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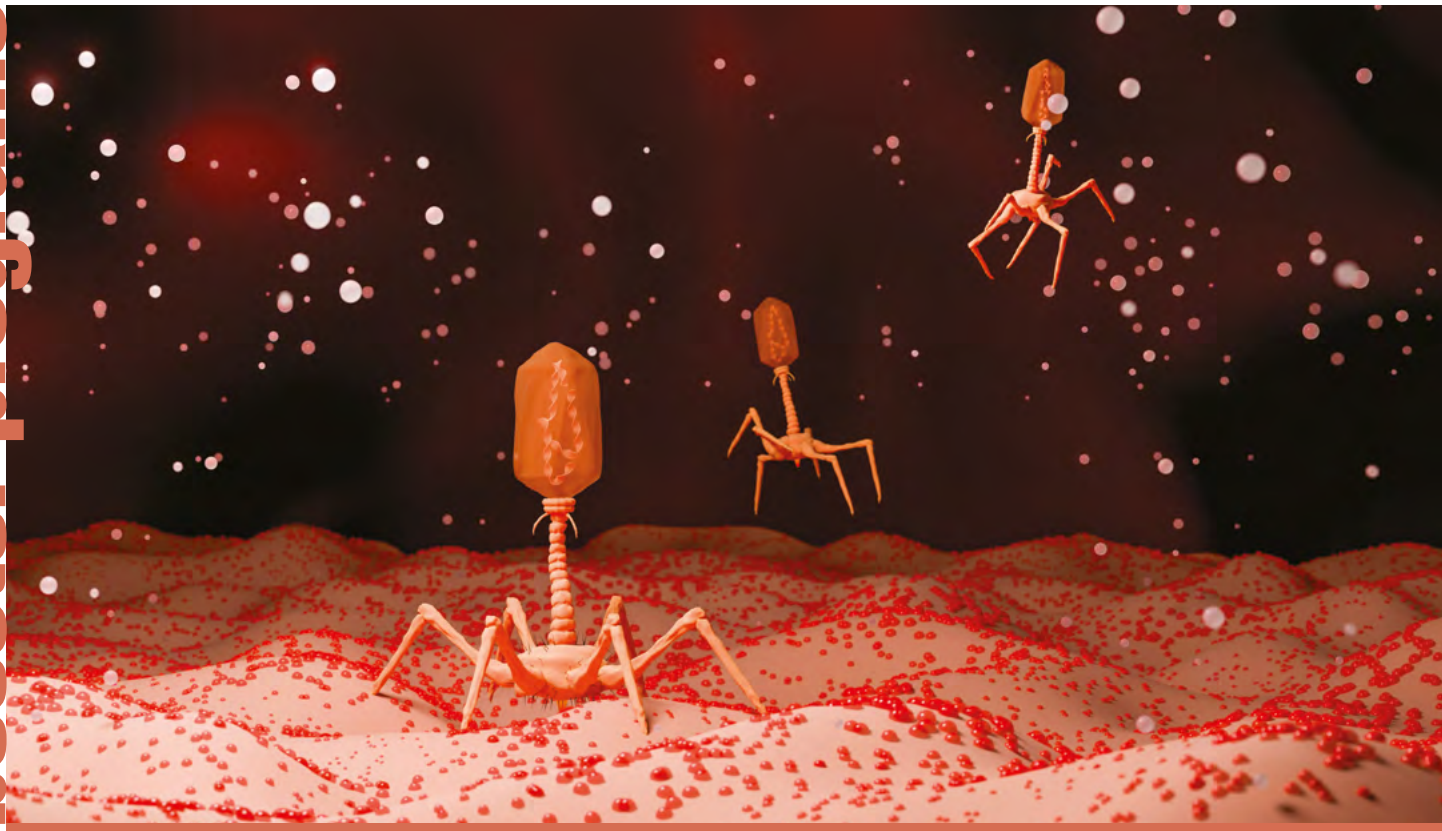
La science pour la santé
From science to health

the booster programs



Booster program led by
the **theme-based institutes** of Inserm:

- **Health technologies (TS)**
- **Immunology, inflammation, infectiology and microbiology (I3M)**

Phage Therapy
booster program

Deadline for electronic submission:

September 18th, 2026 – 5:00 PM

the booster programs

SUMMARY

Inserm

GENERAL OVERVIEW OF THE PHAGE THERAPY BOOSTER PROGRAM

As antibiotic resistance is reaching critical levels and only a limited number of new antimicrobial molecules enter the market, phage therapy is gaining renewed attention as a highly promising strategy to combat bacterial infections, either in combination with, or as an alternative to traditional treatment. Notably, the use of bacteria-killing viruses (bacteriophages) is currently attracting considerable interest because of its potential to address the challenges posed by resistance to conventional treatments. Accordingly, the WHO Regional Office for Europe has recently taken up the issue in collaboration with the Global AMR R&D Hub to help define the regulatory and legislative requirements governing the use of bacteriophages as part of efforts to combat antimicrobial resistance (AMR) from a One Health perspective (https://www.who.int/europe/news-room/fact-sheets/item/bacteriophages-and-their-use-in-combating-antimicrobial-resistance).

Over the past decade, phage therapy has been used for compassionate treatments and was evaluated in early-phase clinical trials, demonstrating an acceptable safety profile and some efficacy against infections caused by multidrug resistant bacteria although the level of evidence is currently weak. Moreover, these studies have also highlighted critical bottlenecks – encompassing scientific, technological, regulatory and clinical fields- that currently limit a larger clinical deployment and acceptance of phage therapy (Moon *et al*, 2025; Kim *et al*, 2025; Faltus *et al*, 2024). Thus, and although phage therapy represents a promising therapeutic approach for combating antibiotic-resistant infections, several obstacles must be overcome to enable their routine clinical application. Inserm wants to tackle them by mobilizing its forces around this booster program.

GOALS OF THE PHAGE THERAPY BOOSTER PROGRAM

Overall goals

Through complementary approaches, the Inserm Phage therapy booster initiative is aimed to promote fundamental and translational research to overcome some of the obstacles that are hindering both the development and acceptance of phage therapy.

Building an ambitious, collaborative and multidisciplinary network of teams capable of addressing interconnected challenges described below will be essential for the success of this Phage therapy booster program. The program emphasizes the integration of multidisciplinary and interdisciplinary knowledge – beyond microbiology, infectious diseases and bacteriophages – to develop technological and methodological solutions, necessary to advance clinical applications of bacteriophages. The program seeks to engage laboratories from different theme-based institutes of Inserm beyond the field of microbiology to promote transferable expertise (e.g. oncology, bioengineering, bioprocess, computational modeling, public health…) or expand clinical applications beyond the treatment of bacterial infections.

As a guiding thread, all developments – whether technological, methodological, or knowledge-based – should meet the requirements of quality, safety and efficacy, while remaining closely aligned with relevant clinical situations at the patient's bedside.

Specific goals

To overcome the intertwined scientific, technological, regulatory, and clinical barriers that continue to hinder the clinical deployment and societal acceptance of phage therapy, the following strategic and operational objectives are proposed:

- **Work package 1: Advancing biotechnology and bioproduction of bacteriophages for patient benefit**
- **Work package 2: Driving therapeutic innovation through improved preclinical frameworks**
- **Work package 3: Innovative monitoring of the societal impact of phage therapy**

Each work package will require multidisciplinary approaches to provide solutions to unlock and accelerate phage therapy access to patients within an emerging european regulatory framework. Across all these objectives, a broad diversity of bacteriophages should be incorporated in a systematic manner to ensure robustness, enhance generalizability across multiple applications, and strengthen clinical relevance. Strengthening connections with university hospitals (CHU) already active in this field, such as AP-HP and the Hospices Civils de Lyon, will be essential to ensure effective translation into clinical practice. In parallel, a group has been set up by Inserm, under the France's Ministry of Health (DGS and DGOS) and the France's national agency responsible for the safety of medicines and health products (ANSM) request, to coordinate and further and also boost the conduct of large adequatly designed clinical trials in France and at the european level. However, this group needs to be fed by the booster program.

PERSPECTIVES OF THE PHAGE THERAPY BOOSTER PROGRAM

The booster program of Inserm dedicated to phage therapy is expected to deliver significant scientific, clinical and societal impacts.

Scientific impact

- Advance fundamental and translational knowledge on bacteriophage biology, host–phage-bacteria interactions
- Structure and integrate multidisciplinary expertise to overcome current hurdles for phage therapy development

Clinical impact

- Accelerate the translation of bacteriophages into clinical trials and trial practice, beyond compassionate use
- Improve patient access to safe, robust and effective therapeutic options for multidrug resistant infections

Societal impact

- Contribute to addressing the major public health issue on antimicrobial resistance
- Foster innovation in phage therapy enhancing France's position as a european leader in this field

Economic impact

- Reduce the long-term economic impact of antimicrobial resistance, which is projected to become one of the largest global healthcare costs this century

› Generate high-skill jobs and establish regional biotechnology clusters, similar to what was observed for monoclonal antibodies

The specific goals of the Phage therapy booster program are detailed below.

WORK PACKAGE 1: ADVANCING BIOTECHNOLOGY AND BIOPRODUCTION OF BACTERIOPHAGES FOR PATIENT BENEFIT

One of the most prominent challenges regarding phage therapy is the suboptimal match between therapeutic phages and patient's strains, which currently leads to variable clinical outcomes. This underscores the need for robust, rapid, and predictive screening platforms capable of identifying effective natural phages for a given pathogen and systematically optimizing host range coverage prior to administration (Moon *et al*, 2025). Beyond natural diversity, recent lessons from experimental and clinical contexts emphasize the potential of phage engineering and synthetic biology to overcome intrinsic biological limitations, by expanding host range, enhancing killing activity, and circumventing resistance mechanisms. Finally, several trials have reported difficulties in producing phages with consistent quality, high infectious titers, acceptable endotoxin levels, and sustainable manufacturing costs, highlighting that bioproduction challenges remain a major limiting factor for regulatory acceptance, clinical development, and the overall resilience of healthcare systems when foreseeing large scale deployment (Faltus T, 2024).

Scientific questions and challenges

This work package aims to address three interconnected challenges through an integrated biotechnology-driven approach, focusing on enhancing phage predictability by developing advanced screening pipelines and strategies to maximize host-range coverage of natural phages; leveraging cutting-edge synthetic biology to generate next generation engineered phages with improved efficacy and robustness against resistance; and targeting the optimization of bioproduction processes to deliver qualified phage products at scale and affordable cost.

A. **Improving phage predictability: from rapid screening to improved host-range coverage of natural phages.** The intrinsic specificity of natural phages, together with the rapid emergence of bacterial resistance, makes the design of effective therapeutic cocktails particularly challenging. As highlighted by the PhagoBurn clinical trial, the heterogeneity of clinical isolates reveals the limited coverage provided by predefined cocktails and emphasizes the need for more precise, patient-specific phage selection. Advances in high-throughput and rapid screening, coupled with genomic and phenotypic characterization, offer promising opportunities to accelerate the rational design of tailored phage cocktails. These approaches can facilitate the identification of complementary phages, enable faster prediction of host–phage compatibility, and support a more systematic and targeted selection process for each bacterial strain. Ultimately, such strategies may enhance the robustness and adaptability of phage cocktails, while enabling a faster and more precise match of phages to infecting strains, thereby improving the likelihood of therapeutic efficacy.

B. **Advancing phage engineering and synthetic biology: toward the next generation of broad-spectrum phages.** Natural phages vary widely in their host range, a feature primarily shaped by bacterial surface determinants that dictate phage adsorption and genome injection, as well as intracellular defence systems that restrict phage replication. These biological constraints increase the number of phages required to cover a large

spectrum of bacterial hosts in a therapeutic context. While recent discoveries expanded our understanding on the genetic determinants of phage host range, novel technological developments in genetic engineering have the potential to transform our ability to design improved therapeutic phages, for instance to expand host range, to design tailored *de novo* ligands on demand for new host variants, to evade bacterial defence systems, to deliver tailored genetic content to kill (e.g., antibacterial factors) or manipulate host genes (e.g. reversing antibiotic resistance). Importantly, regulatory considerations and safety concerns – such as genomic stability, absence of lysogenic or virulence-associated genes, and controlled genetic modifications – must be integrated early in the design process to ensure acceptability in future clinical trials.

C. **Optimizing upstream and downstream bioprocesses for phage production: enabling low-cost manufacturing, high infectious titers, and improved host tolerance.** Producing phage preparations with consistent quality, high infectious titers, and acceptable endotoxin levels within clinically relevant timelines requires optimized upstream and downstream bioprocesses that are both scalable and compliant with Good Manufacturing Practice (GMP). In this context, innovations in fermentation strategies, purification technologies, and formulation stability are essential to improve reproducibility, cost-effectiveness, and patient safety. In parallel, host strain engineering remains a key priority. The use of non-pathogenic, prophage-free production strains is particularly important to address biosafety concerns and avoid contamination of phage preparations by spontaneously induced prophages. Such strain can be then complemented (or diversified) with cognate receptors of the phage produced. Further, directed evolution approaches can be automated and parallelized to drive selection of "hyperproducer" strains (amenable for producing several phages) in conditions that are faithful to the actual bioproduction pipeline. Finally, cell-free phage production can be envisaged (cell extract or reconstituted PURE-like systems), reducing the risk of live bacteria contamination, offering a path to cost reduction and opening the door to local, distributed phage production in further future.

Cross-cutting considerations

A critical cross-cutting issue that must be explicitly addressed within WP1 is to facilitate the future availability of GMP-grade phage therapies, which is currently limited primarily by high production costs that restrict the number of phages that can be manufactured. Accordingly, the proposed approaches should integrate cost-reduction objectives from the outset, whether through the implementation of innovative bioproduction methods in the context of personalized phage therapy approaches based on the optimized selection of natural phages from pre-characterized phage banks, or through strategies aimed at reducing the number of phages to be produced. These include, the development of synthetic phages and/or the identification and prioritization of broad host-range phages capable of overcoming diverse bacterial resistance mechanisms. Overall, methodologies developed within one specific challenge should be leveraged across others to promote rationalization, streamline efforts, and improve overall efficiency and effectively address WP1.

Considered approaches

By bridging gaps between discovery, engineering, and manufacturing, this work package directly responds to the key lessons learned from clinical trials and positions phage therapy for broader and more reliable clinical implementation. Ultimately, it aims to transform phages from personalized, case-by-case interventions into standardized, accessible therapeutic solutions capable of addressing the global AMR crisis.

› For **Challenge A (Improving phage predictability)**, develop integrated, high-throughput screening pipelines combining advanced phenotypic assays with genomic

and bioinformatic analyses to rapidly identify active phages against clinically relevant bacterial strains. These approaches could incorporate multiplexed host panels, real-time infection dynamics, and machine-learning–assisted prediction models to better capture the complexity of phage–bacteria interactions. Innovative high-throughput strategies should be implemented to systematically test large numbers of phage-bacteria combinations, for instance by leveraging automated, robotic or, and microfluidic platforms, as well as multiplexed miniaturized assays with reporter-based readouts. These approaches also include efforts to improve the predictability of *in vivo* efficacy, for instance through the development of culture conditions that mimic the in-situ environment. In parallel, automated phage selection strategies should expand and rationalize host-range coverage through the assembly of optimized phage libraries and therapeutic cocktails, towards maximizing bacterial targeting while limiting the emergence of resistance. By linking rapid screening outputs, driven by machine learning algorithms to efficiently probe the large parameters space, with predictive models of phage-host specificity and efficacy, this task aims to generate structured, information-rich datasets suitable for training predictive models, while simultaneously establishing a robust framework for the selection of natural phages with improved reliability, broader coverage, and greater translational potential in clinical settings.

- For **Challenge B (Advancing phage engineering and synthetic biology)**, develop an integrated Design-build-test-learn (DBTL) cycle for the rational engineering of next-generation therapeutic phages with expanded or programmable host range. This should include the identification, engineering and AI-driven *de novo* design of key host-range determinants, such as tail fibres, tail spikes, receptor-binding proteins and anti-defence functions, together with the development of synthetic biology approaches enabling the rapid generation, assembly and evaluation of phage variants. Approaches are expected to combine high-throughput construction and screening of engineered phages with predictive modelling, structural and functional analyses, and experimental validation on clinically relevant bacterial panels, including resistant strains. Further strategies could enable delivery of genetic payloads to suppress virulence or restore antibiotic susceptibility. Importantly, this DBTL framework should integrate safety, stability, manufacturability and regulatory considerations from the outset, to generate engineered phage candidates with clear translational potential for future therapeutic development.
- For **Challenge C (Optimizing upstream and downstream bioprocesses for phage production)**, develop and validate integrated upstream and downstream bioprocessing strategies for phage manufacturing that deliver high infectious titers, safe, robust, reproducible, and GMP-compatible scalability at controlled cost. These approaches should address downstream optimization of fermentation conditions, purification and concentration workflows, formulation and storage stability, as well as upstream engineering of safe, non-pathogenic, prophage-free production hosts with improved productivity and tolerance. Approaches may also include automated and parallelized directed-evolution pipelines to select "hyperproducer" strains under process-relevant conditions, customized grafting of phage receptors and exploratory cell-free production systems as alternative manufacturing platforms. Overall, the expected outcome is a bioproduction framework enabling faster, safer, and more affordable production of therapeutic-grade phages for clinical use.

WORK PACKAGE 2: DRIVING THERAPEUTIC INNOVATION THROUGH IMPROVED PRECLINICAL FRAMEWORKS

The scarcity and heterogeneity of data from compassionate phage therapy treatments limit the establishment of robust clinical guidelines. Therefore, there is a critical need for predictive and mechanistic preclinical frameworks to guide therapeutic decisions.

Several phages assembled into cocktails aim to improve treatment efficacy in patients. However, no guidelines have been established and accepted because of the lack of robust methods for assessing the added value of cocktails across multiple parameters (host range, resistance, efficacy, combination with antibiotics…). Development of innovative methods and analyses to define the main parameters ensuring a robust design for therapeutic cocktails across clinically relevant environments is strongly needed.

Phage administration to patients remains largely empirical, not only in terms of dose and frequency, but also regarding formulation and biodistribution. While animal models remain pivotal for assessing some organism-level parameters, ethics, costs, relevance to human and low throughput are constraining their use for exploring a large combinatorial space underlying treatments with phages (dose, timing, formulation, combination with antibiotics…). These traditional preclinical models represent a major bottleneck for the rational optimization of treatment strategies including multiple variables. Recent advances in *ex-vivo* and *in vitro* systems based on human cells, tissues and organoids offer a unique opportunity to overcome several limitations by enabling controlled, high-resolution and scalable investigations of phage–bacteria interactions under physiologically relevant conditions.

A major breakthrough will rely on the integration of complementary disciplines – biophysics (e.g. microfluidics, imaging, quantitative molecular characterization methods), chemistry (formulation science, stability, and molecular interactions characterization), mathematics (multi-scale modeling and predictive frameworks design), and biology (possible design of host cells, bacteria, phages) – to develop a new generation of experimental and computational systems. Such transdisciplinary approaches are expected to enable the quantitative and predictive analysis of multipartite interactions, including phage-bacteria-host dynamics, and to transform phage therapy from an empirical practice into a rational, controllable, and scalable therapeutic strategy.

Scientific questions and challenges

This work package aims to provide innovative methods for the preclinical evaluation of phage cocktails in clinically relevant conditions. This includes building experimental and theoretical frameworks for establishing guidelines on building robust cocktails with actionable parameters for adaptability to different host-related conditions.

A. Innovative design of robust phage cocktails across conditions. The antibacterial action of phages measured *in vitro* in the laboratory may not necessarily translate into clinical efficacy, due to the complexity of the host environment in which phages interact with bacteria. The physiological state of bacteria, their organization in spatial structures (e.g. biofilms) and host-mediated constraints can profoundly alter phage efficacy. Moreover, a major anticipated drawback of phage therapy is the selection of phage-resistant bacterial clones along treatments. Phage cocktails represent a promising strategy to lower the frequency at which phage-resistant will be selected, but their design is largely driven by few parameters (host range, genetic diversity, evolutionary trade-offs…) while others remained unaddressed (combination with antibiotics, structured environments, host-mediated constraints…). The first challenge is to establish innovative, flexible and robust frameworks for the rationale design and evaluation of phage cocktails, integrating evolutionary dynamics, genomic features, and ecological constraints, to limit resistance

emergence and increase long-term efficacy. This requires systems mimicking near-clinical conditions associating experimental and theoretical analyses to accurately predict and monitor infection modulation and phage activity across relevant physiological environments and scales (cell, organ, organism). These robust biomimetic frameworks will account for multi-parameter interactions for designing phage cocktails with improved efficacy.

B. Phage–host interactions and treatment efficacy. As biologics, phages administered to patients interact with human cells, which affects their distribution in tissues, delivery to the site of infection, penetration to biofilms as well as their elimination through either the reticuloendothelial system, renal excretion or immune neutralization. Moreover, phages will inevitably induce immune responses that will challenge the behavior of these particles in the infected host and ultimately influence treatment efficacy despite the self-amplification nature of phages in contact with susceptible bacteria. Therefore, it is necessary to identify and characterize mechanisms governing phage-host interactions (immunogenicity, neutralization, distribution, administration) and develop methods for monitoring them in variable environments (immunosuppression, combination with antibiotics…) to optimize treatment strategies and avoid rapid inactivation.

C. Modeling and predictive frameworks. The analysis of preclinical and clinical data requires the development of mathematical models capable of capturing their multidimensional nature. These models should particularly account for longitudinal aspects, i.e., the temporal evolution of biological systems across scales (host, bacteria, phage), as well as stochastic features reflecting the variability observed in their dynamics. Models may be developed to characterize and predict the *in vivo* and clinical pharmacokinetics of phages, integrating key determinants such as biopharmaceutical properties, route of administration, biodistribution, replication dynamics, phage neutralization and the associated host immune response. Additional models may be designed to describe and predict phage pharmacodynamics, whether administered individually or in cocktails, as well as phage-antibiotic interactions. Integrated PharmacoKinetic/PharmacoDynamic (PK/PD) modeling approaches are strongly encouraged to adequately capture the multidimensional complexity of the underlying biological processes taking place during phage therapy.

Cross-cutting considerations

In addressing these challenges, future studies should integrate diverse and complementary approaches across several fields. Methods and tools developed for model systems (phage-bacteria or phage-host pairs) should be adaptable and generalize to phage cocktails. A major issue to be addressed is the establishment of guidelines that are expected to be adaptable to evolving clinical conditions. Identification of critical parameters that would allow the rapid adjustment of cocktails to customize optimal treatments will directly benefit the patients. Moreover, predictive models exploiting clinical data from patients are expected to facilitate the guidance on strategic medical decisions to incorporate phage therapy with optimal efficacy.

Considered approaches

Addressing these challenges requires integrated experimental and computational strategies aimed at moving from empirical investigation toward predictive and scalable frameworks.

› For **Challenge A (Innovative design of robust phage cocktails across conditions)**, iterative design frameworks integrating genomic, evolutionary, and ecological/epidemiological data should be implemented. These should rely on high-throughput phenotyping to identify robust and evolutionary stable phage combinations, including in the presence of antibiotics and host-related constraints.

- For **Challenge B (Phage-host interactions and treatment efficacy)**, advanced *in vitro* and *ex vivo* systems based on human cells, tissues, and organoids, combined with microfluidic platforms, should be developed to reproduce controlled yet physiologically relevant conditions to both mimic infection and monitor anti-bacterial effect on chips. These systems should be associated with analytical methods to enable systematic and quantitative exploration of phage-bacteria interactions under tunable spatial and temporal parameters. Combined with *in vivo* systems, they should monitor phage antibacterial activity across biological scales (cell, organ, organism). These approaches should combine functional assays, imaging, and systems-level readouts to enable comparative evaluation and optimization of phage cocktails, thereby improving the predictability of therapeutic outcomes.
- For **Challenge C (modeling and predictive frameworks)**, multi-scale mathematical and computational models should be developed to integrate existing and novel experimental data on several model phages representative of the phage diversity for exploring large combinatorial spaces (phage combinations, dosing regimens, antibiotic co-treatments). These models should support prediction of antibacterial efficacy, resistance dynamics and help prioritize experimentally testable strategies.

WORK PACKAGE 3: INNOVATIVE MONITORING OF THE SOCIETAL IMPACT OF PHAGE THERAPY

While WP 1 and WP2 focus on pre-clinical research, thus covering only part of the research and development phase, it is important to consider subsequent steps in order to anticipate and integrate them into the analysis.

Scientific questions and challenges

This work package aims to address societal issues related to the use of bacteriophages in human medicine. This includes safety and regulatory aspects, perception and acceptability by patients and the medical community, as well as cost and integration into the healthcare system. It will also be important to consider the One Health dimension of phage therapy, as phages are already used for veterinary indications, and its impact on human medicine.

A. Safety and regulation of phage therapy. To address both the principles of accessibility and sustainability, regulation is paramount. It establishes the conditions of access to treatment, its uses and its modalities. While the issue is now relatively well-defined for natural phages, whether as a commercial product (regulated by the ANSM and the European Medicine Agency (EMA)) or as a hospital preparation (ANSM and European Directorate for the Quality of Medicines & HealthCare (EDQM)), the same cannot be said for engineered phages, which have so far been rejected by the ANSM. Therefore, it is essential to clarify how modified phages would be regulated and to determine the nature of the preclinical data required by regulatory authorities. Similarly, it is essential to consider a regulatory framework that governs both the production and the uses of engineered phages so as to minimize ecological and environmental impacts. The type of modification, the extent of the modifications, and the potential indications are important questions to address from the outset of research.

B. Perception and acceptability of phage therapy by the medical community and patients. Questions about acceptability of limited relevance if raised after the innovation has been developed. It is therefore crucial to address the perceptions, concerns, and understanding of phages within the medical community and among patients during their development, regardless of their intended applications (human and animal

medicine, biocontrol, additives, etc.). Attention should be paid to engineered phages, with qualitative surveys conducted among the different stakeholders (researchers, healthcare professionals – doctors, nurses, caregivers – patients, associations, learned societies, etc.).

C. Costs and economic models. The development and commercialization of healthcare innovations are typically driven by the private sector, sometimes leading to adverse consequences for both innovation uptake and patient access when pricing is excessively high. Therefore, it is important to consider both the economic and environmental costs of innovation, with the latter integrated into the former. Cost/benefit analyses should be conducted early in drug development to anticipate potential challenges. Alternative models to existing ones, based, for example, on public development or on public/private development of innovation, but with strict control and regulation, should be considered in order to uphold the two principles of accessibility and sustainability (for the planet and for the healthcare system). It would also be necessary to study how natural and engineered phages could be integrated into healthcare services, and with what type of support.

Considered approaches

To determine the various socio-cultural elements to consider within the framework of the booster program on phage therapy, the analysis relies on the concept of a development model, which extends from the research and development stage to the administration of the drug.

It is also important to distinguish between natural and engineered phages. Although significant progress has been made with natural phages, engineered phages have not been the subject of any in-depth studies from a social, cultural, economic, ecological, or political perspective.

Regarding development models, two essential principles should guide the analysis:

- the first one is to make phages (natural or engineered) accessible to the widest possible range of patients according to their needs (accessibility). Given the increasing antibiotic resistance expected in the coming years/decades, the number of patients likely to benefit from phage therapy (natural or engineered) will likely follow this upward trend. Accessibility is therefore directly linked to cost, including for the healthcare system;
- the second one involves integrating the sustainability of the phage therapy (from production to administration and distribution) into every stage of the phage development model (natural or engineered), as well as the ecological consequences of its use (resistance, dissemination, etc., especially with modified phages where there could be a shift in the host spectrum).

PROGRAM OPERATION

Governance and organization

The booster program. Through its booster programs, Inserm supports collaborative projects to foster scientific excellence and breakthrough innovation in strategic priority areas such as the phage therapy field. Inserm is launching a call for proposals of letters of intent for Inserm research teams contemplating to join the scientific consortium of the Phage therapy booster program; this will be done in collaboration with Laurent Debarbieux's microbiology team.

The Phage therapy booster program will be structured into different work packages (WPs), by a single scientific consortium composed of 10-12 participants (individual researchers or teams) selected by a scientific advisory board (SAB). This consortium is led by a scientific coordinator appointed by Inserm, the coordinating institution, in close collaboration with the directors of Inserm's theme-based institutes for (i) Health Technologies (TS) and (ii) Immunology, Inflammation, Infectiology and Microbiology (I3M). The program will be guided by the leaders of each WP, selected among the participating members of their respective WP.

The scientific advisory board (SAB). An international scientific expert committee responsible for (a) selecting participants based on the letter of intent, (b) providing recommendations to the directors of the Inserm's theme-based institutes of the Booster program, (c) advising on the arrangement across the participants and work packages, (d) reviewing the final scientific program that will be submitted for approval to Inserm, and (e) evaluating the completed booster program.

The SAB is composed of four to six (4-6) international experts appointed by the directors of the theme-based institutes of Inserm TS and I3M who will also attend SAB meetings as observers.

The program scientific committee. Responsible for monitoring the progress of the scientific component of the program, this committee is composed of the scientific coordinator and the leaders from each work package.

The program steering committee. Responsible for managing the implementation of the program, including the budget, and for approving proposals from the program's scientific committee related to the execution of the overall program strategy. It is composed of the scientific coordinator, the directors of the theme-based institutes of Inserm TS and I3M, and the director of the Inserm's Strategic programs department.

Program implementation

Preparation of the program. A prospective meeting of the theme-based institutes of Inserm and the executive management of Inserm leads to the identification of a specific scientific need or opportunity.

Following this meeting, scientific working group composed of national experts[1], with complementary areas of expertise in the field, was established to identify the major scientific challenges that need to be addressed. Several brainstorming meetings led to the definition of the proposed booster program and work packages.

It is important to note that since the letters of intent to participate in the program will be evaluated by an international SAB, there will be no conflict of interest if any of the national field experts apply to be part of the program.

Set-Up of the consortium. The program is established by a scientific consortium involving the participants and is organized around work packages. The set-up of the consortium will occur in two stages: an initial selection of candidates based on letters of intent by the international SAB, followed by the generation of the preliminary scientific program thanks to a phase of co-construction of the scientific component of the program and working work packages.

Electronic submission of the letter of intent. The proposals can originate from:

- A single researcher
- A research team

[1] Composition of the working group: Oumya Adjali (Nantes), Jean-Michel Bolla (Marseille), Cédric Bouzigues (Paris), Charlotte Brives (Bordeaux), Charles Burdet (Paris), Laurent Debarbieux (Paris), Baptiste Gaboriau (Paris), Nicolas Grégoire (Poitiers), Nathalie Heuzé-Vourc'h (Tours), Ariel Lindner (Paris), Jean-Yves Madec (Lyon), Laurent Kremer (Montpellier), Sandrine Marchand (Poitiers), Marie-Cécile Ploy (Limoges), Jean-Damien Ricard (Paris), François Rousset (Lyon), Harry Sokol (Paris), Régis Tounebize (Paris).

Co-construction of the work packages. The international SAB will select participants based on the evaluation criteria described below. Following the selection of the participants based on letters of intent, and based on the proposals and recommendations of the SAB, the TS and I3M directors of the theme-based institutes of Inserm, together with the director of Inserm's Strategic programs department, will invite the selected participants at a brainstorming seminar aimed at drafting the preliminary scientific program. Upon completion of this seminar, the scientific coordinator of the consortium will submit a final scientific program to the steering committee and will be evaluated by the members of the international SAB. It will detail the contribution of each participant, the objectives and expected outcomes, as well as a detailed three-year funding plan and identified potential external funding sources. After validation by the SAB of the finalized proposal, the document will be submitted to the executive management of Inserm. A kick-off meeting will be held shortly after approval by the CEO of Inserm.

Follow-up of the program. The program scientific committee will organize an annual scientific meeting bringing together the consortium participants and the steering committee. During this meeting, the scientific achievements and progress on the booster program will be presented. The discussion will also address the upcoming stages, the next steps to be taken, and, if necessary, propose new developments and strategic directions for research.

ELIGIBILITY AND EVALUATION CRITERIA FOR THE LETTERS OF INTENT

Eligibility criteria

To be considered eligible to participate in the consortium, the letter of intent must meet the following conditions:

- Respond to the objectives of this call for proposals and address at least one of the scientific questions and challenges of the work packages previously described
- The participant must be or must involve a tenured researcher, a tenured teaching-researcher or a university hospital researcher working within a scientific team labelled by Inserm[2]. They may, for the needs of the project, propose the association of participants from other institutions, with the agreement of these institutions[2]
- Each participant must specify:
  - the time commitment to the program;
  - the resources, including staff or equipment, that they intend to mobilize as part of the program.
- Participants that have already initiated joint reflection before submitting the letter of intent will be favored. In this case, individual applications are still necessary, specifying any pre-established collaborations.

Evaluation criteria

After checking the eligibility criteria, the letters of intent will be submitted for evaluation by the international SAB. Letters of intent that do not meet the eligibility criteria will not be evaluated.

The evaluation criteria are as follows:

- **Quality and originality of the proposed research**
  - Clarity of research objectives and hypotheses
  - Innovative and progress compared to the state of the art

[2] A labelled team is a team approved by Inserm in accordance with its own process of evaluation.

› **Know-how/skills**
- Relevance of skills in relation to the objectives of the program
- Ability to associate skills in a wide network

› **Scientific and/or technical excellence of the participant**
- International recognition
- Competence of team leaders in their discipline

› **Quality of the research environment**
- Human resources mobilized in the program
- Infrastructure available to carry out the program

› **Innovation/competition**
- Innovative nature of the project in relation to international scientific challenges or in relation to international competition

› **Expected outcomes**
- Impact of the outcomes in terms of knowledge and solving technological challenges
- Articulation of the project in the construction of a consortium in response to international calls.

ELIGIBILITY CRITERIA FOR THE FINALIZED PROGRAM

To be considered eligible, the scientific program must meet the following conditions:

› the project must meet the goals of the booster program;

› each work-package must include at least two participants with complementary skills. At least one of the participants involved in the work-package must be a team labelled by Inserm[2] or be employed by Inserm;

› The scientific coordinator must be significantly involved in the project.

PHAGE THERAPY BOOSTER PROGRAM'S CALENDAR

Publication of the call for proposals and opening of the proposal submission website	**July 10th, 2026**
Deadline for electronic submission of the letter of intent	**September 18th, 2026 – 5:00 PM**
Meeting of the international SAB for the selection of letters of intent	**October 16th, 2026**
Brainstorming seminar with the members of the consortium. In-person meeting in Paris	**November 9th, 2026**
Co-construction of work packages and the scientific program	**November 9th to December 15th, 2026**
Deadline for submission of the finalized scientific program to the coordinating establishment	**December 15th, 2026**
Evaluation of the scientific program by the international SAB	**January 7th, 2027**
Validation of the proposal by the CEO of Inserm	**January 21th, 2027**
Kick-off meeting	**January 28th, 2027**

OPERATING CONDITIONS OF THE CONSORTIUM

Coordination of the consortium

The coordinating institution of the consortium is Inserm.

Duration of the program

Three (3) years.

Scientific reports

The scientific coordinator of the consortium will provide scientific reports to the coordinating institution according to the charter of good practices of Inserm (inserm.fr/en/our-research/good-practices-at-inserm) in the following schedule:

A brief progress report six (6) months after the beginning of the project
A mid-term report
A final report that must be submitted no later than two (2) months after the end of the booster program.

The reports may lead Inserm to request additional information, suspend the program, or end financial support, and also to request reimbursements notably if the program is not properly run or if funding is not being used properly.

Responsibility of the scientific coordinator

The scientific coordinator must inform Inserm and its partners, if necessary, via the program steering committee of any substantial modification of the research program or difficulties hindering the program completion. The scientific coordinator must also participate actively in the program monitoring procedures organized by Inserm (presentation seminars, colloquia, etc.).

Publications and communication

It is requested that for all communications and publications, including presentations at conferences, interviews or other events, proper acknowledgement is given to the booster program.

Without prejudice of any other statement, the publication or communication must include the following funding statement:

"**Financial support from Inserm to the Phage therapy booster program**"
or "**Avec le soutien financier de l'Inserm dans le cadre du programme d'impulsion Phagothérapie**"

These publications will be sent to Inserm for reference as soon as possible and at the latest five (5) days following publication, which enables the preparation of a possible institutional communication.

Intellectual property

Subject to prior agreement regulating this topic, the rules of ownership, use and exploitation of the results of the program will be defined in an agreement concluded by and between the legal body involved in the consortium.

Consortium agreement

The drafting of a consortium agreement is strongly recommended, in particular to manage the aspects of governance of the program, sharing data, and the production of the program deliverables including the production of scientific reports, the organization of progress and annual meetings, intellectual property, use and exploitation of results from the program. It becomes mandatory as soon as a legal body regulated by the French private law (or equivalent for a foreign legal body) is involved in the program.

RULES FOR SUBMISSION

Submission of the letter of intent

The submission of the letters of intent should be done through the Inserm website of applications to the strategic programs (https://appels.programmesstrategiques.inserm.fr).

Electronic submission deadline

Deadline	September 18th, 2026 – 5:00 PM
It is strongly recommended not to wait until the closing deadline of the call to submit the letter of intent.	

Submission of the finalized scientific program

Submission will be made to the coordinating institution: Inserm.

PUBLICATION OF RESULTS

The list of participants selected from the letters of intent will be published on the Inserm pro website. In addition, all the candidates will receive a notification of the result of their application.

COMMITMENTS OF THE PARTICIPANTS

Each participant shall provide evidence or shall warrant that:

- Its commitment within the program shall be consistent and compatible with its others commitments outside of the program prior and after the beginning of the program
- Nothing prevents its involvement in the program (therefore, prior to the beginning of the program, each participant shall notably obtain the prior approval, when requested, of its employer and during the program each participant shall inform Inserm without delay of any situation that could prevent the participant from participating in the program).

When a participant shall not meet anymore one of the criteria described in this document, Inserm shall be entitled to exclude the said participant (excluding participant) of the program and, as the case may be, claim reimbursement of all or part of the fund provided by Inserm.

A participant may withdraw from the consortium for legitimate reasons, subject to giving three (3) months notice to Inserm by a registered letter with acknowledgment of receipt.

The excluding or departing participant undertakes to communicate to the other participants, at no charge and without delay, all the records and information needed to enable them to continue the program.

Similarly, the excluding or departing party undertakes not to impose its intellectual property rights to prevent or preclude the continuation of the program and, subject to third-party rights, undertakes to grant a license to use its background knowledge and possibly its proprietary results.

CONTACT

In case of scientific or technical questions, or if you have questions related to the electronic submission, you can contact us at programmes.strategiques@inserm.fr

the booster programs

June 2026

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Cover illustration:
3D Rendering of bacteriophage virus on bacterial cell

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Inserm is the only French public research organisation entirely dedicated to health. Our aim is to advance our understanding of living organisms and diseases, and to drive innovation to improve everyone's health.

Inserm's booster programs

The challenges in biology and health are constantly evolving and offer numerous opportunities for innovation. In this context, and in line with its mission to accelerate the advancement of knowledge, support interdisciplinary and integrated research, and ensure continuity between basic and clinical research, Inserm is establishing scientific booster programs whose goals are to:

- structure scientific communities in specific and priority areas by creating national interdisciplinary consortia that will rely on the expertise and skills of Inserm teams
- make French biomedical research a leading player in these fields by accelerating the acquisition, transfer, and valorization of knowledge, potentially involving industry partners at the conception of the programs.

These federative programs aim to create a new dynamic in innovative fields by developing complementary expertise to explore research areas that are poorly studied.

Only collaborative projects will be funded, which consist of a unique set of actions: several work packages whose implementation will rely on a consortium of teams.

These programs are open to academic and industrial partnerships of variable geometry: either a partnership on the entire program or a partnership on one or more work packages of the program.

Scientific questioning at the border of biological knowledge, new technological opportunities, the pooling of the strengths of Inserm teams in the field of the booster program, and potential societal valorization are determining elements for the establishment of these programs.

Design Myriem Belkacem – Communication department, Inserm – June 2026