



Vincenzo Tiberio (1869–1915) and the dawn of the antibiotic age

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Dear Editor,

After Pasteur's discoveries of bacterial antagonism, many twentieth century scholars focused on the phenomenon of antibiosis of some moulds, whose anti-infective properties were empirically known by ancient Greeks, who used them to treat wounds [1].

On 3 September 1928, the Scottish physician, Sir Alexander Fleming (1881–1955), indelibly marked the history of medicine and of humankind. Returning to his laboratory after the summer holidays, Fleming found that one culture of staphylococci was contaminated with a fungus. He noticed that, around a large colony of a contaminating mould, the *Staphylococcus* colonies became transparent and were obviously undergoing lysis [2]. Sir Fleming identified the mould to belong to the genus *Penicillium*, and on 1929, he named penicillin the substance it released.

Circa 35 year before Fleming's discovery, Vincenzo Tiberio (1869–1915), an Italian researcher, medical officer of the Corps of the Italian Navy and a physician at the University

of Naples, discovered that moulds could inhibit bacterial growth. His studies were inspired by an empirical observation. In the court of the house where he lived, there was a well used to supply drinking water. Because of the humidity, moulds grew on the well's walls and periodical cleaning of the well was performed. Tiberio noticed that, when the well was cleaned off, the inhabitants of the house had enteritis; if moulds were allowed growing, no cases of enteritis were registered [3]. Thus, he guessed that there was a relationship between the absence of moulds and the growth of pathogenic bacteria in the intestines.

Tiberio started his experimental studies at the University of Naples and showed, both in vitro and in vivo (guinea pigs and rabbits), that moulds had bactericidal effect due to the substances they contained [4]. He stated that the properties of these moulds are a major obstacle for the life and the propagation of pathogenic bacteria [4]. Moreover, he succeeded in growing some strains of hyphomycetes (*Mucor mucedo*, *Penicillium glaucum*, *Aspergillus flavescens*) to prepare an aqueous extract of these fungi and studied their effects on some bacteria, such as *Vibrio cholerae*, and some staphylococci strains [4]. In 1895, he published the results of his experiments in an Italian medical journal but his work did not receive further attention [4].

In 1947, a medical officer of the Italian navy, Giuseppe Pezzi, read Tiberio's paper entitled *Sugli estratti di alcune muffe* ("On the extracts of some moulds") and decided to disseminate Tiberio's outstanding findings [5]. However, 2 years before (1945), the Nobel Prize in Physiology and Medicine had already been assigned to Sir Alexander Fleming.

Vincenzo Tiberio was a misunderstood researcher; his important discovery did not receive the deserved attention within the Italian academia neither had the appropriate international echo. Besides the priority of the discovery, both Tiberio and Fleming did not manage to produce the drug industrially as they lacked awareness and technologies, which would have grown only a decade later. The production of the mould on an industrial scale occurred, in the Forties, when Ernst Chain, a German biochemist who fled to Great Britain to escape Nazism, met Howard Florey; together they

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developed a method to enlarge the amount of penicillin produced by Fleming's extracts. A pivotal figure in this story is a woman, Mary Hunt, who worked as a technician: she used a different mould, *Penicillin chysogeum*, able to produce an active substance 200 times more effective than that produced by the Fleming's *Penicillium*. Mutations induced by X-rays allowed Florey and the American team to reach a production 1000 times more effective than Fleming's *Penicillium*, paving the way to the dawn of antibiotic age [1].

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