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# **Pascale Cossart: *Listeria monocytogenes*, host-pathogens interactions & beyond**

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I met Pascale Cossart for the first time in Paris in May 1998, on my way to the 'General Meeting' of the American Society for Microbiology in Atlanta (presided over that year by Stanley Falkow). While concluding a Ph.D. investigating the intracellular life of the bacterial pathogen *Brucella abortus* with Jean-Pierre Gorvel in Marseilles (Pizarro-Cerdá *et al.*, 1998a, 1998b, Sola-Landa *et al.*, 1998), I was determined to pursue my career in the field of host-pathogen interactions. I was interested in joining an environment combining strong expertise in both mammalian and bacterial biology, and Pascale's laboratory working on cellular infection by *Listeria monocytogenes* was truly outstanding in that respect: at the time she had already identified ActA as the molecule required for the actin-based motility of *L. monocytogenes* (Kocks *et al.*, 1992), she had also identified internalins as key surface molecules of *L. monocytogenes* triggering bacterial internalization in epithelial cells (Gaillard *et al.*, 1991). She had also characterized E-cadherin as the cellular receptor for InlA (Mengaud *et al.*, 1996), and her team was deciphering the signaling cascades activated by InlB that favored bacterial engulfment (Ireton *et al.*, 1996). Her article 'Cellular Microbiology Emerging' (Cossart *et al.*, 1996) had precisely set the grounds for a new discipline (and a new journal) dedicated to explore in detail the molecular interactions between microbial pathogens and eukaryotic cells. My first encounter with Pascale convinced me right away to join her lab: I met a very warm person, full of enthusiasm and energy, with whom we passionately discussed the best ways to combine the interests and questions of her lab with technological tools I had used and applied during my Ph.D. We met again later in August 1998 in the Greek island of Spetses at the EMBO-FEBS Course 'Molecular Basis of Bacterial Infection' (organized then by Marianne Gruenberg-Manago, and subsequently organized between 2002 and 2019 by Pascale herself and Roberto Kolter) to discuss implementation of the project I was going to develop in her lab (the proteomic and phosphoinositide analysis of the *L. monocytogenes* internalization vacuoles in epithelial cells). Pascale provided me full support to write an application for a national call from the French Ministry of Research that soon was going to result in my first research grant.

When I joined Pascale's laboratory in March 1999, I didn't know that I was going to work with her for the next 19 years and that we were going to co-author 50 papers! This has been a

tremendously exciting period. In collaboration with Jérôme Garin, we identified septins as novel cytoskeletal components recruited by *L. monocytogenes* at bacterial entry sites (Pizarro-Cerdá *et al.* 2002), and subsequently with Serge Mostowy we investigated how different members of the septin family differentially affected bacterial internalization (Mostowy *et al.*, 2009, 2011). In collaboration with Bernard Payrastre, we also studied the production of phosphoinositides at the surface of the *L. monocytogenes* internalization vacuoles, and we highlighted the function of a type II PI 4-kinase in a signaling cascade different from the previously identified pathway involving the class I PI 3-kinase (Pizarro-Cerdá *et al.* 2007). However overall, it has been particularly impressive to witness Pascale's force and capacity to tackle major questions in the field, taking advantage of a most extraordinary array of technological developments and approaches: she has pioneered the use of comparative genomics to identify novel *L. monocytogenes* virulence factors (Archambaud *et al.*, 2005; Cabanes *et al.*, 2004; Dussurget *et al.*, 2002; Glaser *et al.*, 2001), she has developed transgenic mice to investigate in a physiological context the traversal of the intestinal barrier by *L. monocytogenes* (Lecuit *et al.*, 2001), she has performed global transcriptomic studies to understand the molecular landscapes that characterize the transition of *L. monocytogenes* from saprophytism to virulence (Toledo-Arana *et al.*, 2009), she has implemented systematic analyses of post-translational modifications of host molecules during infection (Radoshevich *et al.*, 2015; Ribet *et al.*, 2010), and she has pioneered the investigation of host receptor activation/internalization (Bonazzi *et al.*, 2007; Lecuit *et al.*, 1999; Seveau *et al.*, 2004; Sousa *et al.*, 2007; Veiga *et al.*, 2007), cytoskeletal rearrangements (Bierne *et al.*, 2001), chromatin remodeling (Hamon *et al.*, 2007) and organelle manipulation (Stavru *et al.*, 2011) during infection by bacterial pathogens. With Pascale's support, we have also applied genome-wide small-interfering RNA silencing to identify novel host cell signaling cascades modulating *L. monocytogenes* infection positively or negatively (Kühbacher *et al.*, 2015), as well as metabolomic approaches to reveal the modulation of the host microbiota by the first bacteriocin described for *L. monocytogenes* (Quereda *et al.*, 2016).

It is important to mention that Pascale is not only an outstanding investigator, she has also critically impacted her scientific environment in many different ways. She has been a major promotor of scientific exchanges and through her partnerships with Institut Pasteur, EMBO, FEBS and other organizations, she has orchestrated numerous international courses, meetings, congresses and workshops that have benefited multiple scientists in diverse fields that expand beyond the frontiers of infection biology. Pascale has always supported young researchers and particularly women in science, and with the French Academy of Sciences she has developed programs to recognize the achievements and contributions of young Ph.D. students and post-docs. Pascale's work and dedication to science have been recognized through the award of more than 40 prizes, including major distinctions such as the Robert Koch Prize, the Balzan Prize or the Louis Jeantet Prize. She is also a member of major Academies around the globe including the Académie des Sciences

(France), the Royal Society (UK), the Leopoldina (Germany), the European Academy of Microbiology (EU) and the American National Academy of Sciences (USA).

This special issue of Cellular Microbiology is a tribute to Pascale's numerous achievements and scientific contributions throughout her career. It gathers a collection of articles from colleagues, collaborators or former members of the Cossart Lab that present state-of-the-art snapshots of model pathogens and model systems, illustrating key advances in the field of Cellular Microbiology, providing exciting perspectives for the coming years.

## References

- Archambaud, C., Gouin, E., Pizarro-Cerdá, J., Cossart, P., and Dussurget, O. (2005) Translation elongation factor EF-Tu is a target for Stp, a serine-threonine phosphatase involved in virulence of *Listeria monocytogenes*. *Mol. Microbiol.* **56**: 383-396.
- Bierne, H., Gouin, E., Roux, P., Caroni, P., Yin, H.L., and Cossart, P. (2001) A role for cofilin and LIM kinase in *Listeria*-induced phagocytosis. *J. Cell Biol.* **155**: 101-112.
- Bonazzi, M., Veiga, E., Pizarro-Cerdá, J., and Cossart, P. (2007) Successive post-translational modifications of E-cadherin are required for InlA-mediated internalization of *Listeria monocytogenes*. *Cell. Microbiol.* **10**: 2208-2222.
- Cabanes, D., Dussurget, O., Dehoux, P., and Cossart, P. (2004) Auto, a surface associated autolysin of *L. monocytogenes* required for entry into eukaryotic cells and virulence. *Mol. Microbiol.* **51**: 1601-1614.
- Cossart, P., Boquet, P., Normark, S., and Rappuoli, R. (1996) Cellular microbiology emerging. *Science* **271**: 315-316.
- Dussurget, O., Cabanes, D., Dehoux, P., Lecuit, M., Buchrieser, C., Glaser, P., Cossart, P., and the European *Listeria* Genome Consortium (2002) *Listeria monocytogenes* bile salt hydrolase is a PrfA-regulated virulence factor involved in the intestinal and hepatic phases of listeriosis. *Mol. Microbiol.* **45**: 1095-1106.
- Gaillard, J.L., Berche, P., Frehel, C., Gouin, E., and Cossart, P. (1991) Entry of *L. monocytogenes* into cells is mediated by internalin, a repeat protein reminiscent of surface antigens from Gram-positive cocci. *Cell* **65**: 1127-1141.
- Glaser, P.,
- Hamon, M.A., Batsché, E., Régnault, B., Tham, T.N., Seveau, S., Muchardt, C., and Cossart, P. (2007) Histone modifications induced by a family of bacterial toxins. *Proc. Natl. Acad. Sci. USA* **104**: 13467-13472.
- Ireton, K., Payraastre, B., Chap, H., Ogawa, W., Sakaue, H., Kasuga, M., and Cossart, P. (1996) A role for phosphoinositide 3-kinase in bacterial invasion. *Science* **274**: 780-782.

Kocks, C., Gouin, E., Tabouret, M., Berche, P., Ohayon, H., and Cossart, P. (1992) *L. monocytogenes*-induced actin assembly requires the actA gene product, a surface protein. *Cell* **68**: 521-531.

Kühbacher, A., Emmenlauer, M., Rämö, P., Kafai, N., Dehio, C., Cossart, P., and Pizarro-Cerdá, J. (2015) Genome-wide siRNA screen identifies complementary signaling pathways involved in *Listeria* infection and reveals different actin nucleation mechanisms during *Listeria* cell invasion and actin comet tail formation. *mBio* **6**: e00598-15.

Lecuit, M., Dramsi, S., Gottardi, C., Fedor-Chaiken, M., Gumbiner, B., and Cossart, P. (1999) A single amino acid in E-cadherin responsible for host specificity towards the human pathogen *Listeria monocytogenes*. *EMBO J.* **18**: 3956-3963.

Lecuit, M., Vandormael-Pournin, S., Lefort, J., Huerre, M., Gounon, P., Dupuy, C., Babinet, C., and Cossart, P. (2001). A transgenic model for listeriosis: role of internalin in crossing the intestinal barrier. *Science* **292**: 1722-1725.

Mengaud, J., Ohayon, H., Gounon, P., Mege, R.M., and Cossart, P. (1996) E-cadherin is the receptor for internalin, a surface protein required for entry of *L. monocytogenes* into epithelial cells. *Cell* **84**: 923-932.

Mostowy, S., Danckaert, A., Tham, T.N., Machu, C., Guadagnini, S., Pizarro-Cerdá, J., and Cossart, P. (2009) Septin 11 restricts InlB-mediated invasion by *Listeria*. *J. Biol. Chem.* **284**: 11613-11621.

Mostowy, S., Janel, S., Forestier, C., Roduit, C., Kasas, S., Pizarro-Cerda, J., Cossart, P., and Lafont, F. (2011) A role for septins in the interaction between the *Listeria monocytogenes* invasion protein InlB and the Met receptor. *Biophys. J.* **100**: 1949-1959.

Pizarro-Cerdá, J., Jonquières, R., Gouin, E., Vandekerckhove, J., Garin, J., and Cossart, P. (2002) Distinct protein patterns associated with *Listeria monocytogenes* InlA- or InlB-phagosomes. *Cell. Microbiol.* **4**: 101-115.

Pizarro-Cerdá, J., Meresse, S., Parton, R.G., van der Goot, G.F., Sola-Landa, A., Lopez-Goni, I., Moreno, E., and Gorvel, J.P. (1998) *Brucella abortus* transits through the autophagic pathway and replicates in the endoplasmic reticulum of non-professional phagocytes. *Infect. Immun.* **66**: 5711-5724.

Pizarro-Cerdá, J., Moreno, E., Sanguedolce, V., Mege, J.L., and Gorvel, J.P. (1998) Virulent *Brucella abortus* prevents lysosome fusion and is distributed within autophagosome-like compartments. *Infect. Immun.* **66**: 2387-2392.

Pizarro-Cerdá, J., Payraastre, B., Wang, Y.-J., Veiga, E., H.L. Yin, and Cossart, P. (2007) Type II phosphatidylinositol 4-kinases promote *Listeria monocytogenes* entry into target cells. *Cell. Microbiol.* **9**: 2381-2390.

Quereda, J.J., Dussurget, O., Nahori, M.A., Ghoulane, A., Volant, S., Dillies, M.A., Régnault, B., Kennedy, S., Mondot, S., Villoing, B., Cossart, P., and Pizarro-Cerdá, J. (2016) Bacteriocin from epidemic *Listeria* strains alters the host intestinal microbiota to favor infection. *Proc. Natl. Acad. Sci. USA* **113**: 5706-5711.

- Radoshevich, L., Impens, F., Ribet, D., Quereda, J.J., Tham, T.N., Nahori, M.A., Bierne, H., Dussurget, O., Pizarro-Cerdá, J., Knobloch, K.P., and Cossart, P. (2015) ISG15 counteracts *Listeria monocytogenes* infection. *eLife* **4**: e06848.
- Ribet, D., Hamon, M., Gouin, E., Nahori, M.A., Impens, F., Neyret-Kahn, H., Gevaert, K., Vandekerckhove, J., Dejean, A., and Cossart, P. (2010). *Listeria monocytogenes* impairs SUMOylation for efficient infection. *Nature* **464**: 1192-1196.
- Sola-Landa, A., Pizarro-Cerdá, J., Grillo, M.J., Moreno, E., Moriyon, I., Blasco, J.M., Gorvel, J.P., and Lopez-Goni, I. (1998) A two-component regulatory system playing a critical role in plant pathogens and endosymbionts is present in *Brucella abortus* and controls cell invasion and virulence. *Mol. Microbiol.* **29**: 125-138.
- Sousa, S., Cabanes, D., Bougnères, L., Lecuit, M., Sansonetti, P.J., Tran Van Nhieu, G., and Cossart, P. (2007) Src, cortactin and Arp2/3 complex are required for E-cadherin-mediated internalization of *Listeria* into cells. *Cell. Microbiol.* **9**: 2629-2643.
- Stavru, F., Bouillaud, F., Sartori, A., Ricquier, D., and Cossart, P. (2011) *Listeria monocytogenes* transiently alters mitochondrial dynamics during infection. *Proc. Natl. Acad. Sci. USA* **108**: 3612-3617.
- Toledo-Arana, A., Dussurget, O., Nikitas, G., Sesto, N., Guet-Revillet, H., Balestrino, D., Loh, E., Gripenland, J., Tienssu, T., Vaitkevicius, K., Barthelemy, M., Vergassola, M., Nahori, M.A., Soubigou, G., Régnault, B., Coppée, J.Y., Lecuit, M., Johansson, and Cossart, P. (2009). The *Listeria* transcriptional landscape: from saprophytism to virulence. *Nature* **459**: 950-956.