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LETTER TO THE EDITOR

WILEY

Nocardiosis and mycobacteriosis of bivalves: "Yet-to-emerge" zoonoses of public concern?

To the editor:

Novel zoonotic pathogens are among the greatest challenges to global health security (Bird & Mazet, 2018). Accordingly, the key event to succeed in fighting zoonoses is detecting "yet-to-emerge" novel pathogens from animal reservoirs and human population as quickly as possible (Bird & Mazet, 2018). Among the characteristics these pathogens must express, to make us suspect their potential danger, the sudden change of their biology, a jump of host species, the involvement in episodes of illness not detected previously, even if on a simple local scale, are underlined (Bird & Mazet, 2018). In this context, *Nocardia crassostreae* and *Mycobacterium sherrisii* seem to be excellent candidates to "yet-to-emerge" zoonotic pathogens of possible public concern (Figure 1). In late nineteens, *N. crassostreae* was recognized as a new species, responsible for the so-called summer mortality outbreaks occurring in the bivalve molluscs *Crassostrea gigas* in several embayments in Canada and USA (Friedman et al., 1998). Lesions were characterized by focal areas of brown discoloration on the mantle or raised green or yellow nodules in the adductor muscle, gills, heart and mantle. Histological observation revealed dense clumps of branching, Gram-positive, acid-fast filamentous bacteria, surrounded by both haemocytic capsules and nodules (Friedman et al., 1998). Later, the disease appeared in Europe in summer 2006, causing an extensive mortality of *C. gigas* in Lake Grevelingen, the Netherlands (Engelsma, Roozenburg, & Joly, 2008). In 2013, the first report of *N. crassostreae* in a bivalve host of different genus and species, *M. galloprovincialis* and in a new geographic area, the Mediterranean Sea, was described (Carella et al., 2013). In this case, the lesions were observed most frequently in the connective tissue surrounding the digestive tract, with scattered multifocal lesions resulting from formation of haemocytic nodules (Carella et al., 2013). Concomitantly, the first case of human nocardiosis by *N. crassostreae* was recorded in an immunocompromised patient with non-Hodgkin's lymphoma, showing abscess-like lesions in the left psoas muscle extending outward and producing a multiloculated abscess in the left lumborum muscle (Taj-Aldeen et al., 2013). Finally, Igbaseimokumo et al. (2016) recently reported the first human infection of *N. crassostreae* in an immunocompetent patient suffering of a brain abscess. As far as *M. sherrisi* is concerned, it belongs to the *Mycobacterium simiae complex*, a heterogeneous group of Non-Tuberculous Mycobacteria (NTM) considered relevant emergent pathogens, which only recently have made the transition from environmental to pathogenic bacteria (Steffani-Vallejo, Brunck, Acosta-Cruz, Montiel, & Barona-Gómez, 2018). The first strains of *M. sherrisi* were isolated from HIV-infected human patients born in Africa and appeared later in Italy (Tortoli, Mariottini, & Mazzarelli, 2007), Argentina (Barrera, Palmero, Paul, & Lopez, 2010) Singapore (Ho et al., 2012) and USA (Lee, Myers, Singh, & Kansal, 2013). The clinical pictures differ in that is prevalently disseminated, or both pulmonary and disseminated, in HIV-infected patients, whereas it is mainly pulmonary in other patients (van Ingen et al., 2011). The first isolations of this mycobacterium in wild animals were recorded in Africa by Botha, Gey van Pittius, and Helden (2013) and again in Africa in 2017, there was the first isolation from a sick lion with tuberculous-like lesions (Gcebe & Hiokwe, 2017). Finally, very recently, *M. sherrisii* has been involved in mass mortality events affecting the bivalve Pen shell *Pinna nobilis*, recorded in two different regions of Italy, Campania and Sicily, in the Mediterranean Sea (Carella et al., 2019). The origins of disease caused by *M. sherrisii* remains an area of investigation. In general, NTM are in soils, dust and natural waters.

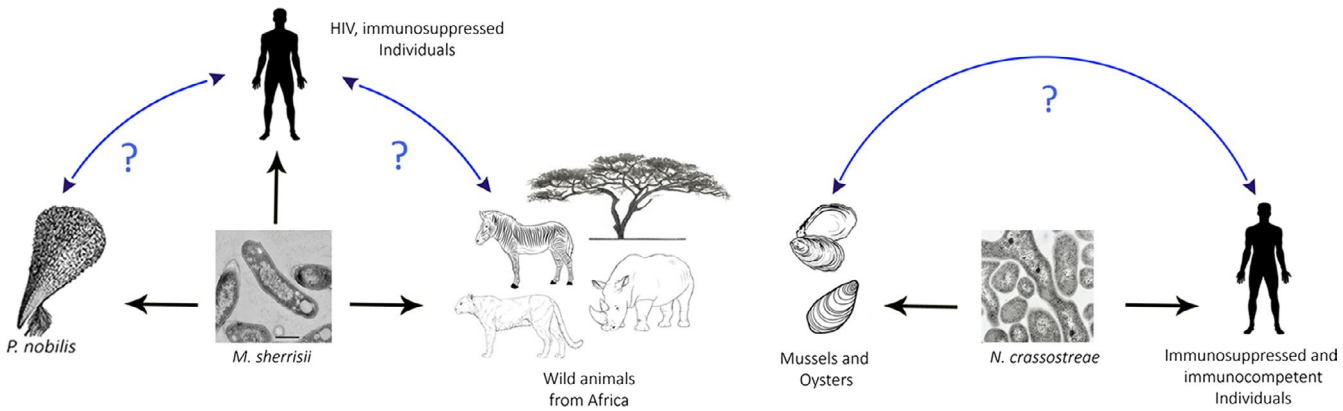

FIGURE 1 A schematic view of the known (black arrows) and hypothetical (blue line with arrowheads) infections route of both *Mycobacterium sherrisii* (left) and *Nocardia crassostreae* (right) [Colour figure can be viewed at wileyonlinelibrary.com]

Impact

- Emerging Zoonotic pathogens are among the greatest challenges to global health security. Key event to succeed in fighting zoonoses is detecting "yet-to-emerge" zoonotic pathogens as quickly as possible.
- *Nocardia crassostreae* and *Mycobacterium sherrisii* are both emerging pathogens of bivalve molluscs and humans which (a) increased their pathogenicity and virulence, (b) expanded their hosts range and (c) extended the geographical area in which the episodes of illness linked to them occurred, both in invertebrates and in vertebrates.
- It is suggested to monitor both pathogens in a systematic and globalized way to increase knowledge on their zoonotic potential.

Thus, drinking water, dust/water aerosol and biofilms are considered the major infection source for both humans and animals (Honda, Virdi, & Chan, 2018). However, NTM infections are among the most common chronic disease of aquatic animals, which along with terrestrial wild animals could represent environmental reservoirs and interspecies source of infection (Honda et al., 2018; Figure 1). In conclusion, according to available data, both *N. crassostreae* and *M. sherrisii* 1) quickly increased their pathogenicity and virulence, 2) expanded their hosts range and 3) extended the geographical area in which the episodes of illness linked to them occurred, both in invertebrates and in vertebrates, including humans. Furthermore, they are both multidrug-resistant organism (Taj-Aldeen et al., 2013; Tortoli, 2014). Overall, these data suggest, in our opinion, to monitor such emerging pathogens in a systematic and globalized way, and to increase the research on their biology, pathogenicity, virulence and zoonotic potential.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

Gionata De Vico
Francesca Carella

Department of Biology, University of Naples Federico II, Complesso Universitario di Monte S. Angelo, Naples, Italy

Correspondence
Department of Biology, University of Naples Federico II, Complesso Universitario di Monte S. Angelo, Via Cinthia, Ed. 7, 80136, Naples, Italy.
Email: gionata.devico@unina.it

ORCID

Gionata De Vico https://orcid.org/0000-0001-5953-4160

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