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Editorial

Utilizing Discoveries in Microbiology

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While the drive to discover and learn new things about the seemingly never ending world of microbes motivates us in our academic laboratories, it turns out that the world may not benefit in any practical way from all of our efforts. It is usually the case that the discovery process and the excitement that goes with being the first to invent or uncover a hidden secret of a microbe are the critical components that prompt a scientific endeavor. The discovery process is usually terminated by a report at a professional scientific meeting or more importantly, a scientific publication. This is usually followed by a series of professional credits, accolades or prizes associated with the discovery. Once successful, this process can be enhanced and repeated as funds from foundation, government entities and private sources may be further brought to bear on the subject. Basically, the scientific knowledge base about the microbe and its life and function is enhanced. Unfortunately, this may not have any impact on the general public who may be the chief supporters of the scientific investigations.

Throughout the world, in most developed countries, a system for patenting potentially useful discoveries exists. It is usually the case that the publication of the results of a discovery prior to initiating the patent process can nullify any patent activity on the discovery. Having a patent on a useful discovery is a key element in attracting commercial interests in getting the discovery to market. I feel that it is important for every investigator to carefully examine all scientific activities in the laboratory for potential utility and then proceed to go through the processes of patent protection and licensing to an interested company. There are financial as well as personal rewards in adopting this method of operation as one can reap the benefits of a novel discovery but also of its impact on the public sector.

As an example of this approach I should like to comment on just one example of how this has been done in my laboratory over the past 40 years. I have been particularly interested in the discovery and role of endophytes in plants. These microorganisms (mostly fungi and bacteria) exist in the roots, stems leaves, flowers and fruits of all plants. Their role is somewhat obscure but they may provide protection from environmental factors such as disease or heat stress and have an influence on plant growth. Only a few percent of the world's 350, 000 plant species have ever been investigated for their endophyte population. In the late 1990s, we discovered a novel fungal endophyte in a cinnamon tree in Honduras and it was named *Muscodor albus* [1]. The organism produced a plethora of volatile organic compounds (VOCs) that possessed enormous antimicrobial activities [2]. Quickly it was realized that the organism had enormous potential utility as a biocontrol agent since many of its target organisms were plant pathogenic fungi, bacteria and nematodes and it was patented [3, 4, 5]. A biocontrol company was found and expressed interest in the organism. They demonstrated its bioactivity "in house" and licensed the organism. Suffice it to say that *M. albus* has been approved by the US- EPA for release into the environment for agriculture purposes and it is now on the market offered by MBI of Davis, California. It has the potential to replace the commonly used sterilant-methyl bromide, which is not only toxic, but harmful to the ozone layer and is Internationally banned.

The discoveries around the novel genus Muscodor continued over the years with more and more species being found in plants all over the world in a wide variety of plant families [6]. One of the most fruitful species is *Muscodor crispans* that was found in the Brazilian Amazon [7]. Its VOC composition, consisting of mostly GRAS (generally recognized as safe) listed compounds by the USA- FDA, was patented and now it and modifications of its gas formula are being sold by Jeneil Biotech of Saukville, Wisc. as Flavorzon [8]. It was learned that the VOCs of this organism as a 1% solution had antimicrobial activity that was indistinguishable from that of Clorox or quaternary ammonium solutions [9]. Flavorzon is now being used to treat animal processing plants as well as hides and carcasses in order to control *E. coli* and *Salmonella* sp. populations. Modifications of the formula are being used in salad dressings and soy milk to extend shelf life and another modification of the formula has been found useful in protecting fruits and vegetables from post-harvest decay. Still other potential uses of it exist for controlling fungal and bacterial infections of man and animals. And as an example, Ecoplanet of Montana has a version of a Muscodor inspired formula that is on the market as Sx Calf to very successfully treat scours or diarrhea in farm animals [10].

These various VOC formulae, because of their broad spectrum efficacy against pathogenic fungi and bacteria have enormous potential to be used not only in plant and animal agriculture but in humans as well. Initial indications, as a result of hundreds of volunteer trials are applications for topical creams to treat skin infections, oral rinses for bacterial gum and fungal infections, as well as its potential (VOC) advantage for treating lung diseases [11]. It appears that the stage is set for the VOCs of Muscodor to solve a myriad of problems to treat a multitude of diseases in the human population, especially as the International concern over development of resistance to these agents has occurred.

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