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University of Padova's Department of Agricultural, Food, and Environmental Microbiology: An Evolutionary Path from Lag Phase

Carol William*

Managing Editor, Journal of Natural Product and Plant Resources, United Kingdom

***Corresponding Author:** Carol William, Managing Editor, Journal of Natural Product and Plant Resources, UK, E-Mail: naturalproductre@gmail.com*

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ABSTRACT

This essay takes readers on a microbiological tour of the key findings and research endeavors of academics that have studied or taught in this area at Padova University over the course of its eight-hundred-year history. The ancient practise of variolization, the alleged Legnaro miracle, and the pellagra controversy, whose observations and investigations were driven at Padova even before microbiology was established as a scientific discipline, along with the contemporary research activities in the fields of agricultural, environmental, and food microbiology, undoubtedly suggest the hallmark and everyday role played by microbes in overwhelmingly global but profoundly human adventures.

***Keywords:** Microbiology, Hypothesis-driven and discovery-driven science, Pellagra, Smallpox virus.*

INTRODUCTION

How Old Is a Thing: Existence vs. Knowledge

The time span covered by the current special issue is the eight hundred years that have passed since the University of Padova was established in 1222. Dealing with microbiology in such a retroactive manner presents a first apparent challenge; as bacteria were unknown to man until the mid-1600s, at least half of the time allotted for this essay may appear to be wasted at this point. When we start to realize that most of what we label as "knowledge" is merely the updated interpretation of events due to prior, previously unidentified causes, the situation takes on a different complexity, though.

Given that bacteria are thought to have been the first life forms, we can reverse the narrative and note that microbiology is the newest of the biological disciplines but the oldest entity in nature. As a result of studying it, people came to understand that all life forms on earth just evolved from that first prokaryotic cell, and that we are therefore merely among the living descendants of a microbe.

As a result, when we make comments about studies conducted by academics who attended or taught at the University of Padova and whose subjects involve microbes, we should note that some of those observations were made before the researchers were aware of the true causal agents of their subjects, whose nature was still unknown. However, one of the first records demonstrating human awareness of the presence of incredibly minuscule "beings," invisible to the unaided sight, that might enter our bodies through the mouth or nose, dates back to 37 B.C., despite being utterly ignored by general knowledge. The structure proposed by the hosting target journal of this series is in fact tied to an equally difficult issue, and possibly an even more unbalanced one. In actuality, the University of Padova's Agriculture College was only officially founded in 1946—less than tenth of the institution's total 800-year existence. Even so, we discover that agricultural experimentation was discussed and carried out at Padova under different academic areas long before a particular degree was created. In fact, the University of Padova established the first Chair of Agriculture in Europe as early as 1762. An Agricultural Garden, operating independently of the Botanical Garden in 1792, contained 645 species or kinds of agricultural plants that were grown to help with hunger prevention, pest control, and food development. Since the Neolithic, more than 10,000 years ago, when the majority of our ancestors stopped relying on the hunting-and-gathering primary lifestyle, agriculture has actually always been an indispensable knowledge governing human existence and survival, even when it is not highlighted in the academic spotlight. In fact, agriculture, the earliest human endeavor since the Holocene, parallels the silently significant role played by microbes in billions of years of natural history.

Microbiology before microbes

Today, vaccination is seen as a potentially life-saving defence against infectious illnesses. The idea that specific microbial agents are the Aetio-logical origins of particular diseases unquestionably aids in the acceptance of this explanation. Once the existence of 'invisible' life forms, such as bacteria, had been postulated in 1665 by Robert Hooke, who described the fruiting structures of moulds, and Antoni van Leeuwenhoek, who is credited with discovering bacteria in 1676, understanding the concept from a scientific perspective became easier. But it wasn't until Louis Pasteur's germ theory of disease, which was also inspired by the Italian priest and biologist Lazzaro Spallanzani, spread widely in the 1870s and 1890 that microbiology reached the standard of an official discipline.

The older idea of posing a light challenge to a human subject by administering little amounts of a diseased patient's tissue, on the other hand, was long believed to be on the cusp of a practise between irrational intuition and empirical spirit. Edward Jenner, who began administering vaccinations against the smallpox virus in England in 1796, is generally acknowledged as the official father of vaccination and immunology. However, Sir Francis Galton would later remark that in science, credit goes to the man who convinces the world, not the man to whom the idea first occurs, and this has a connection to two Venetian scholars named Jacopo Pilarino and Emanuele Timoni who had received degrees from the University of Padova. Both successfully tried out the technique of variolization at Constantinople.

Pilarino and Timoni, two physicians who received their medical degrees from the University of Padova, never claimed to have invented the variolization technique; rather, they simply contributed to its spread to the west by using what they had learned in Turkey, where it had originally originated from further Asian origins and was reportedly a practise that was already used in China in the tenth century. The smallpox saga demonstrates how "microbiology before microbes" has been maintained without interruption for more than a thousand years and how, in situations involving life and death, actions can come before knowledge and the development of disciplines. This is especially interesting in light of the fact that the virus that causes smallpox was only discovered by science between 1892 and 1898, with the tobacco mosaic virus serving as the first example.

Food Microbiology in legnaro two centuries before agripolis

The University of Padova's Agripolis campus for agricultural and veterinary sciences is situated seven kilometers southeast of Padova in the township of Legnaro. After the completion of the new departmental buildings next to the experimental farm in the mid-1990s, researchers and students moved there. A strange fact is recorded in the local history of that town in the 1819 chronicles, independent of such a choice.

The Pittarello family, who were landowners and farmers in Legnaro, were gathered for dinner on a hot August day in 1819 when they observed something peculiar on the polenta leftovers from dinner. Since the previous century, the majority of northern Italians' diets have been based on this common cornmeal porridge. The food had irregular scarlet-red, bloody-looking blotches all over it. Within a few days, the bizarre event extended to other dwellings among the Legnaro peasants, and tales swiftly circulated. The locals called the parish priest, who had just stated that the sacred hosts of his church were still white at the time, out of fear of witchcraft and took the matter to the Archbishop of Padova.

The investigation also engaged the military garrison because the Veneto region was ruled by Austria. The "crimson polenta syndrome" expanded throughout Padova's southern territory in the interim. An official committee headed by the city's Austrian governor started their investigation but came up empty-handed. Young Bartolomeo Bizio, a pharmacy student at the University of Padova, was intrigued by the tale because it was dominating local media. He rode a horse that he had rented to

Legnaro. Antonio Pittarello, the patriarch of the Pittarello family, was at first very hesitant to cooperate because he had barely been able to dissuade the Austrian administration committee from suspecting that his home was the source of the entire story. However, Bizio knew how to use a tool that would soon become strength for contemporary applied research: the prospect of business. Bizio persuaded him and obtained a sample from which he began his studies by explaining that if one multiplied the red spoilage on fresh maize flour, it may have been possible to extract and utilize a novel sort of colour for garment dying and other uses.

The rare purple dye from the Murex mollusks, which the Phoenicians have traded since antiquity, was revealed to be an ethanol extractable purple stain. Bizio kept researching this and other red pigments, which led to another of his contributions to science advancement. Bizio showed that it is the secretion of their intermediate hypobranchial gland, and that, upon oxidation, distinct copper-containing compounds are generated, with a palette of varied red colours, according on the generating mollusk species.

The challenge of hypothesizing the null in situations where microbiology is not the point

The polenta corn meal, a leitmotiv for Veneto identity, is once again the subject of this case, but for a completely different and somewhat contrary purpose. It also provides an illustration to help a scientist understand the repercussions of lacking a crucial virtue. The ability to reject the explanation that seems the most logical and to discuss any potential upstream assumptions that might result from examples of prior knowledge is a quality. Filippo Lussana, a teacher of anatomy and physiology at the University of Padova, held the position.

The case in point is the pellagra illness, whose cause was the subject of two entirely divergent theories. After Columbus brought corn from Central America to Europe, it rapidly replaced other foods as the main source of nutrition for many European communities, particularly those in the Spanish Asturias, Southern France, and the northern Italian Po valley region from Milan to Venice. A unique ailment that first manifested as severe dermatitis, diarrhoea, and eventually dementia was rapidly affecting farmers and countrymen in those areas and had terrible effects for the most of the 1800s.

It is known that Native Americans from Mexico and other regions where corn originates had already discovered a straightforward disease-preventing treatment, which is known as nixtamalization. This is interesting because disregarding opponents' ideas when those are contrary to one's theory or simply ignoring prior culture are both examples of ignoring prior culture. It entails washing, hulling, and soaking the maize grains in an alkaline solution such as limewater or carbonated water. In addition to increasing favour and aroma, the method virtually entirely eliminates aflatoxins. Furthermore, niacin that is bound to hemicellulose is transformed into free niacin, greatly increasing its bioavailability when consumed, which explains why pellagra was unknown to Native American cultures.

Conegliano, the oenological school, and the second campus are mentioned in the grapevine

The two fundamental approaches of science are hypothesis-driven and discovery-driven. In the first case, facts can really come before science and even put off applying it forever. When a discovery may be used effectively in a purely empirical

context, it happens. Science is by definition the starting point if, on the other hand, one is testing hypotheses and thus planning that knowledge should come from a question. The former situation frequently applies to beneficial phenomena, whose advantages seem built into the observation itself. On the other hand, events that reflect negative outcomes for our civilization, including diseases, outbreaks of pests that endanger the crop, and environmental tendencies to global changes, require hypotheses to explain and perhaps even to reverse some occurrences. In other words, scientific information is often seen as facultative or less compelling when it comes to what is seen as the positive side of things. Such a divide makes it difficult to examine some issues and has an impact on the systems for allocating money for research.

Instead, these are significant instances of human knowledge that developed from ancient discoveries and was successfully implemented for incredibly extended periods of time before science began to address them and determine their origin. We mentioned agriculture as one of the earliest human technologies, but there is evidence of an even earlier technology called alcoholic fermentation, whose essential participants were once more certain bacteria. There is evidence that societies of hunters and gatherers utilized honey from forest beehives to be combined with water to create hydromel before the Neolithic revolution, which occurred around 12,000 years ago. Even before agriculture and animal domestication, the mysterious origin of human activities appears to have been a food microbiology topic called alcohol fermentation. The subsequent documentation of human use of various sugar-containing substrates to produce wine and beer, almost everywhere grapevine cultivation was made possible by soil and climate, is now frequently part of a proud collective heritage. This use of sugar-containing substrates dates back to ancient Egypt. However, viticulture and oenology have long been, and continue to be, instances of traditional and practical knowledge that may evolve within their respective technical fields and typically did so without the aid of academic study. This changed recently, and rather quickly, to the point where science and winemaking profoundly converged, with clear rewarding advantages. Since 2001, the University of Padova has maintained a second campus in Conegliano, where it has collaborated with one of the earliest regional institutes for applied research in grapevine cropping, cultivar selection, and winemaking. Previously known as the Conegliano Oenological School, it was founded in 1876 by royal proclamation of His Majesty King Vittorio Emanuele II. There is now a degree in Viticulture and Oenology Science and Technology from the University of Padova offered there, and cutting-edge research facilities are operational at the same time.

Modern Times, 1946–1980

The Agriculture Faculty was officially founded in 1946, despite the fact that the first Chair of Agriculture was established in 1762 and given to the botanist, Pietro Arduino. Since then, Giovanni Luchetti has been teaching the technical and agricultural microbiology course. He earned his degree in Agricultural Sciences from the University of Pisa in 1931, and he began his career there while working under Renato Perotti, who is regarded as a pioneer in the field of microbial endophytes. Between 1931 and 1934, he served as a volunteer assistant in the field of plant biology before receiving a fellowship to study agricultural bacteriology and plant pathology. His period in Paris, 1936–1937, at the Institute Pasteur had a significant influence on his professional life. Luchetti transferred from Pisa to Padova University's newly created Agriculture Faculty following the Second World War He started conducting research in the fields of agricultural, food, and environmental microbiology at Padova University in the early 1950s. He continued his work on soil microbiology, focusing particularly on the saline soils around Ferrara, where he proudly installed his own microbiology laboratory while residing there for a number of years.

The Growth Phase and Its Post-Growth Phase

A successional change in who was in command of the agricultural microbiology sector took place at about the halfway point between the creation of the agricultural sciences college and the present, which may be considered as the start of the following cycle. An increase in numbers also took place, mirroring the growth curve of a healthy microbiological culture. Giovanni Luchetti had been the only microbiologist during the pioneering stage and had consistently taught his solitary course for 34 years. The person who received the relay baton witness when he handed it over was Marco Nuti, also from the University of Pisa. The university continued to operate alone for almost the next ten years after that, but in 1990, the number of faculty members in the microbiology group doubled, and a growth trend began. This entry was followed by another in 1992, one in 1996, and then two more additions in 2001 and one in 2015.

CONCLUSION

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