Pure Science; The Pursuit of Things With No Foreseeable Benefit.

By Cory Cluff

In American history many madmen have carried out wasteful schemes of great scope in the name of science. They have frittered away tax dollars and private funding chasing scientific unicorns. During the tenuous, uncertain years of the Great Depression and WWII, one such man, Isidor Rabi, spent valuable time and resources studying useless scientific toys such as particle beams and magnets. This is appalling, as there were so many actually useful things to do with the time and money that was spent chasing some immaterial and theoretical goal about finding the quantum spin state of an atom. The simple fact is that particle beams did not feed Americans.

After hearing such demonization of Dr. Rabi's research it would be quite easy to cut his funding and stop his work. The claims made are technically all true; Dr. Rabi did study particle beams in the 1930's and 40's and this did absolutely nothing to end the Great Depression or WWII. However, to have cut his funding would have been a terrible mistake because the preceding paragraph is only a piece of the truth. While the research had no foreseeable value, it was most definitely not without eventual benefit. Dr. Rabi's work laid the foundation for nuclear magnetic resonance spectroscopy (NMR), which gives chemists valuable information about atoms within compounds. Today NMR is one of the most useful and informative ways available to chemists to identify and characterize different chemical compounds. In fact, to authoritatively claim to have created a new chemical there must be NMR data to confirm. Without NMR the advancement of chemistry would be greatly hindered; had funding been cut from Dr. Rabi's experiments society would not have many of the medicines, materials, and products that are so vital today. Besides NMR being so useful in its own right, eventually someone realized that the

technique of NMR could be applied to the human body, which led to the development of magnetic resonance imaging (MRI).

Without MRI today's medical professionals would be crippled in their ability to quickly and accurately diagnose and treat many kinds of disease and injury. MRI is the most useful imaging technique available to view the brain and spinal cord without exposing the patient to harmful radiation. MRI is vital in diagnosing multiple sclerosis, encephalitis and other brain related problems. Additionally MRI can give doctors an accurate view of the size of a tumor before they operate or prescribe treatment, allowing them to be better prepared to quickly and efficiently provide the needed treatment. It is an understatement to say that many, many people are alive today because of this MRI technology. Simply stated, after many years Dr. Rabi's purely scientific work has resulted in the saving of many lives and the creation of a wide range of useful products.

Now consider; could contemporary critics have seen the huge and lasting impact that Dr. Rabi's research would have? Admittedly, there are many such projects that lead nowhere useful. Clearly, it is impossible to see beforehand if any given research will create the next MRI technology or nothing but a bill. This poses an interesting question; can we know beforehand which purely scientific research fields will prove revolutionary and which will be useless?

It is illustrative to examine the actions of a farmer. When he plants seeds he does so with the knowledge that some seeds will grow and blossom, some will grow but die prematurely, and some seeds will not even sprout. It is even possible that he could lose the entire crop in a storm or drought. Yet the farmer knows that if he plants many seeds and cares for them adequately that the odds are favorable that he will have a good harvest. It is this knowledge that drives the

farmer's actions; the worth of the harvest merits risking time and money on an endeavor that could possibly fail utterly.

So it is with research that is purely scientific; the research is much like the farmer's seeds. Some research never goes anywhere, some starts to develop but fizzles out before fruition, and a few purely scientific endeavors end up changing the non-scientific world in totally unforeseen ways. There is no guarantee that any given project will change the world by itself. In fact, most purely scientific endeavors do not change much of anything in the daily lives of people. But there are those endeavors which give rise to ideas or techniques that astound the world, and the possibility of such effects is merit enough to try any purely scientific endeavor.

It is important to remember that an idea needs time to be understood, and then even more time to be applied and its relevance to be seen. For instance, electricity is now nearly ubiquitous worldwide. Mankind has been forever changed by it; man's grasp has been greatly extended by this force. Yet, not too long ago electricity was a purely scientific oddity in which only a small handful of men dabbled. Before electricity's rise to worldwide prominence nobody could have predicted that this specific scientists' puzzle would be so paramount in coming years. That is the crux of the matter; Ideas must first be planted and nourished before their full application and scope can be seen. We do not know what the next revolutionary discovery is, and thus we cannot see how and where it will fit into our lives. Were we to see tomorrow's new revolution as it exists today, it would likely seem an odd scientific pastime at best.

Another important aspect of an idea is the stages of its growth. Upon hearing that various physical and chemical processes can result in a concentration or flow of charged subatomic particles, it is difficult to see how that could make your life better. However, you were told that

electricity exists and you can use it to light dark areas or move heavy things, then it would be quite simple to see its usefulness. The descriptions differ only because one is an understanding of how something works and the other is applying that understanding. Once the application of an idea is found, then its usefulness is readily apparent. However, application without understanding is impossible. It would be ludicrous to give a man something new and not tell him what it is, what it does, or how it does it and then expect him to find a way to use it to help him. Thus, for technology and progress to continue we must come to understand more. The only way to understand truly new concepts is pursuing purely scientific goals. Pure science expands the world of our knowledge and allows for innovation and application to change the lives of people for the better.

Yes, we need pure science at all times, for by pure science we understand new aspects of the universe in which we live. It is only once we understand something that we can find applications to benefit our lives as humans. By very definition we cannot see the applications of pure science beforehand, but that does not mean they are not real. The same Isidor Rabi who dabbled in pure science during the Great Depression went on to live a long life and accomplish much more. Towards the end of his life, Dr. Rabi developed cancer. In the course of his treatment his doctors used MRI imaging to view his tumor. Dr. Rabi very aptly summed up the nature of pure science when he spoke of the event later, saying, “I saw myself in that machine. I never thought my work would come to this.”

Bibliography

Note that all information concerning Dr. Rabi was obtained from *Rabi, Scientist and Citizen* and information concerning the uses of MRI comes from "The Nobel Prize in Physiology or Medicine 2003"

1) Rigden, John S. *Rabi, Scientist and Citizen*. New York: Basic, 1987. Print.

2) "The Nobel Prize in Physiology or Medicine 2003." *The Nobel Prize in Physiology or Medicine 2003*. Nobel Media AB, 2003. Web. 29 Jan. 2013.