intravenous Bacteriophage Therapy to Treat Multidrug-Resistant Bacterial Infections at a Single Center in the United States



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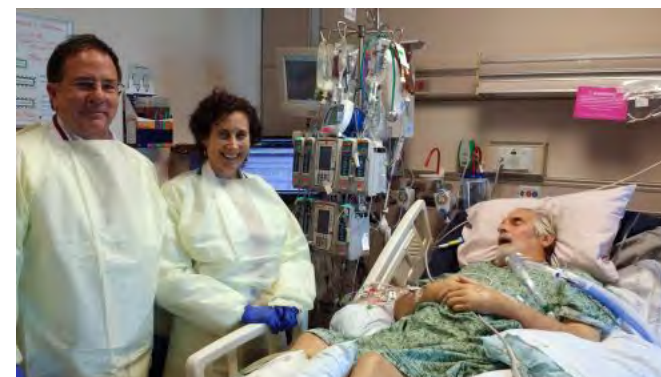
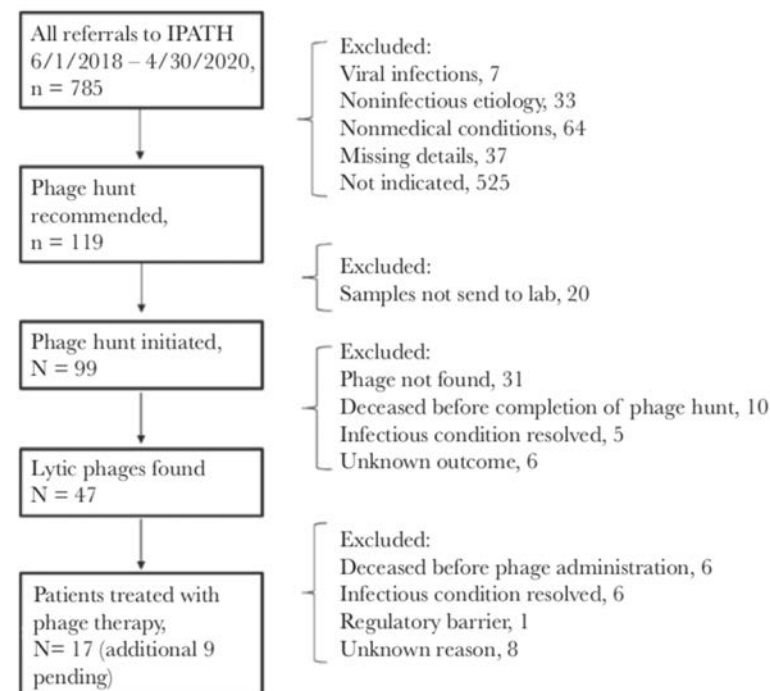


Figure 1. Flowchart depicting outcome of all bacteriophage therapy requests at the Center for Innovative Phage Applications and Therapeutics. Abbreviation: IPATH, Center for Innovative Phage Applications and Therapeutics.

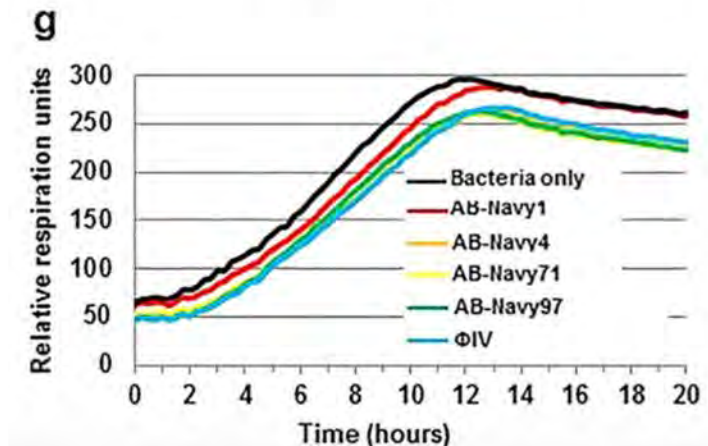
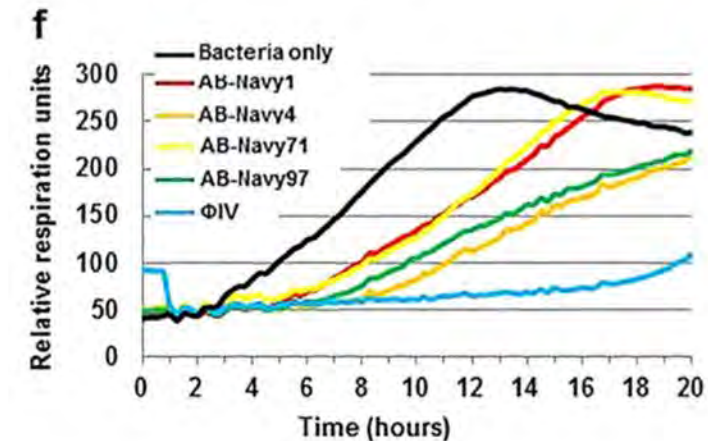
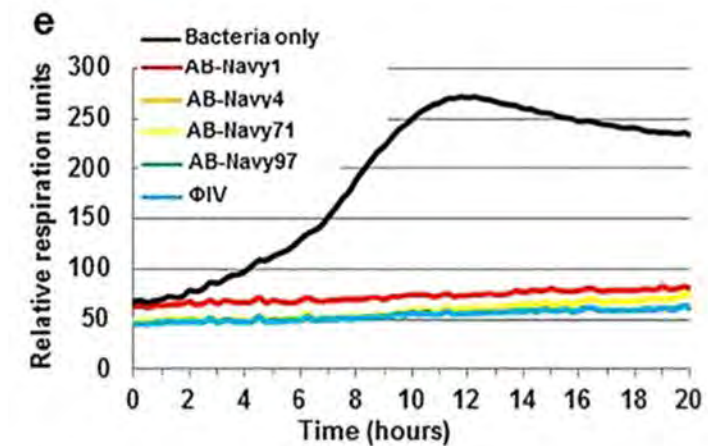


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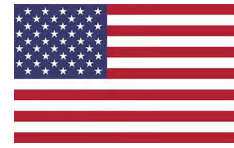
Development and Use of Personalized Bacteriophage-Based Therapeutic Cocktails To Treat a Patient with a Disseminated Resistant *Acinetobacter baumannii* Infection

Robert T. Schooley,^a Biswajit Biswas,^{b,c} Jason J. Gill,^{d,e}
Adriana Hernandez-Morales,^f Jacob Lancaster,^e Lauren Lessor,^e Jeremy J. Barr,^{g,o}
Sharon L. Reed,^{a,h} Forest Rohwer,^g Sean Benler,^g Anca M. Segall,^g Randy Taplitz,^a
Davey M. Smith,^a Kim Kerr,^a Monika Kumaraswamy,^a Victor Nizet,^{i,j} Leo Lin,ⁱ
Melanie D. McCauley,^a Steffanie A. Strathdee,^a Constance A. Benson,^a
Robert K. Pope,^k Brian M. Leroux,^k Andrew C. Picel,^l Alfred J. Mateczun,^b
Katherine E. Cilwa,ⁿ James M. Regeimbal,^b Luis A. Estrella,^b David M. Wolfe,^b
Matthew S. Henry,^{b,c} Javier Quinones,^{b,c} Scott Salka,^m Kimberly A. Bishop-Lilly,^{b,c}
Ry Young,^{e,f} Theron Hamilton^b



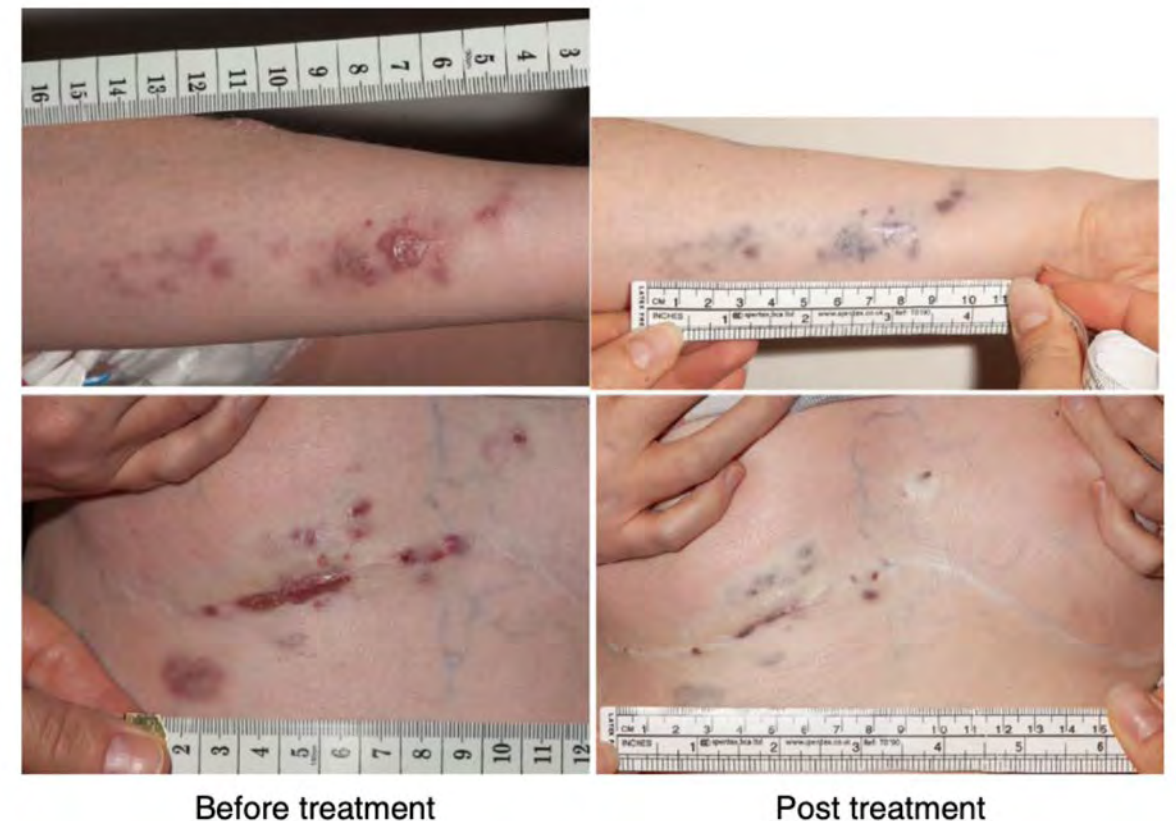
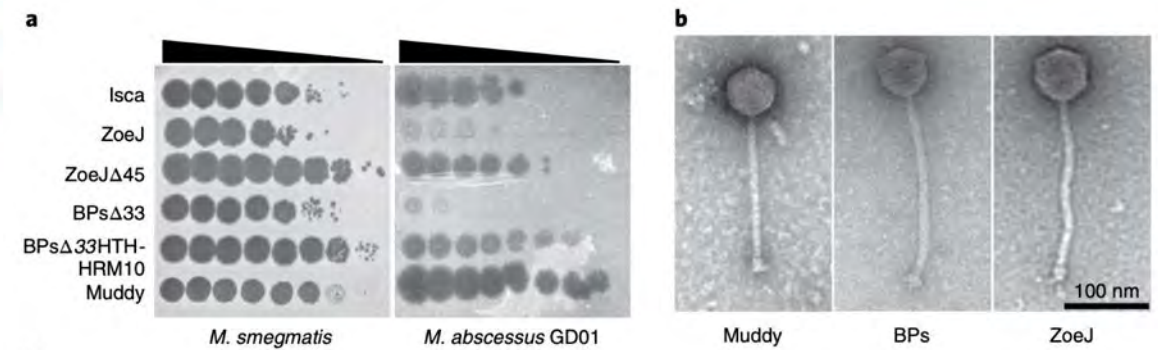
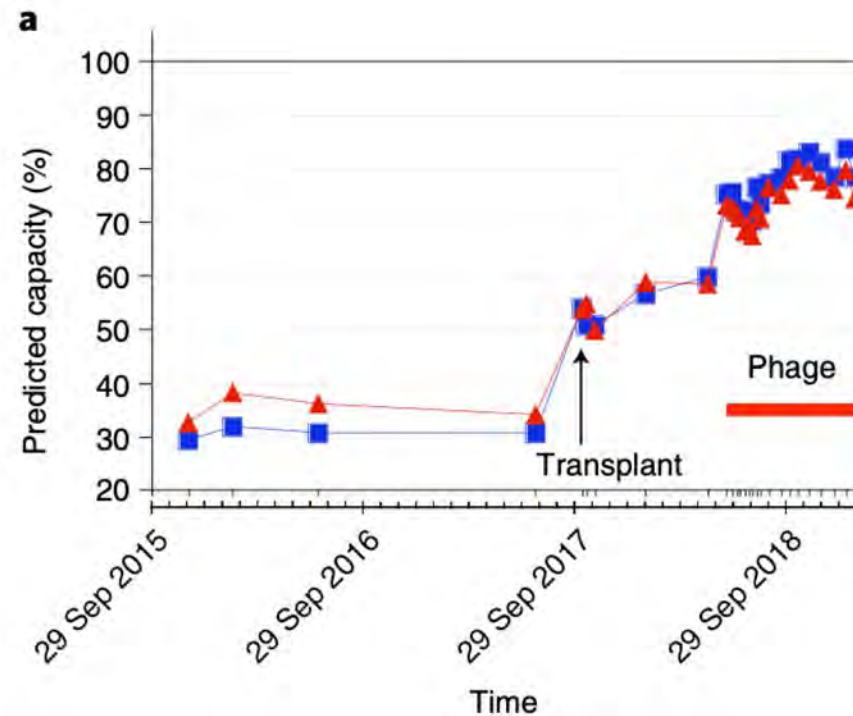
First use of pioneering phage virus therapy to treat patient with cystic fibrosis

10 May 2019, 1:38 p.m.



Engineered bacteriophages for treatment of a patient with a disseminated drug-resistant *Mycobacterium abscessus*

Rebekah M. Dedrick^{1,4}, Carlos A. Guerrero-Bustamante^{1,4}, Rebecca A. Garlena¹, Daniel A. Russell¹, Katrina Ford², Kathryn Harris², Kimberly C. Gilmour², James Soothill², Deborah Jacobs-Sera¹, Robert T. Schooley³, Graham F. Hatfull^{1*} and Helen Spencer^{1,2*}



Eight weeks of INTRAVENOUS phages (1 injection each 12 hours)

Production de bactériophages aux USA



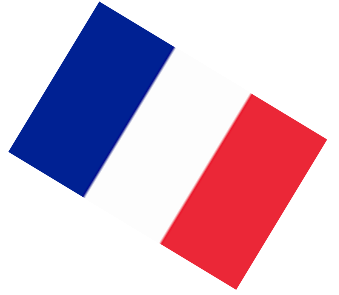
adaptive phage
THERAPEUTICS

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Tailored Antimicrobials and Innovative
Laboratories for **Phage** (Φ) Research

Développement de la phagothérapie en France



PHAGEⁱⁿLYON



BioNTech acquires bacteriophage company PhagoMed

The logo for BioNTech, featuring the word "BIONTECH" in a stylized font. The letters "BIO" and "TECH" are in green, while "N" and "T" are in a lighter green color.The logo for PhagoMed, featuring the word "PHAGOMED" in a blue, sans-serif font. A stylized hexagonal shape with internal lines is positioned above the letter "A".

BioNTech has announced it has completed the acquisition of the bacteriophage therapy, Austrian company PhagoMed GmbH to “increase its infectious disease portfolio capabilities”. According to the Handelsblatt, the operation may have involved a payment of up to €150M.

PhagoMed’s technology is based on two different platforms or therapeutic approaches. The first one uses synthetic lysins, i.e. improved versions of the enzymes produced by bacteriophages to break down and kill bacteria, to fight infectious diseases as an alternative to antibiotics.

The company’s second approach to treat infections involves the use of whole, recombined phages. Its lead candidate here is PM-399, a phage cocktail specifically assembled to treat complex *S. aureus* biofilms that form on implants, causing infection.

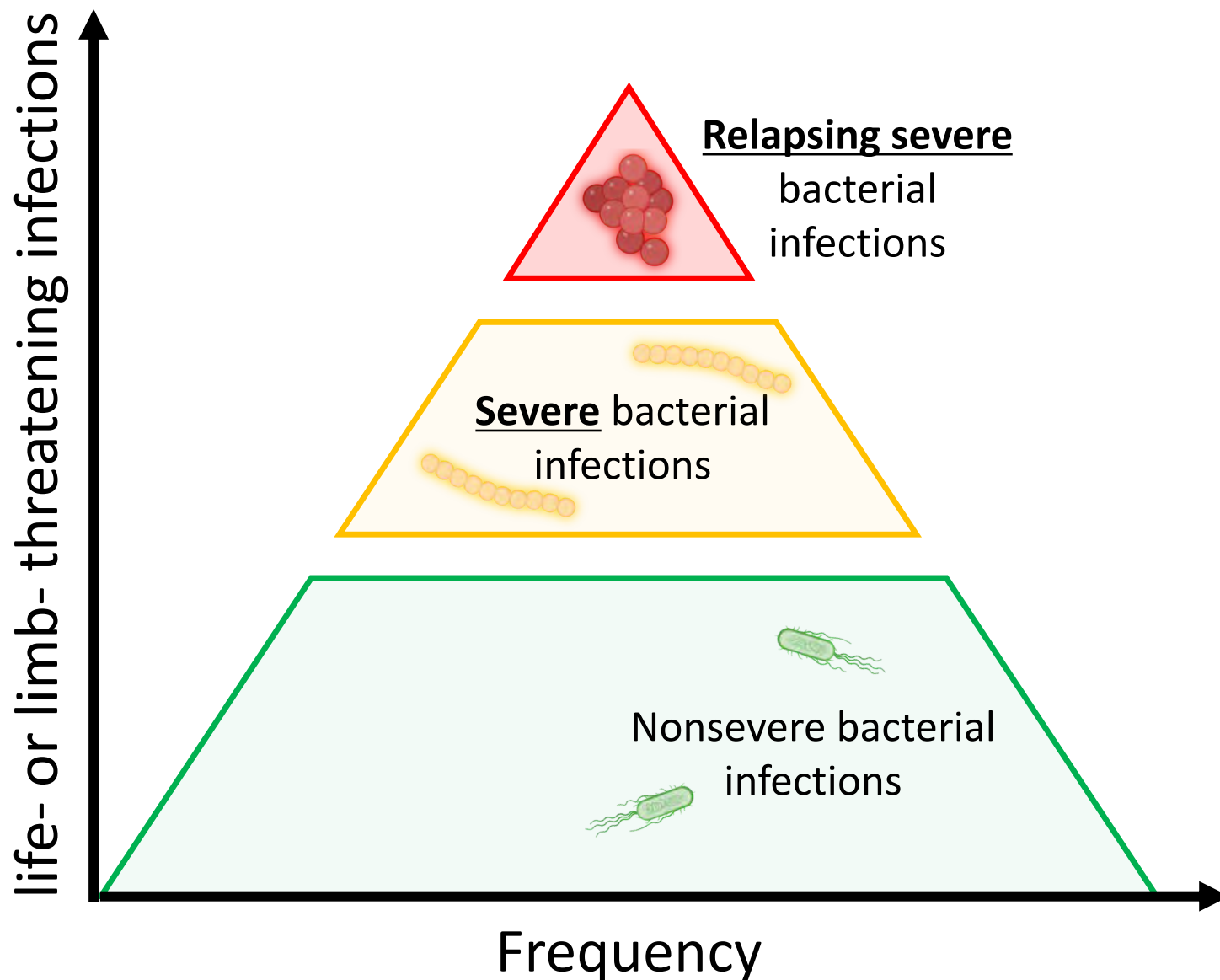
Technophage



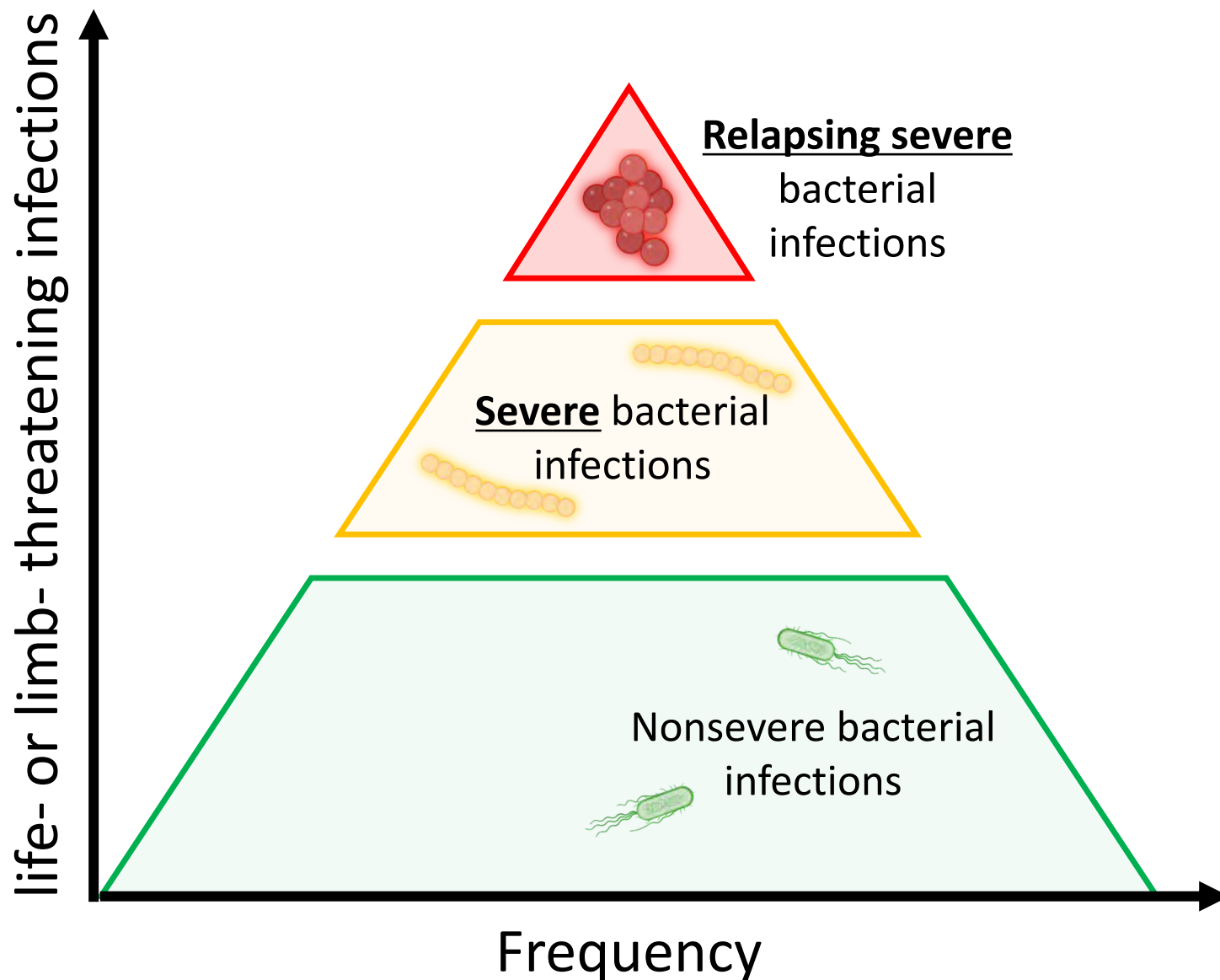
Launched in 2005, TechnoPhage is an innovative biopharmaceutical company committed to the R&D of new biological molecules in several therapeutic areas, such as infection, neuroscience, and ophthalmology. **TechnoPhage's strategy is based on developing new therapeutics from early discovery to clinical development, including in-house capacity for process development, and GMP production.** The company has recently launched its own GMP manufacturing plant specialized in the production of biologics such as bacteriophages and antibody fragments.



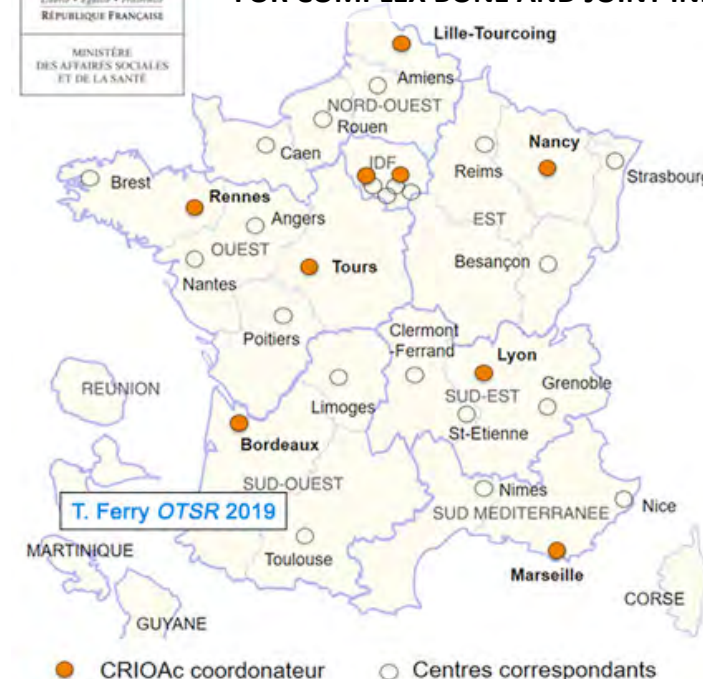
The pyramid of bacterial infectious diseases



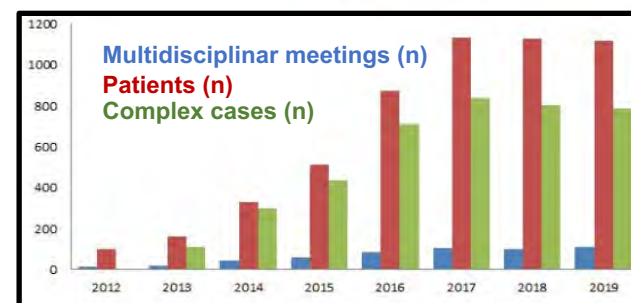
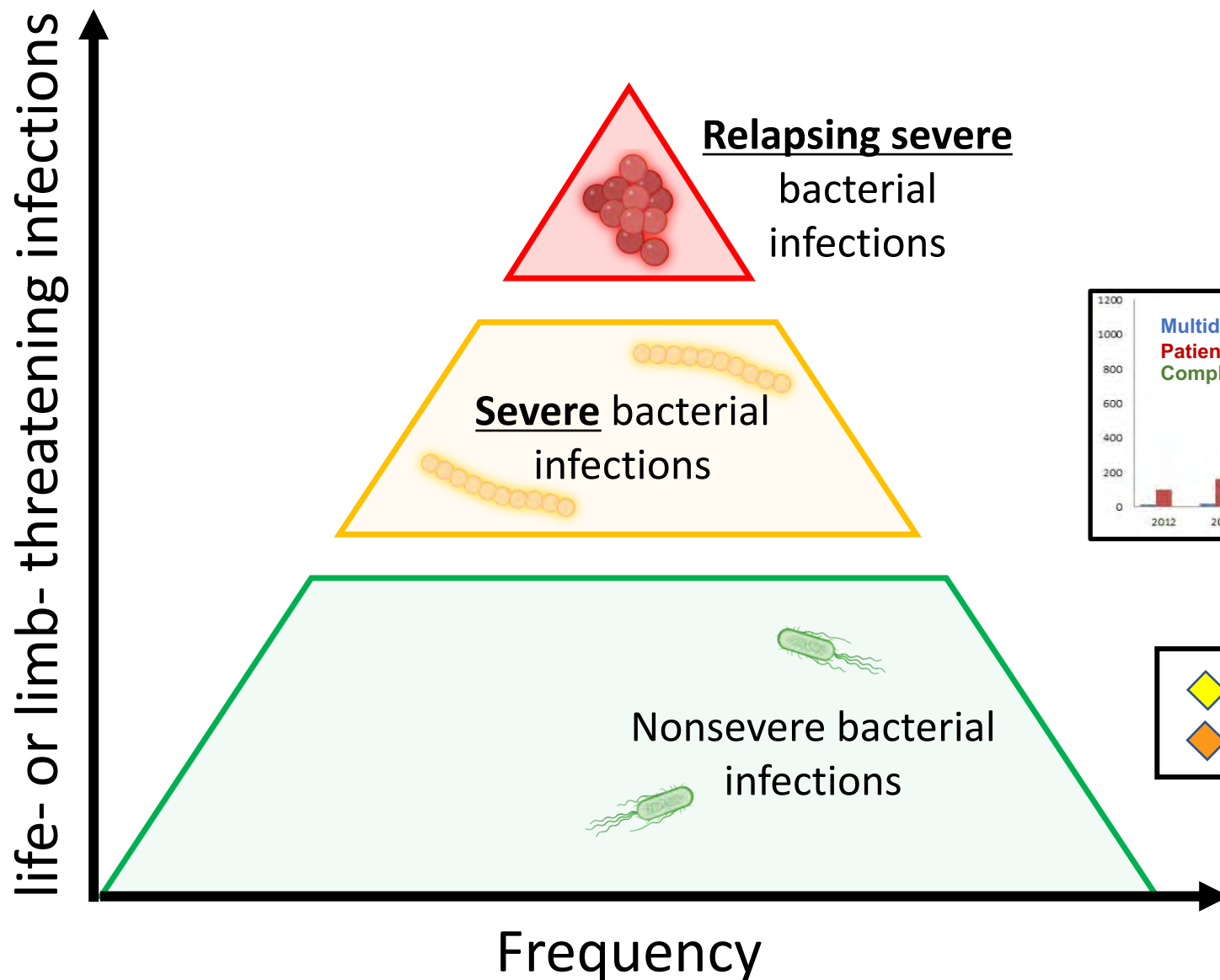
The pyramid of bacterial infectious diseases



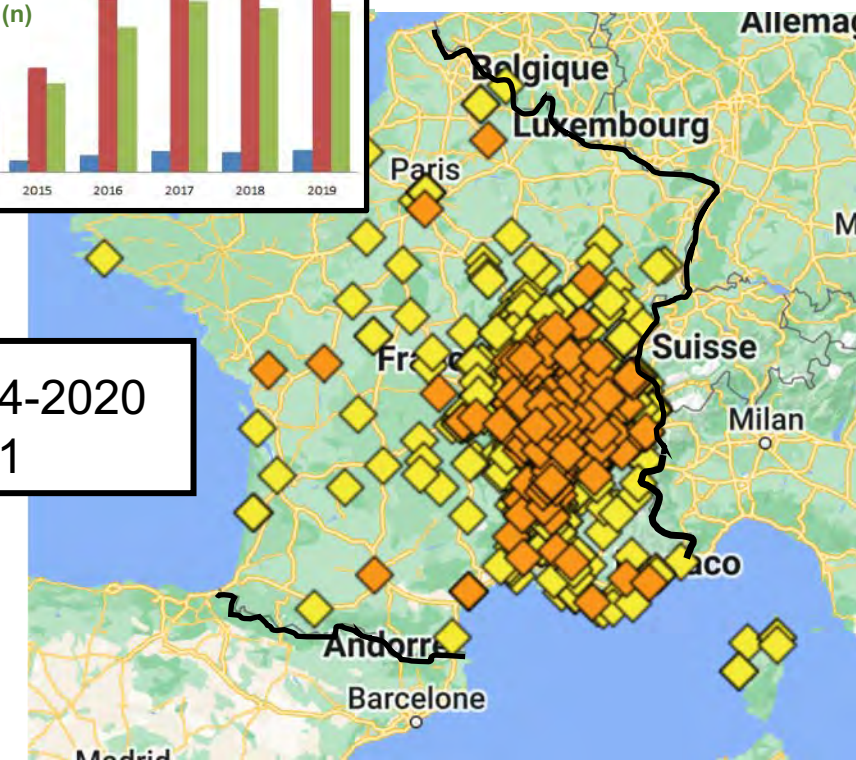
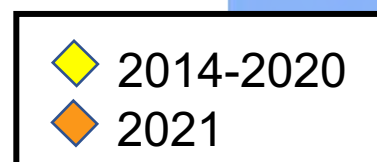
DEDICATED NETWORK
FOR COMPLEX BONE AND JOINT INFECTIONS



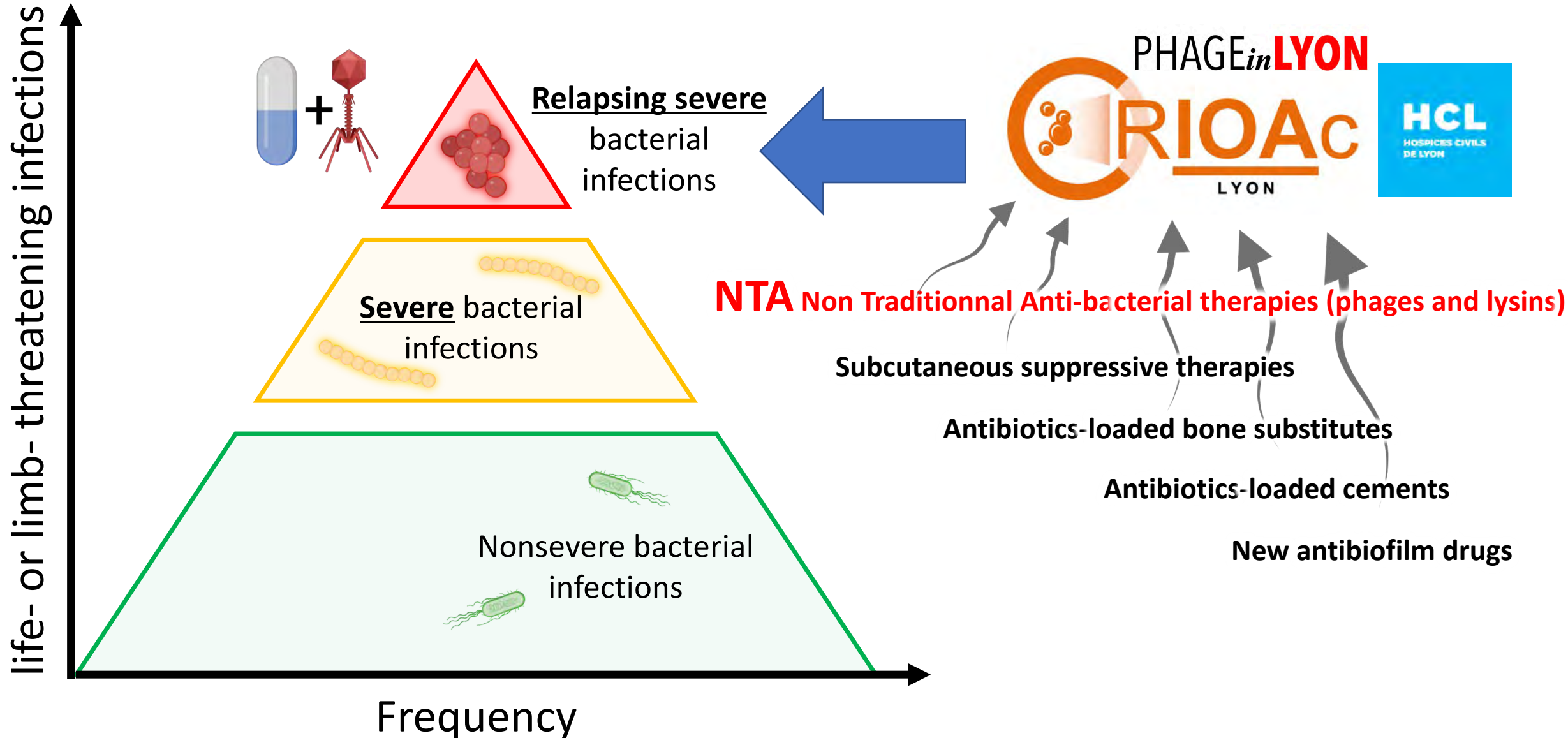
The pyramid of bacterial infectious diseases



PATIENT'S RESIDENCE



The pyramid of bacterial infectious diseases



T. FERRY



KEEP
CALM
AND USE

PHARMACEUTICAL
GRADE
PHAGES

PHAGE
2.0
THERAPY

ESCMID MANAGING INFECTIONS
PROMOTING SCIENCE



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ANTIBACTERIAL THERAPY

Elected Executive Committee:

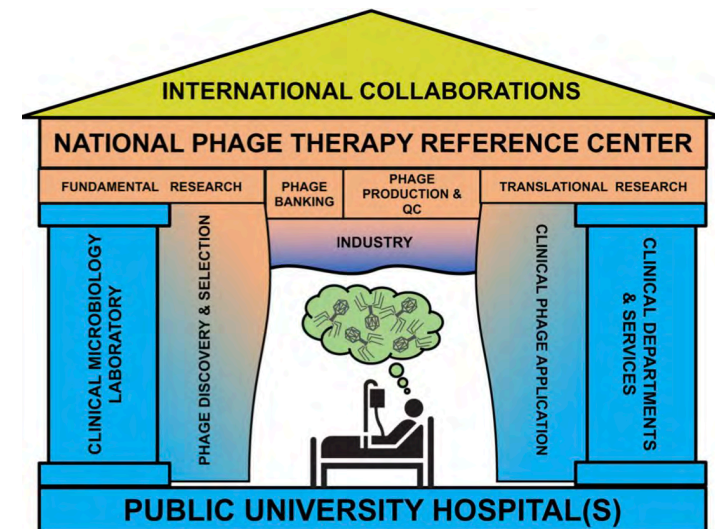
Jean-Paul Pirnay, Belgium

Ran Nir-Paz, Israël

Tristan Ferry, France

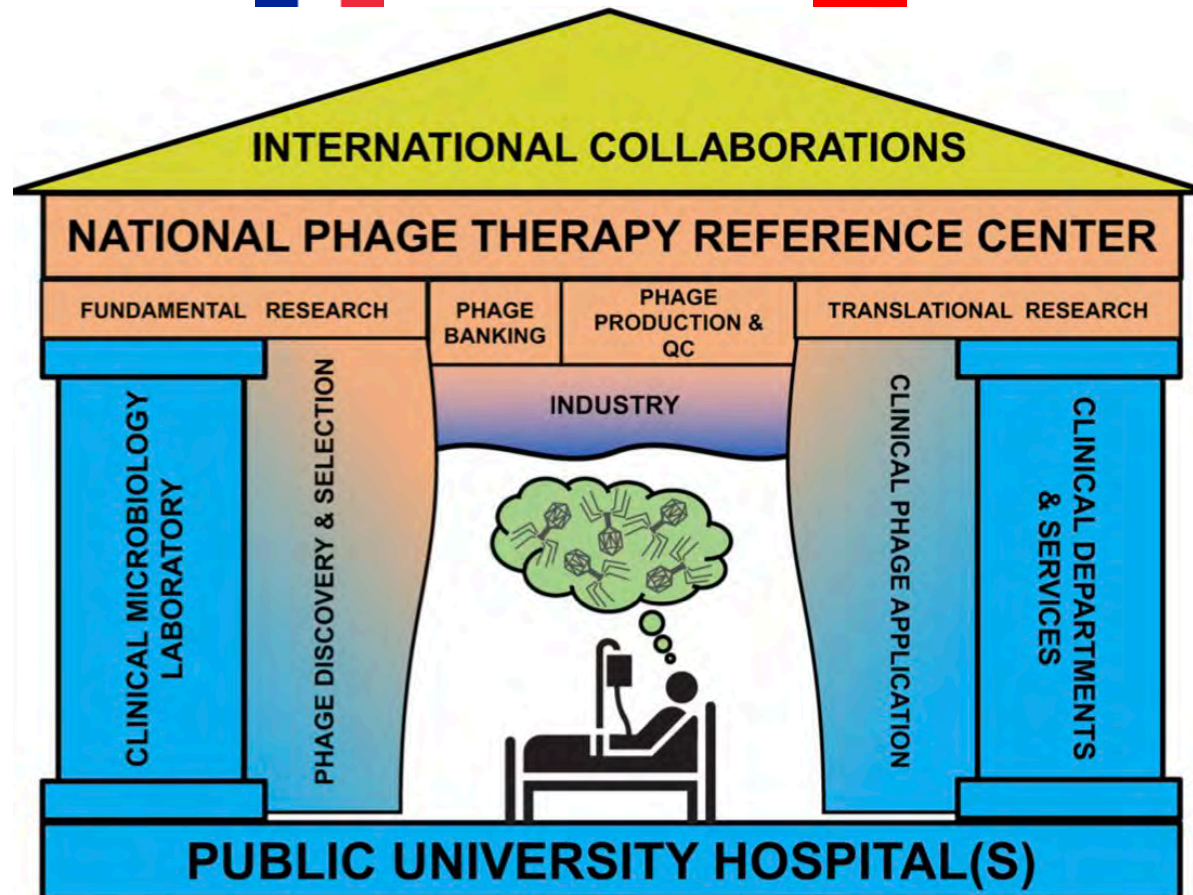
Shawna Mc Callin, Switzerland

Zuzanna Drulis-kawa, Poland



Recent progress toward the implementation of phage therapy in Western medicine

Jean-Paul Pirnay^{1,†}, Tristan Ferry^{2,3,†} and Grégory Resch^{4,*,†}



Cas clinique Mme D. (16^{ème} patiente traitée)

62 ans

Sarcome de la cuisse

Radiothérapie

Fracture

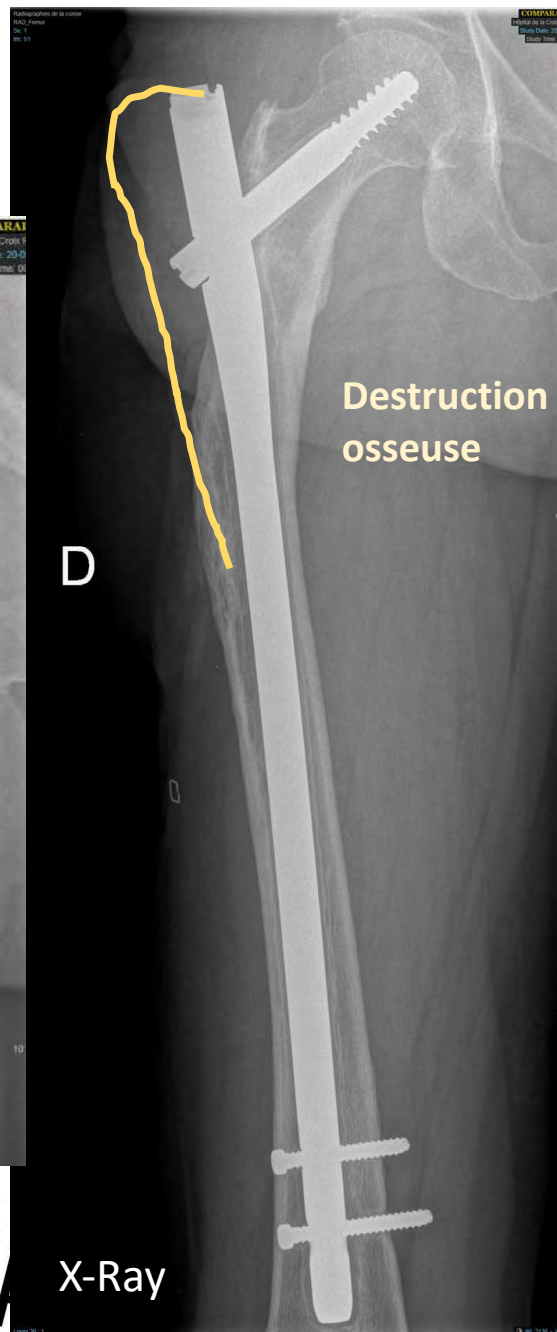
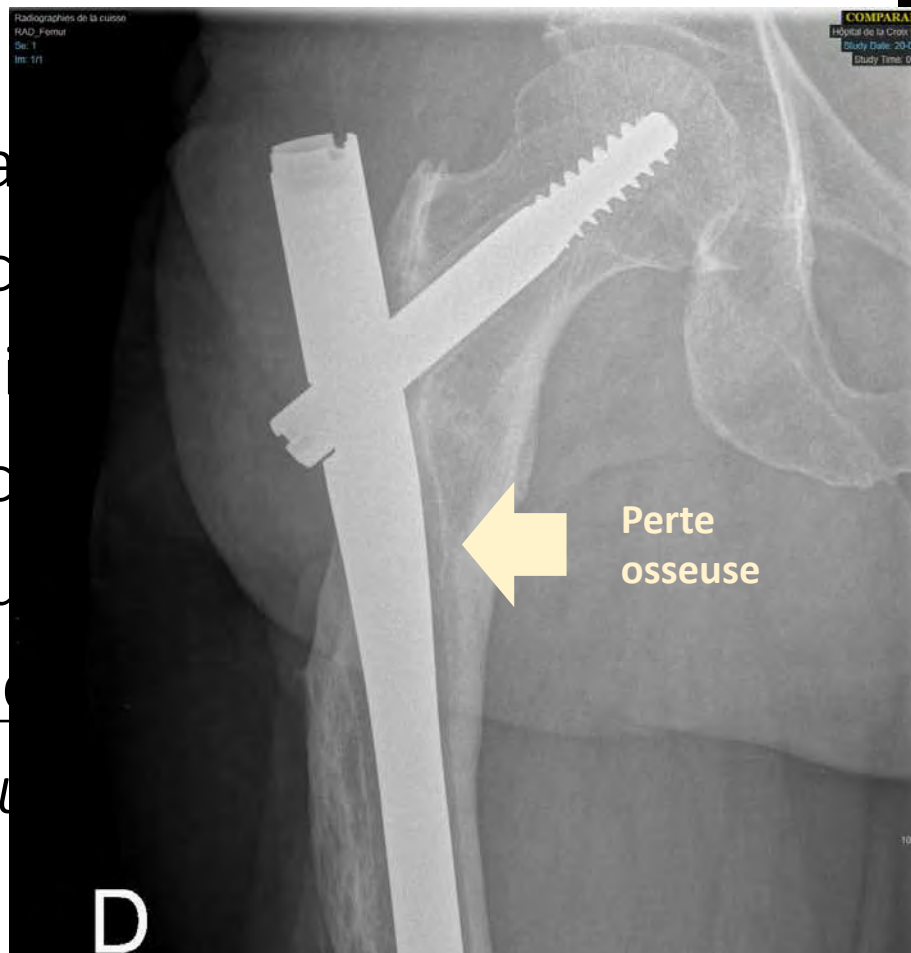
Clou fémoral

Infection récidivante

S. aureus

Cas clinique

62 a
Sarc
Rad
Frac
Clou
Infe
S. au



Cas clinique

62 ans

Sarcome de la cuisse

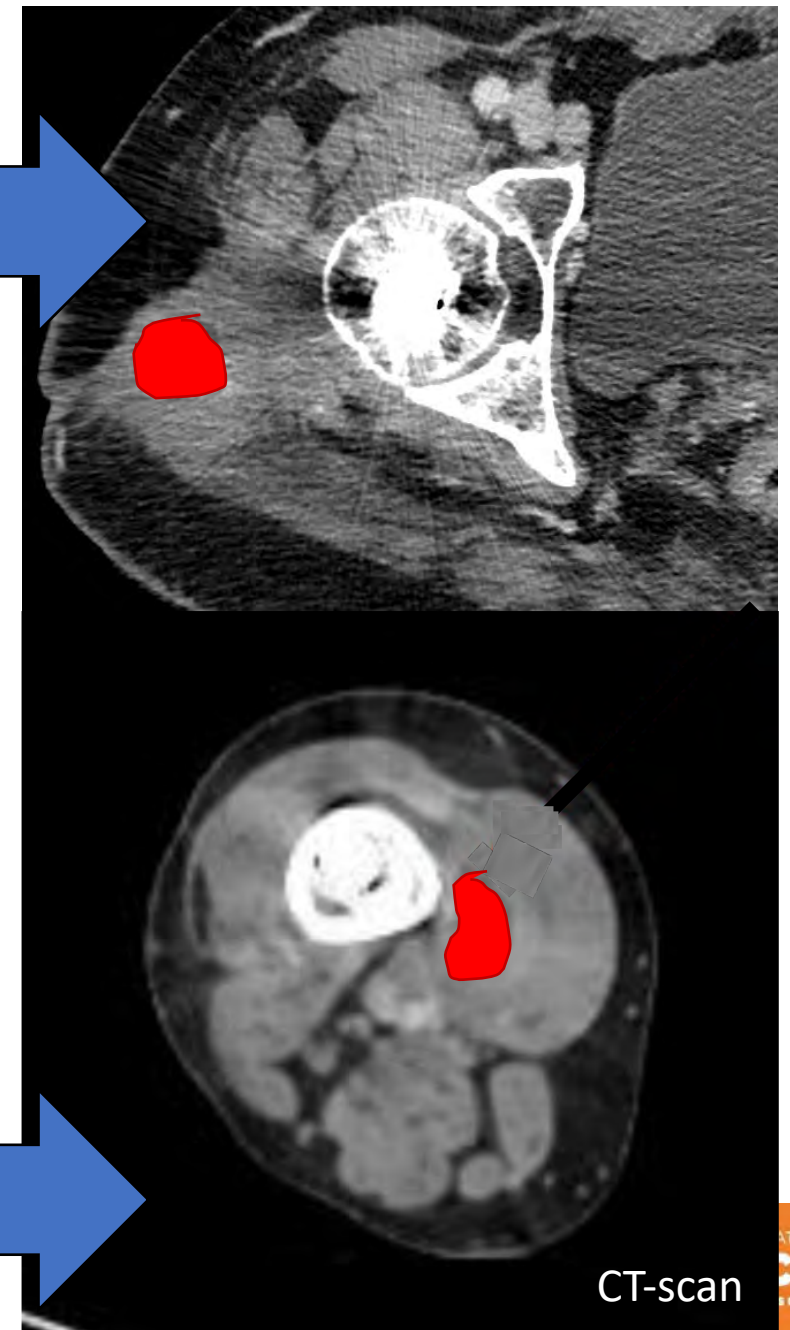
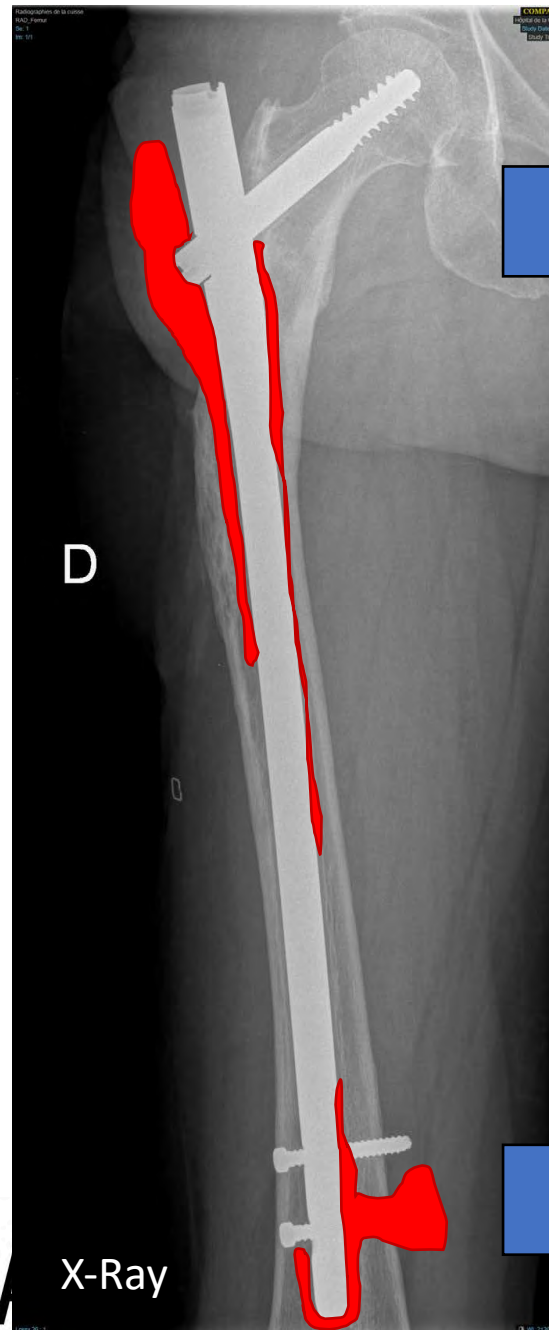
Radiothérapie

Fracture

Clou fémoral

Infection récidivante

S. aureus



Cas clinique

62 ans

Sarcome de la cuisse

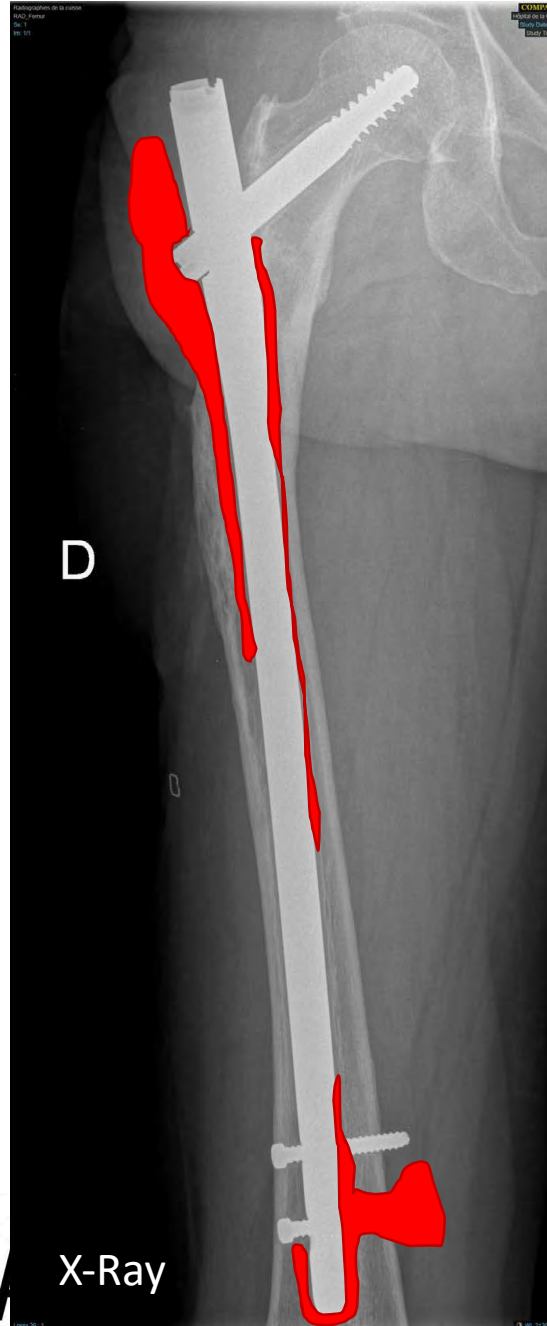
Radiothérapie

Fracture

Clou fémoral

Infection récidivante

S. aureus



Cas clinique

Pas de chirurgie

Cocktail de phages personnalisé

Une seule injection



Cocktail de phages hautement purifiés 10^9 phages/mL



Cas clinique

Pas de chirurgie

Cocktail de phages personnalisé

Une seule injection

En combinaison avec l'antibiothérapie

Evolution favorable à 2 ans



Cas clinique

Pas de chirurgie

Cocktail de phages personnalisé

Une seule injection

En combinaison avec l'antibiothérapie

Evolution favorable à 2 ans



Cas clinique

Pas de chirurgie

Cocktail de phages personnalisé

Une seule injection

En combinaison avec l'antibiothérapie

Evolution favorable à 2 ans



*“Je remercie le Pr. Ferry, Pherecydes
Pharma et l’équipe, PHAGE_{in}**LYON**
J’ai gagné un temps précieux !”*

Un beau signal, mais de nombreuses limites



S. aureus ✓

S. epidermidis ✗

S. haemolyticus ✗

S. caprae ✗

S. ... ✗

Staphylocoques

Mycobactéries

M. tuberculosis ✗

M. abcessus ✗

M. avium ✗

...

E. Coli ✗

Klebsiella spp. ✗

Proteus spp. ✗

Enterobacter spp. ✗

...

Anaérobies ... ✗

Entérobactéries



P. aeruginosa ✓

P. putida ✗

Acinetobacter spp. ✗

Stenotrophomonas spp. ✗

...

Non fermentants

Streptocoques

S. pneumonia ✗

S. pyogenes ✗

S. mitis ✗

S. oralis ✗

...

Cas clinique Mr R. (non traité)

45 ans

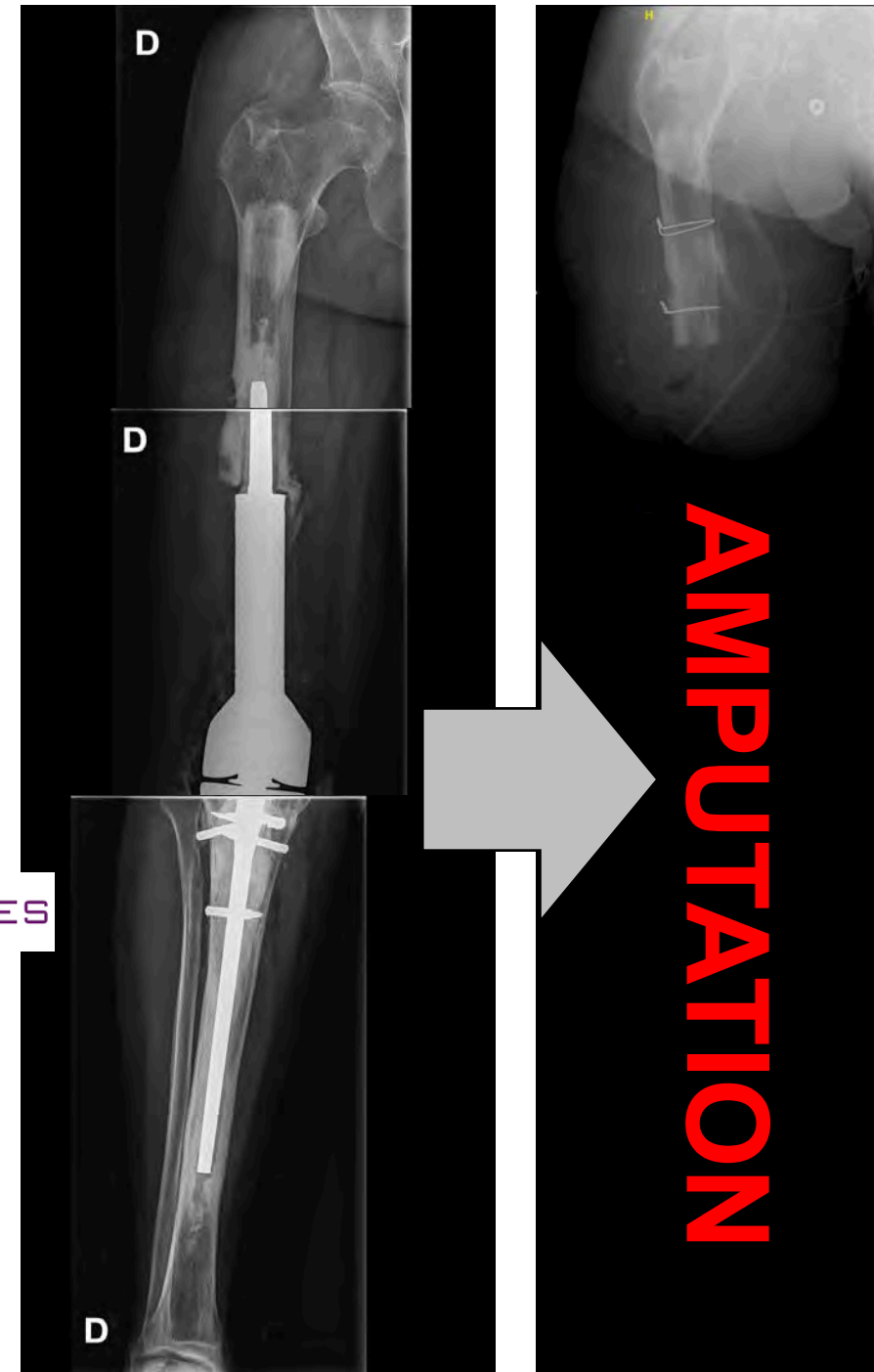
Résection osseuse pour un sarcome

Prothèse « de résection »

Infection récidivante

S. aureus phagorésistante aux phages de
E. coli pour lequel aucun phage n'est disponible

 PHERECYDES
PHARMA



Cas clinique Mme R. (non traitée)

87 ans

Douleur sur prothèse de genou droite

Infection récidivante

Staphylococcus epidermidis

Aucun phage n'est disponible



Management of relapsing infections with bacterial persistence



30 months after the PhagoDAIR procedure
Under cefalexin as suppressive therapy

	<i>Staphylococcus aureus</i> CMI (mg/l)
Pénicilline G	R
Oxacilline	S
Kanamycine	S
Gentamicine	S
Tobramycine	S
Erythromycine	S
Lincomycine	S
Pristinamycine	S
Tétracycline	S
Ofloxacine	S
Cotrimoxazole	S
Nitrofurantoïne	S
Rifampicine	S
Fosfomycine	S
Acide Fusidique	S
Vancomycine	S
Teicoplanine	S
Linézolide	S

Management of relapsing infections with bacterial persistance



Management of bacterial persis



tions with

Cefalexin PO
500 mg tid

PHAGE_{in} **LYON**

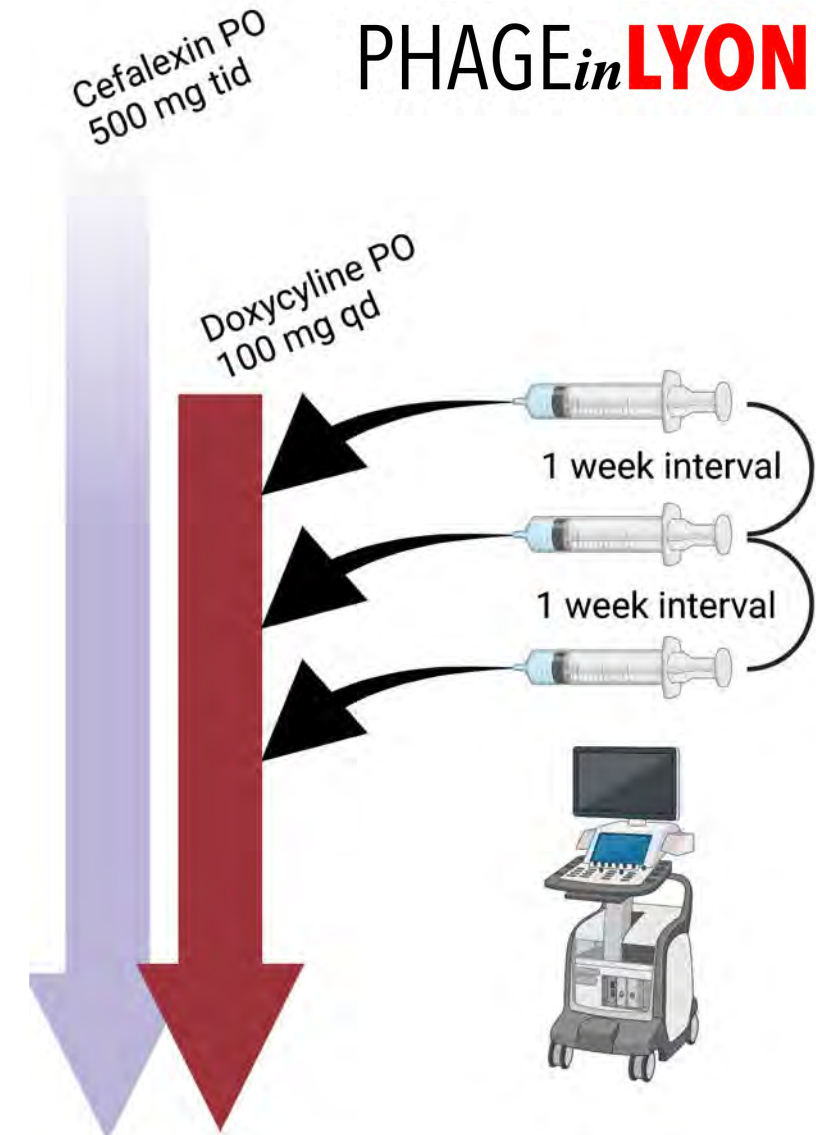
Doxycycline PO
100 mg qd

1 week interval

1 week interval



Management of relapsing infections with bacterial persistence



Clinical case (not published; 34th treated patient)



10,1k
views

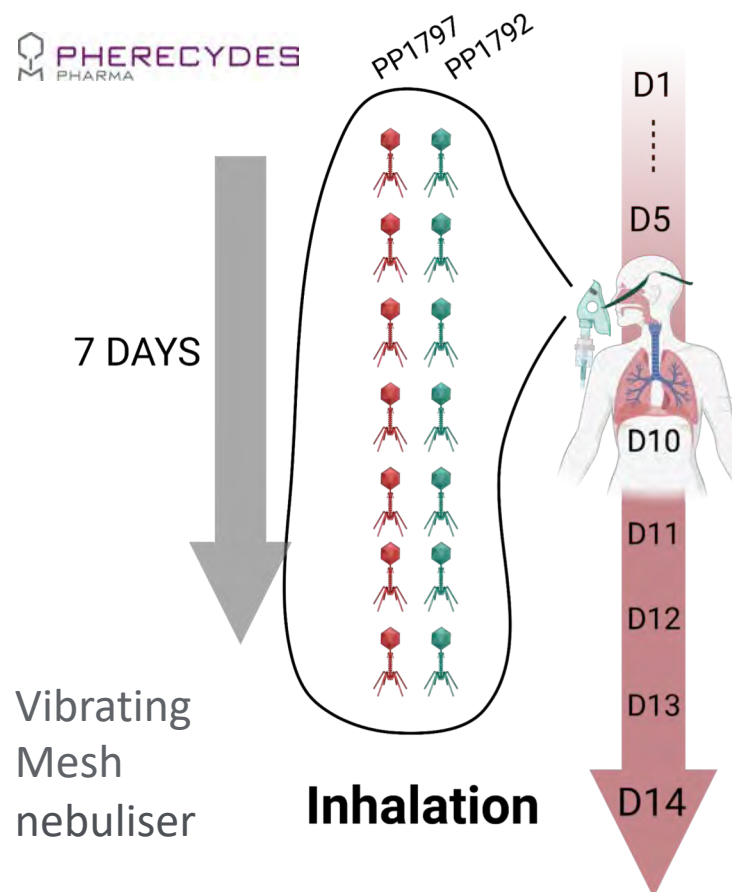
54-year-old woman

Lung transplantation for end-stage COPD

Bronchiectasis

Iterative *P. aeruginosa* exacerbations

Requiring oxygen



THE MYTHOLOGY
OF PHAGE THERAPY



T. FERRY

T. FERRY

EBM

Clinical
Trials





viruses

Lyon BJI
study group



PHAGEinLYON



Review

Past and Future of Phage Therapy and Phage-Derived Proteins in Patients with Bone and Joint Infection

REVIEW ARTICLE

OPEN ACCESS

Tristan Ferry
Jérôme Josse
Frédéric Laurent
on behalf of

Medical innovations to maintain the function in patients with chronic PJI for whom explantation is not desirable: a pathophysiology-, multidisciplinary-, and experience-based approach

Tristan Ferry^{1,2,3,4,*}, Cécile Batailler^{2,3,5}, Sophie Brosset^{2,3,6}, Camille Kolenda^{2,3,4,7}, Sylvain Goutelle^{2,3,8,9}, Elliot Sappey-Marinier^{2,3,5}, Jérôme Josse^{2,3,4,7}, Frédéric Laurent^{2,3,4,7}, Sébastien Lustig^{2,3,5}, On Behalf of the Lyon BJI Study Group,^a

Virologie

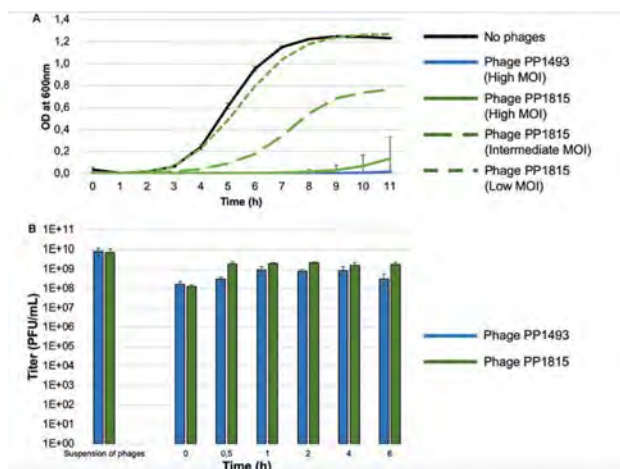
infection ostéoarticulaire : historique, fondements, faisabilité et perspectives en France

Phage therapy in bone and joint infection: history, rationale, feasibility and perspectives in France

The Potential Innovative Use of Bacteriophages Within the DAC[®] Hydrogel to Treat Patients With Knee Megaprosthesis Infection Requiring “Debridement Antibiotics and Implant Retention” and Soft Tissue Coverage as Salvage Therapy

Tristan Ferry^{1,2,3,4*}, Cécile Batailler^{2,3,5}, Charlotte Petitjean⁶, Joseph Chateau⁷, Cindy Fevre⁶, Emmanuel Forestier⁸, Sophie Brosset⁷, Gilles Leboucher⁹, Camille Kolenda^{2,3,4,10}, Frédéric Laurent^{2,3,4,10} and Sébastien Lustig^{2,3,5} on behalf of the Lyon BJI Study Group

4,970
TOTAL VIEWS



J Antimicrob Chemother 2018; **73**: 2901–2903
doi:10.1093/jac/dky263
Advance Access publication 27 July 2018

Innovations for the treatment of a complex bone and joint infection due to XDR *Pseudomonas aeruginosa* including local application of a selected cocktail of bacteriophages

Tristan Ferry^{1–4*}, Fabien Boucher^{1,4,5}, Cindy Fevre⁶, Thomas Perpoint^{1,4}, Joseph Chateau^{1,2,4,5}, Charlotte Petitjean⁶, Jérôme Josse^{2–4,7}, Christian Chidiac^{1,2–4}, Guillaume L’hostis⁶, Gilles Leboucher⁸ and Frédéric Laurent^{2–4,7} on behalf of the Lyon Bone and Joint Infection Study Group[†]

CITATIONS



VIEWS



ALTMETRIC



More metrics information

Case Report: Arthroscopic “Debridement Antibiotics and Implant Retention” With Local Injection of Personalized Phage Therapy to Salvage a Relapsing *Pseudomonas Aeruginosa* Prosthetic Knee Infection

Tristan Ferry^{1,2,3,4*}, Camille Kolenda^{2,3,4,5}, Cécile Batailler^{2,3,6}, Romain Gaillard^{3,6}, Claude-Alexandre Gustave^{2,3,4,5}, Sébastien Lustig^{2,3,6}, Cindy Fevre⁷, Charlotte Petitjean⁷, Gilles Leboucher⁸, Frédéric Laurent^{2,3,4,5} and the Lyon BJI Study group

4,072

TOTAL VIEWS



Open Forum Infectious Diseases

BRIEF REPORT

Salvage Debridement, Antibiotics and Implant Retention (“DAIR”) With Local Injection of a Selected Cocktail of Bacteriophages: Is It an Option for an Elderly Patient With Relapsing *Staphylococcus aureus* Prosthetic-Joint Infection?

Tristan Ferry,^{1,2,3,4} Gilles Leboucher,⁵ Cindy Fevre,⁶ Yannick Herry,^{2,4,7} Anne Conrad,^{1,2,3,4} Jérôme Josse,^{2,3,4,8} Cécile Batailler,^{2,4,7} Christian Chidiac,^{1,2,3,4} Mathieu Medina,⁶ S. Lustig,⁷ and Frédéric Laurent^{2,3,4,8}, on behalf of the Lyon BJI Study Group

VIEWS

3,770

Phage Therapy as Adjuvant to Conservative Surgery and Antibiotics to Salvage Patients With Relapsing *S. aureus* Prosthetic Knee Infection

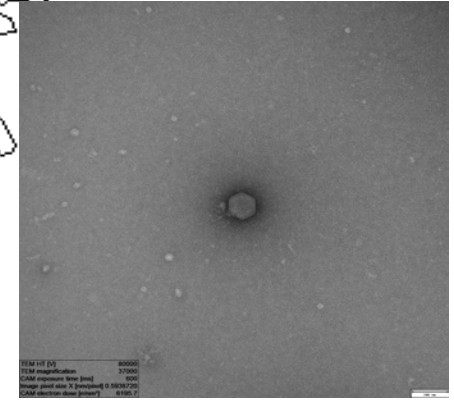
Tristan Ferry^{1,2,3,4*}, Camille Kolenda^{2,3,4,5}, Cécile Batailler^{2,3,6}, Claude-Alexandre Gustave^{2,3,4,5}, Sébastien Lustig^{2,3,6}, Matthieu Malatray^{3,6}, Cindy Fevre⁷, Jérôme Josse^{2,3,4,5}, Charlotte Petitjean⁷, Christian Chidiac^{1,2,3,4}, Gilles Leboucher⁸ and Frédéric Laurent^{2,3,4,5} on behalf of the Lyon BJI Study group

6,208

TOTAL VIEWS



PHAGEⁱⁿLYON

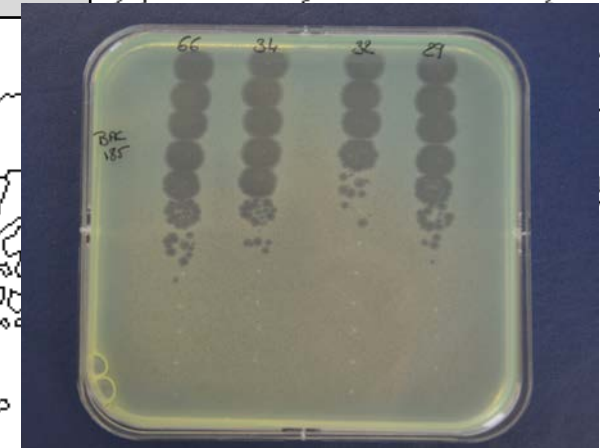


Jean-Paul Pirnay

Gregory Resch

HCL
HOSPICES CIVILS
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2022

nature
COMMUNICATIONS

Article | [Open Access](#) | Published: 22 July 2022

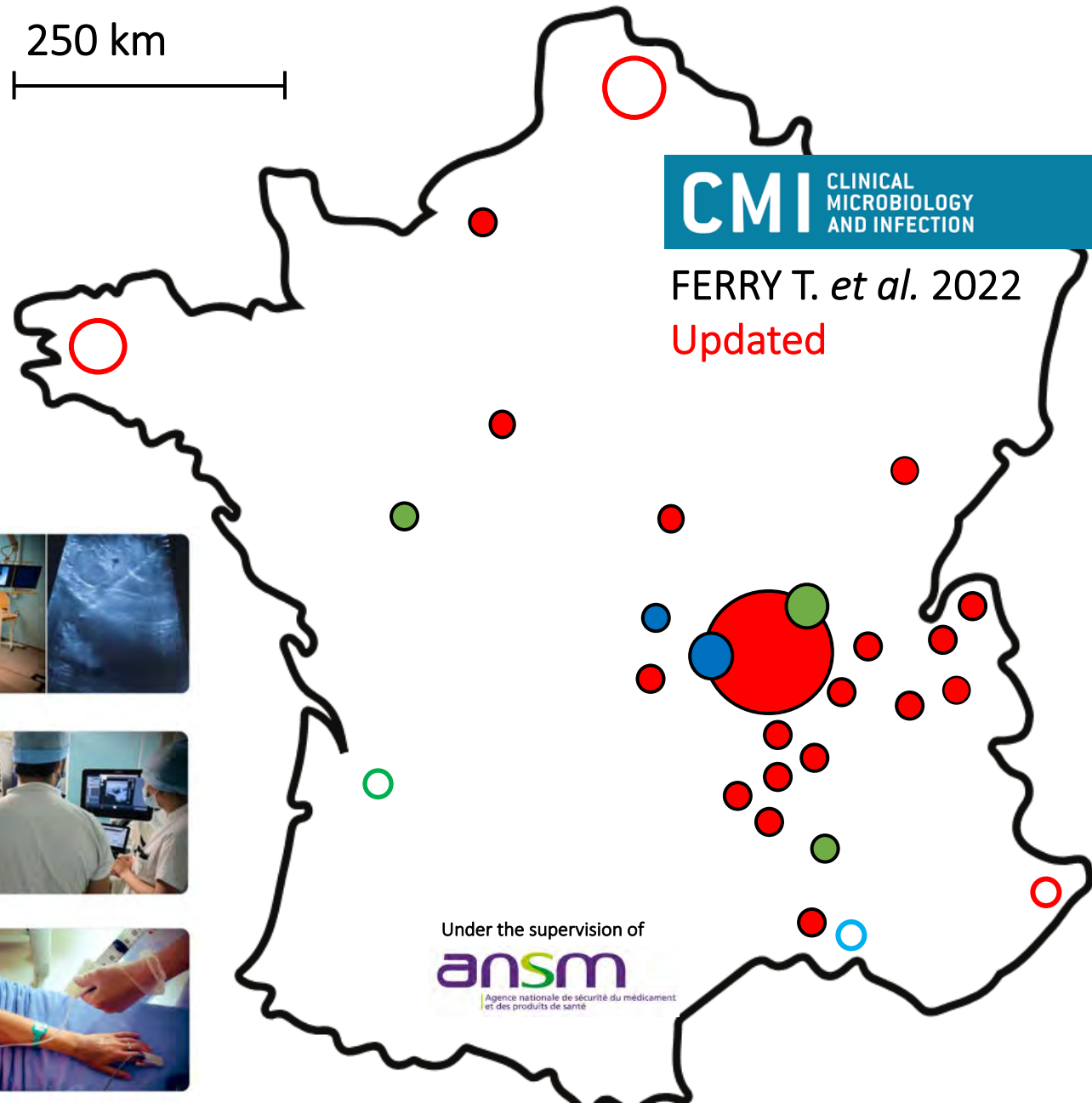
**Personalized bacteriophage therapy to treat
pandrug-resistant spinal *Pseudomonas*
aeruginosa infection**

[T. Ferry](#) , [C. Kolenda](#), [F. Laurent](#), [G. Leboucher](#), [M. Merabischvili](#), [S. Djebara](#), [C.-A. Gustave](#), [T. Perpoint](#), [C. Barrey](#), [J.-P. Pirnay](#) & [G. Resch](#)

[Nature Communications](#) **13**, Article number: 4239 (2022) | [Cite this article](#)

2701 Accesses | 37 Altmetric | [Metrics](#)

Implementation of a Phage Therapy Center in a CRIOAc



PHAGE*in***LYON**



43 patients in Lyon since 2017
~75% of the whole patients treated in France



- 40 with phages from **PHERECYDES PHARMA**

- 3 with phages from



- 36 **BJI** (including 31 **PJI**)
- 4 **endocarditis/vascular graft**
- 3 **lung infections** (VAP + bacteremia, pneumonia in lung graft bronchiectasia, cystic fibrosis exacerbation)



+ 9 patients managed outside Lyon ○
including 1 in and 1 in

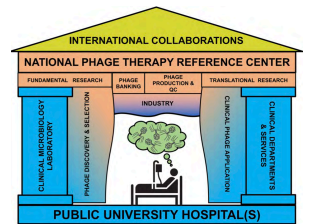
●○ **BJI**

●○ **Endocarditis**

●○ **Pneumonia**

Conclusion

- Ré-émergence de la phagothérapie
- Augmenter la probabilité de succès des infections bactériennes difficiles à traiter, dans un contexte d'antibiorésistance croissante
- Espérer conserver la fonction avec des approches mini invasives chez des patients présentant des infections ostéoarticulaires complexes
- Réelle place pour la phagothérapie 2.0 :
 - Utilisation de phages de grade pharmaceutiques
 - Créer des centres académiques pouvant avoir à un accès à des phages produits par des structures privées, ou publiques
- Créer un réseau de centres de phagothérapie à l'échelle Européenne pour faciliter les utilisations compassionnelles, et favoriser l'évaluation dans des essais thérapeutiques



Lyon BJI Study group



Coordinator: Tristan Ferry

Infectious Diseases Specialists – Tristan Ferry, Florent Valour, Thomas Perpoint, Florence Ader, Sandrine Roux, Agathe Becker, Claire Triffault-Fillit, Anne Conrad, Cécile Poudroux, Pierre Chauvelot, Paul Chabert, Johanna Lippman, Evelyne Braun

Surgeons – Sébastien Lustig, Elvire Servien, Cécile Batailler, Stanislas Gunst, Axel Schmidt, Elliot Sappey-Marinier, Quentin Ode, Michel-Henry Fessy, Anthony Viste, Jean-Luc Besse, Philippe Chaudier, Lucie Louboutin, Adrien Van Haecke, Marcelle Mercier, Vincent Belgaid, Aram Gazarian, Arnaud Walch, Antoine Bertani, Frédéric Rongieras, Sébastien Martres, Franck Trouillet, Cédric Barrey, Ali Mojallal, Sophie Brosset, Camille Hanriat, Hélène Person, Samuel Prive, Philippe Céruse, Carine Fuchsmann, Arnaud Gleizal;

Anesthesiologists – Frédéric Aubrun, Mikhail Dziadzko, Caroline Macabéo, Dana Patrascu;

Microbiologists – Frederic Laurent, Laetitia Beraud, Tiphaine Roussel-Gaillard, Céline Dupieux, Camille Kolenda, Jérôme Josse;

Imaging – Fabien Craighero, Loic Boussel, Jean-Baptiste Pialat, Isabelle Morelec;

PK/PD specialists – Michel Tod, Marie-Claude Gagnieu, Sylvain Goutelle;

Clinical research assistant and database manager– Eugénie Mabrut

PHAGE_{in}LYON

Some figures
were created with

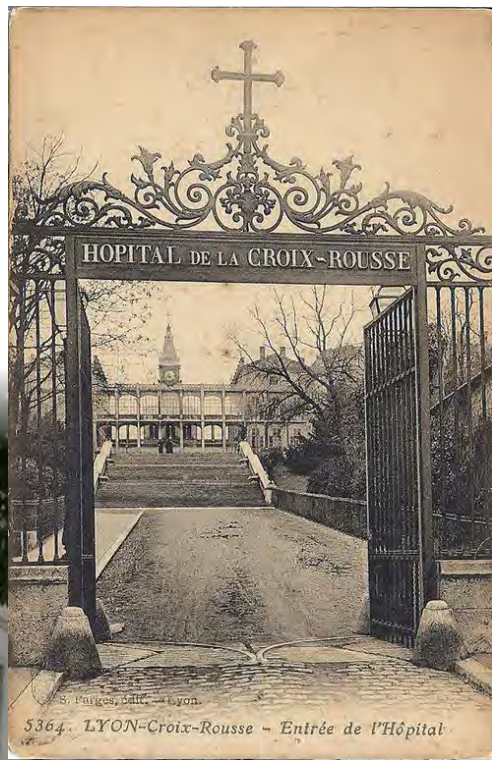


Coordinator: Tristan Ferry (clinic); and Frederic Laurent (lab)

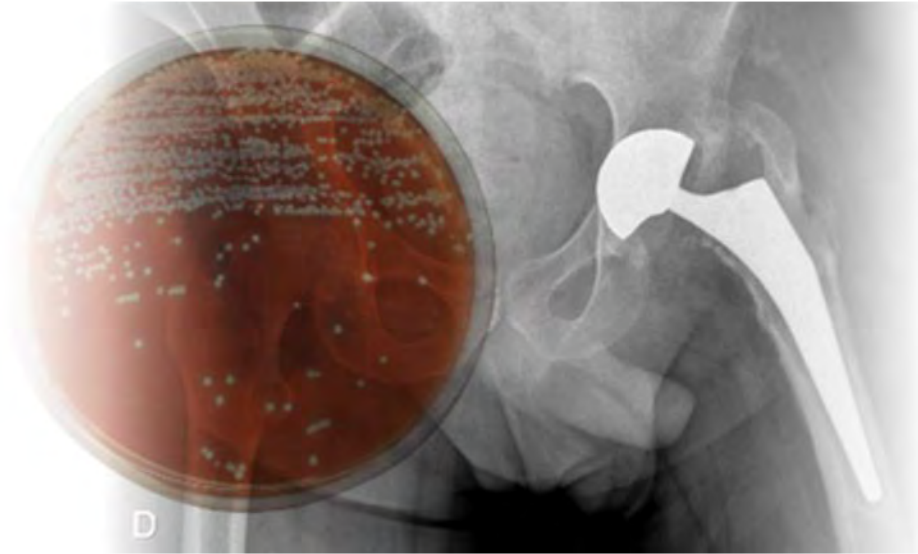
Myrtille Le Bouar, Gilles Leboucher, Thomas Briot; Mathieu Medina, Camille Kolenda, Floriane Laumay, Melanie Bonhomme, Leslie Blazere, Tiphaine Legendre, Eline Terrazzoni, Fabrice Pirot, Camille Merienne, Samira Filali, Benjamine Lapras



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