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Aude Bernheim
Group Leader at Institut Pasteur



Education

- 2022 **Habilitation to direct research, HDR**, Université Paris-Cité, Paris, France
2014-2017 **PhD in Microbiology** Pasteur Institute, Paris, France
2013-2014 **Post Master Degree: Management of public policies** Pont ParisTech –AgroParisTech.
2012-2013 **Master Degree, "Interdisciplinary Approaches to life sciences"** Center for Interdisciplinary Research (Paris 7)
2009-2013 **Engineering degree from AgroParisTech**: Paris Institute for life and environmental sciences
2007-2009 **BCPST**: Program preparing the national entrance exams for the selective "Grandes Ecoles" (Lycée Henri IV, Paris)

Working Experiences

- 2023-curr. **Group leader at Institut Pasteur, Paris, France.**
Group leader of the Molecular Diversity of Microbes Lab (<https://mdmlab.fr>)
- 2021-2023. **Team leader at INSERM (French National Institute of Health and Medical Research), Paris, France.**
U1284 Unit. Principal Investigator of the Molecular Diversity of Microbes Lab (<https://mdmlab.fr>)
- 2018-2020 **Post-doc at the Weizmann Institute of Sciences, Rehovot, Israel.**
Department of Molecular Genetics. Rotem Sorek's lab.
- 2014- 2017 **PhD in Microbiology at the Pasteur Institute, Paris, France**
Microbial Evolutionary Genomics and Synthetic Biology labs. Supervisors: Eduardo Rocha and David Bikard.
- 2013- curr **French civil servant**: Engineer of the « Bridges, Waters and Forests »
Technical Corps of the French State. Resource for informed public policies for the Ministry of Agriculture

Scientific productions

Selected publications

Predicting phage-bacteria interactions at the strain level from genomes

Gaborieau B*, Vaysset H*, Tesson H*, Charachon I., Dib N., Bernier J., Dequidt T., Georjon H., Clermont O., Hersen P., Debarbieux L, Ricard JD, Denamur E., **Bernheim A.** [bioRxiv, 2023.11. 22.567924 \(2023\)](https://doi.org/10.1101/2023.11.22.567924)

Viperin immunity evolved across the tree of life through serial innovations on a conserved scaffold

Shomar H*, Georjon H*, Feng Y, Olympio B, Tesson F, Cury J, Wu F*, **Bernheim A***. [bioRxiv, 2023.09. 13.557418 \(2023\)](https://doi.org/10.1101/2023.09.13.557418)

The highly diverse antiphage defence systems of bacteria

Georjon H, **Bernheim A.** [Nature Reviews Microbiology, 21 \(10\), 686-700 \(2023\)](https://doi.org/10.1038/s41579-023-0100-0)

Conservation of antiviral systems across domains of life reveals novel immune mechanisms in humans.

Cury* J, Mordret* E., Hernandez Trejo V., Tesson F., Hervé A., Ofir G., Enzo Z. Poirier, **Bernheim A.** [bioRxiv \(2023\)](https://doi.org/10.1101/2023.09.13.557418)

Systematic and quantitative view of the anti-viral arsenal of prokaryotes.

Tesson F., Hervé A., Touchon M., d'Humières C., Cury J., **Bernheim A.** [Nature Communications 13:256 \(2022\)](https://doi.org/10.1038/s41467-022-28256-1)

Patents:

PhD: **Inhibition of NHEJ repair using Csn2** US n° 62/589,660 (2017)

Post doc: **Anti-viral and anti tumoral compounds** P-583071-USP (2019), licensed to Pantheon Biosciences.

PI: **Novel human antiviral genes related to the Eleos and Lamassu Prokaryotic systems** US: EP22306832.1 (2022).

Fellowships and Grants

2024 EMBO Young Investigators Program, EMBO

2021 ERC starting grant: European Research Council (1.5M)

2021 ATIP-avenir laureate: INSERM-CNRS (300k€)

2021 Emergence Paris Université de Paris (40k€)

2021 ANR JCJC French Nation Research Agency (300k€, declined)

2021 Rosalind Franklin Young Investigator Award, American Society of Genetics and Gruber Foundation (75k€)
2021 CRI group Leader, Center for Research and Interdisciplinarity (300k€)
Post doctoral fellowship: EMBO Long term fellowship (2018), **Weizmann Institute of Science's Dean of Faculty's** fellowship (2018), **Israel Academy of Sciences**, post-doctoral fellowship (2018)

Scientific Prizes

Prize of the College de France for Young investigators (2022, 20k)
Jacques Monod Prize for Young Investigators, Fondation Jacques Monod (2020,16k)
Prize for outstanding achievements during post-doctoral research Weizmann Institute of Science (2020)
Bettencourt Schueller Prize for Young Researchers, Fondation Bettencourt Schueller (2018, 25k€)
100, 300 talents 2016, 2017 L'Oréal-UNESCO for Women in Science
Grand Prize iGEM (Competition of synthetic biology) Winning project among 210 international teams

Member of committees / academies

French Presidential Council of Sciences (2023-curr): 12 members ranging from social and natural sciences to advise French President Macron. (details [here](#))
Elected to the European Academy of Microbiology (2023)
Scientific Advisory Board Generare Bioscience (2023-curr)

Selected communications:

Invited Seminars

2024: TUM (Munich), UMass Chan Medical School (Worcester, USA, online), Wageningen University (Netherlands), Vienna BioCenter (Austria)
2023: ETH (Zurich), Ewag (Zurich), Institute for Innovative Genomics (Berkley), UCSF (San Francisco), Laboratoire Chimie Bacterienne (CNRS, Marseilles), Hebrew University (Rehovot, online), EMBL (Heidelberg), Retraite Institut Curie (Paris), Biozentrum (Basel), Gingko Bioworks (online)..
2022: LMB (Cambridge, UK), Columbia University (New-York), Center of Virus Research (Glasgow), Harvard Medical School (Boston), NIH (Bethesda), Université Pierre et Marie Curie (Paris), EligoBiosciences (Paris)..
2021: INSERM ARNA Laboratory (Bordeaux) ; CIRI (Lyon) Cochin Institute (Paris), INEM (Paris), Forschung Zentrum (Julich), UCL (London), St Andrews University (Scotland)..
2020: MicroSeminar (online seminar), CIIMAR (Porto), IBB (Barcelona), John Ines Center, (Norwich), Pasteur Institute (Paris) , Cochin Institute (Paris)

Conferences

2023: The mathematics of microbial evolutionnary biology Banff, Canada (Invited Speaker) ; Symposium on the immune system of bacteria, Weizmann Institute, Israel (Organizer); Gordon Evolutionary Genomics (Invited Speaker), Gordon Microbial Adhesion and Signal Transduction (Invited Speaker), SPP Phage Interactions, Berlin (Invited Speaker), New Concepts and Approaches in Microbiology (Selected Talk), Immunology Quo Vadis, Munich (Keynote Speaker), Congres des Sociétés Francaises et Allemandes d'Immunologie (Invited Speaker), Evol Lyon (Keynote Speaker)
2022: CRISPR 2022, Boston, USA (Invited Speaker), CRISPR Frontiers, Cold Spring Harbor CRISPR, USA (Invited speaker), Understanding and Predicting Microbial Evolutionary Dynamics, Manchester, Microbiology Society (Invited speaker), FEMS Summer School, Split, Croatia (Invited Speaker), Phage symposium, Leiden Consortium (Keynote Speaker, BioSynSys, Paris, (Keynote Speaker)
2021: Evergreen conference, USA (Selected Talk, 2021); Keynote speaker, PHAGES Network, Roscoff, France (Keynote Speaker); Viruses of Microbes webinar, online (Invited Speaker); French Society of Virology (Selected Talk), VEGA Series, Joint Genomic Institute, California, USA (Invited Speaker)

Before 2020

New Concepts and Approaches in Microbiology, Heidelberg Germany, 2019 (Selected Talk) ; CRISPR 2019 : Quebec, Canada, 2019 (Selected Talk) ; FEMS 2017 : European Society of Microbiology Valencia, Spain (Selected Talk) ; SFM 2017: French Society of Microbiology, Paris, France (Invited speaker) ; ALPHY 2017 : Bioinformatics and Evolutionary Genomics, Lyon, France, (Selected Talk) ; Journée Claude Bernard, French Society of Biology, French Academy of Medecine, Paris, France (Invited Speaker, 2017)

Community work

- Symposium Organization: Organization with Rotem Sorek (Weizmann Institute) and Philip Kranzusch (Harvard Medical School) of the Symposiums on the immune systems of bacteria: SISB2023 EMBO Workshop, Weizmann Institute of Science. SISB2024 Harvard Medical School, Boston.
- Organization of a European Phage Workshop (December 2022)
- Participation to committees: Phd thesis juries (4), Phd committees (3), prize selection (1)
- Reviewer for diverse journals (15/year): Nature, Science, Cell Host Microbes, Nature Microbiology, Plos Biology ...
- Reviewer of grants: ERC starting grant (2023), EMBO Short term Exchange (10)

Teaching

- “**The immune systems of bacteria**”, (Lectures Master 2, >10 times)
- **Bacterial genetics (Magistere of Genetics of University of Paris, master IMVI)** Coordination and teaching of the module (2nd year of Master Degree, one week, 2020, 2021, 2022).
- **Computational Biology**, Master 1 AIV (Interdisciplinary Approaches to Life Sciences) coordination/6 hours teaching in (2022)
- ‘**Disruptive technologies and public policies**’ for Master students, Science-Po Paris, School of Public Affairs. Creation of a innovative class about links between science and public policies for 2nd year of Master Degree; 2h/week for 12 weeks. (2016, 2017).
- « **Quantitative evaluation of public policies for gender equality** » in the Master PAPDD (**Public policies and administration Management for Sustainable Development**).(2015, 2016, 2017)

Science and Society work

Selected Work

Lab outreach

- Created video channel to describe our science to the general public: <https://www.youtube.com/@mdmlab/videos>
- Conferences for the general public on bacterial immunity: ex [College de France](#), Paris-Saclay’s summit, EvolLyon ...
- Podcasts; FEMS [Microbes and US](#), BBC’s Bacteria: [The Tiny Giants](#), [Curieux](#)
- Created an approach to estimate gender bias in citation: https://github.com/mdmparis/Estimating_gender_bias_in_references
- Seminars on Gender equality in research: Institut Curie, Société Française du Cancer, EAWAG etc
- Medias: Matinale de France Inter, France 2, RFI, TV5 Monde

Science à la Pelle: A Citizen Science Initiative to discover new drugs from soil <https://www.science-a-la-pelle.fr/>

Launched in June 2022, with Vincent Libis, another researcher in INSERM U1284, the project aims at collecting soils with citizens. Using these samples, bacteria are isolated (*Streptomyces*) using selective media to create a collection. This collection is then screened for the biosynthetic potential of the strains further used to discover novel molecules. The project is also used as a platform to do science outreach. It was featured in French national media (Le Figaro, France Inter, France Info...).

Co-author with F. Vincent of the book “L’intelligence artificielle pas sans elles”, Belin edition, 2019

Loose title translation : *Artificial Intelligence, not without her*. **Book for the general public** on algorithms bias and more generally on links between sex/gender and artificial intelligence. The book was accompanied by development of an exhibition, a comic book and a series of conferences on AI sexist bias (Description of the full campaign [here](#)). Book was reprinted 3 times in a few months and sold in several thousands of copies. Inspired political, activist and companies to make algorithms less biases.

Co-Founder and Co-President of WAX Science: [WAX Science](#) is an NGO that promotes science without stereotypes and gender balance in science by creating and spreading innovating tools (co-presidency 2013-2016 ; 2022-). It was founded in 2013 and during the co-presidency rose to 40 active volunteers, 6 full time interns, 50k€ budget, dozens of projects, and more than 10 000 people reached by the activities of the association.

Co-Founder and Co-President of ItCounts: an open source, citizen science crowd-sourcing application to promote gender balance. <http://itcounts-app.org/>.

Member of the Club “Science Publique” on France Culture : Debate for one hour every 2 months on national radio channel France culture about general scientific subjects with scientific personalities (2013-2015)

Selected prizes for Wax Science

European Gender Summit Laureate with the video ‘[Science It’s Your Thing](#)’ (2012, more than 50 000 views)

Awards for **Digital Educative Technology** (Ministry of Education and Research, 2013).

Innovative Project of the Year (AIV, 2013, **25k€**).

“**Disruptive Activism**” Prize of Hackathon Women Innovation by Orange ; Build up program by Google for 6mths

AFNIC Foundation laureate for Digital Solidarity. (2016, **30k€**)

Selected media for Wax Science and IA pas sans elles

Speaking on national radios and TV: [France Inter](#) (Les Savantes, la TAC), [France Culture](#) (Science Publique), [Europe 1](#) (30 glorieuses) and France Info ([L'instant T](#))

Portraits and articles about WAX Sciences: [Cheek Magazine](#), [ELLE](#), [Le Figaro](#), [Studyrama](#), [L'Etudiant](#), [Mademoizelle](#), [Le Monde](#), [Marie Claire](#)...

Articles about the book « l'intelligence artificielle pas sans elles » : ([Le Monde](#), [Les Echos](#), Challenge, [L'Opinion](#), [Liberation](#), [Uzbek et Rica](#), [France Inter](#), [France Info](#), ...).

Selected communications for Wax Science and IA pas sans elles

L'Echappée Volée : General public conference (TED-like, 1200 people) on stereotypes in science ([vidéo](#)), the text of the talk was published in the book "**Demain, territoire de tous les possibles** "under the direction of Michel Levy-Provencal, Larousse.

General public conferences towards:

- **youth** (Youth We Can, La Riposte...) ; **start-up** (Osons la France, Hello Tomorrow...) ; **gender equality** (Women Forum, Forum de la mixité...) ; **art and sciences** (Gaieté lyrique, Festival Numok, Lieu Unique...)

Talks and workshops for institutionnal organizations, NGOs companies : More than 40 talks for companies (RATP, BNP Parisbas, Altran...), NGOs (Animafac, Open Knowledge Foundation, Network of women administrators...), institutional organizations (French Academy of Medecine, Council of Europe...)

Writings for different specialized journals (with F. Vincent)

Revue de la Ligue des droits de l'homme: *La diversité, outil de questionnement scientifique*

Diplômées: *Cultures numériques, la norme mâle.*

Full List of Publications

* Equal contributions

Group Leader

2024

A Comprehensive Resource for Exploring Antiphage Defense: DefenseFinder Webservice, Wiki and Databases.

Tesson F., Planel R., Egorov A., Georjon H., Vaysset H., Brancotte B., Neron B., Mordret E., Atkinson G., **Bernheim A***, Cury J*
[bioRxiv, 2024.01.25.577194](https://doi.org/10.1101/2024.01.25.577194)

Viral proteins activate PARIS-mediated tRNA degradation and viral tRNAs rescue infection

Burman N.*, Belukhina S.*, Depardieu F.*, Wilkinson R.*, Skutel M., Santiago-Frangos A., Graham A., Livenskyi A., Chechenina A., Morozova N., Zahl T., Henriques W., Buyukyoruk M., Rouillon M., Shyrokova L., Kurata T., Hauryliuk V., Severinov K., Grosseille J., Thierry A., Koszul R., Tesson F., **Bernheim A.**, Bikard D.*, Wiedenheft B.*, Isaev A*
[bioRxiv, 2024.01.02.573894](https://doi.org/10.1101/2024.01.02.573894)

Lessons from twenty years of the life of commensal Escherichia coli populations in a human gut

Condamine B, Morel-Journel T, Tesson F., Magnan M, Bernheim A., Denamur E., Blanquart F., Clermont O.
[bioRxiv 2024.02.21.581337](https://doi.org/10.1101/2024.02.21.581337)

2023

Predicting phage-bacteria interactions at the strain level from genomes

Gaborieau B*, Vaysset H*, Tesson H*, Charachon I., Dib N., Bernier J., Dequidt T., Georjon H., Clermont O., Hersen P., Debarbieux L, Ricard JD, Denamur E., **Bernheim A.**
[bioRxiv, 2023.11.22.567924 \(2023\)](https://doi.org/10.1101/2023.11.22.567924)

Viperin immunity evolved across the tree of life through serial innovations on a conserved scaffold

Shomar H*, Georjon H*, Feng Y, Olympio B, Tesson F, Cury J, Wu F*, **Bernheim A***.
[bioRxiv, 2023.09.13.557418 \(2023\)](https://doi.org/10.1101/2023.09.13.557418)

The highly diverse antiphage defence systems of bacteria

Georjon H, **Bernheim A.**
Nature Reviews Microbiology, 21 (10), 686-700 (2023)

Genomic characterization of the antiviral arsenal of Actinobacteria

Georjon H., Tesson F., Shomar H.*, **Bernheim A***.
Microbiology, 2023 Aug;169(8):001374_(2023)

Conservation of antiviral systems across domains of life reveals novel immune mechanisms in humans

Cury* J, Mordret* E., Hernandez Trejo V., Tesson F., Hervé A., Ofir G., Enzo Z. Poirier*, **Bernheim A***.
[bioRxiv https://doi.org/10.1101/2022.12.12.520048 \(2023\)](https://doi.org/10.1101/2022.12.12.520048)

Immunité bactérienne: à la découverte d'un nouveau monde

A Hardy, H Shomar, **A Bernheim**
médecine/sciences 39 (11), 862-868

2022

Systematic and quantitative view of the anti-viral arsenal of prokaryotes

Tesson F., Hervé A., Touchon M., d'Humières C., Cury J., **Bernheim A.**
Nature Communications 13:256 (2022)

Synergy and regulation of anti-phage systems: towards the existence of a bacterial immune system ?

Tesson F., **Bernheim A.**
Current Opinion in Microbiology, 71, 102238 (2022)

CRISPR-Cas and restriction-modification team up to achieve long-term immunity

Cury J., **Bernheim A.**
Trends in Microbiology S0966-842X(22)00091-9. (2022)

Phages and their satellites encode hotspots of antiviral systems

Rousset F., Dowding J., **Bernheim A.**, Rocha E.P.C, Bikard D.
Cell Host and Microbes, 30 (5) 740-753.e5 (2022)

Evolutionary and mechanistic diversity of Type I-F CRISPR-associated transposons

Klompe S, Jaber N, Bel L, Mohabir J, **Bernheim A.**, Sternberg S
Molecular Cell 82 (3), 616-628.e5 (2022)

An expanding arsenal of immune systems that protect bacteria from phages

Millman A., Melamed S., Leavitt A., Doron S., **Bernheim A.**, Hör J., Lopatina A., Ofir G., Hochhauser D., Stokar-Avihail A., Tal N., Sharir M., Voichek M., Erez Z., Lorenzo M. Ferrer J., Dar D., Kacem A., Amitai G., Sorek R.
Cell Host and Microbes (2022)

Post-doctoral

Prokaryotic viperins produce diverse antiviral molecules.

Bernheim A., Millman A., Ofir G., Meitav G., Abraham C., Shomar H., Rosenberg M., Tal N., Melamed S., Amitai G., Sorek R
Nature 589, 120-124 (2021)

Bacterial retrons function in anti-phage defense.

Millman A*, **Bernheim A***, Stokar-Avihail A.*, Fedorenko T., Voichek M., Leavitt A., Oppenheimer-Shaanan Y., Sorek R
Cell 183 (6), 1551-1561 (2020)

The bacterial pan-immune system: anti-phage defense as a community resource

Bernheim A., Sorek R
Nature Reviews Microbiology 2020 18, 113–119 (Perspective) (2020)

Multiple phage resistance systems inhibit infection via SIR2-dependent NAD⁺ depletion.

Garb J, Lopatina A. **Bernheim A.**, Zaremba M, Siksnys V, Melamed S, Leavitt A, Millman A, Amitai G, Sorek R
Nature microbiology 7 (11), 1849-1856 (2022)

Virus cooperate to defeat bacteria

Bernheim A., Sorek R
Nature 559 (7715), 482-484, (News and Views) (2020)

Phd

Atypical organizations and epistatic interactions of CRISPRs and cas clusters in genomes and their mobile genetic elements

Bernheim A., Bikard D, Touchon M, Rocha EPC
Nucleic Acids Research 2020 48 (2), 748-760

A matter of background: DNA repair, pathways as a possible cause for the sparse distribution of CRISPR–Cas, systems in bacteria.

Bernheim A., Bikard D, Touchon M, Rocha EPC
Philosophical Transactions of the Royal Society B 2019 B 374 (1772), 2018008

Inhibition of NHEJ repair by type II-A CRISPR-Cas systems

Bernheim A., Calvo-Villaman A, Basier C, Cui L, Rocha EPC, Touchon M, Bikard D
Nature Communications 2017 8 (1), 1-9

CRISPRCasFinder, an update of CRISPRFinder, includes a portable version, enhanced performance and integrates search for Cas proteins.

Couvin D., **Bernheim A.**, Toffano-Nioche C., Touchon M., Michalik J., Néron B, Rocha EPC, Vergnaud G., Gautheret D., Pourcel C.
Nucleic Acids Research 2018 46 (W1), W246-W251

Genetic exchanges are more frequent in bacteria encoding capsules.

Rendueles, O, de Sousa, J, **Bernheim A.**, Touchon M, Rocha EPC
PLoS Genetics 2018 (14(12)) 1-25

A Eukaryotic-like Serine/Threonine Kinase Protects Staphylococci against Phages

Depardieu, F, Didier J.P, **Bernheim A.**, Sherlock A, Molina H. Duclos B, Bikard D.,

Cell Host and Microbes 2016 20 (4), 471-481

Methods for the Analysis and Characterization of Defense Mechanisms Against Horizontal Gene Transfer: CRISPR Systems

Calvo-Villamañán A., **Bernheim A.**, Bikard D.

Horizontal Gene Transfer. 2020 235-249 (Book Chapter)

Master

Genetic and life-history traits associated with the distribution of prophages in bacteria

Touchon M, **Bernheim A**, Rocha EPC

ISME Journal 2016 10 (11), 2744-2754

Phage-mediated Delivery of Targeted sRNA Constructs to Knock Down Gene Expression in *E. coli*

Bernheim A.*, Libis V.*, Lindner A., Wintermute E.,

Journal of Visualized Experiments 2016 109 e53618.

Silencing of antibiotic resistance in *E. coli* with engineered phage bearing small regulatory RNAs

Libis, V*, **Bernheim, A***, Basier C, Deyell M, Aghoghobe I, Atanaskovic, I, Amel C, Benony M, Koustoubelis N, Lochner A, Marinkovic Z, Zahra S, Zegman Y, Lindner AB, Wintermute EH,

ACS Synthetic Biology 2014 3 (12), 1003-1006

Engineering gene overlaps to sustain genetic constructs in vivo

Decrulle A, Frenoy A, Meiller-Legrand T, **Bernheim, A**, Lotton C, Gutierrez A, Lindner AB

Plos Computational Biology 2021 17(10): e1009475

Characterization of Mycobacterial Growth Inhibition by Lytic Enzymes Expressed in Vectorized *E. coli In Situ*

Atanaskovic I, Bencherif C, Deyell M, Jaramillo-Riveri M, Benony M, **Bernheim A**, Libis V, Koustoubelis A, Zegman Y, Lochner A, Basier C, Aghoghobe I, Marinkovic Z, Zahra S, Toulouze M, Lindner AB, Wintermute EH,

ACS Synthetic Biology 2014 3 (12), 932-934

Assessment of the health impact of GM plant diets in long-term and multigenerational animal feeding trials: A literature review.

Snell C, **Bernheim A**, Bergé JB, Kuntz M, Pascal G, Paris A, Ricroch AE,

Food and Chemical Toxicology 2012 50 (3-4) 1134-48