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Conceptual paper

Science, ideology and daily life

La ideología de la ciencia y de la vida cotidiana

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ABSTRACT

Despite years of scientific effort to develop useful and safe biotech crops, ideologies have prevailed and genetically modified (GM-)crops have still not been fully accepted by today's society. This leads one to reflect on the role of Science in society, on what makes scientists credible, and how scientists themselves understand the world we live in. While Science remains a black box for many of the uninitiated, scientists themselves are also generally less-interested in sociology or the economy, such that the coevolution of science and daily life is often frustrated by incomprehension or even disinterest on both sides.

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The title of this talk may be intriguing, but it reflects the fact that, despite 30 years of scientific efforts to develop useful and safe biotech crops, ideologies have prevailed and GM-crops have not been fully accepted by society. This leads one to think about the meaning of science, what makes people believe scientists, and how scientists understand the world. While science remains abstruse for the uninitiated, scientists are not so much interested in sociology or the economy such that the coevolution of science and daily life is often frustrated by incomprehension. A widely accepted theory of human history is that we started by hunting and gathering fruits, seeds and tubers and then progressed to understanding how to save, and select seeds of critical food crops, eventually evolving to where we are with our current agricultural practices. Indeed, food technology that utilizes the best of what science, and the life sciences in particular have to offer is an extremely recent phenomenon, and the huge population increase from the 18th century onwards would not have been sustainable without these advances in precision agriculture.

The organization Greenpeace has often warned of the precariousness of today's agriculture. In today's developed world food production is an industrial process, and I agree that such intensive agriculture can be highly disconcerting. But, with the current global

population of seven and a half billion people, and predictions that we will reach nine or ten billion within 30 years, we simply cannot turn the clock back. One may dream of a lost paradise and of the natural environment that has disappeared, but we have to face reality – there are simply so many of us on this globe that if we do not find a way to work together to develop solutions and to stop the exploitation of natural resources we will find ourselves back into slavery with its horrible injustices. Nonetheless with the advances in modern science it is clear that it is possible to make intensive agriculture sustainable.

On the acreage that has already been destroyed it is possible to double or triple the crop output by using recent scientific developments. Unfortunately, this is hindered by obstructionist ideologies.

If we look back in history, all too often we find that scientific progress and innovation has been blocked by ideologies, and yet humanity has still survived. Ideology is fantastic for motivating and bringing people together, and as individuals we sometimes need ideologies to drive the necessary changes in the society in which we live. Nevertheless, ideologies can also be dangerous when they lead to 'secondary effects'. i.e. when not based on sound reasoning or when the full meaning and consequences may be misunderstood. Indeed, things such as the joy of living, emotions, beliefs and spiritual life are part of our neurobiology and have evolved with us, emphasizing that they have been, and still are important to human social evolution. However, to understand why this is so, and how we can benefit from ideological values while avoiding collateral

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damage, requires deeper, scientific studies. This point should be kept in mind as we continue to explore the subject.

Calestous Juma, a Kenyan Professor of Sociology from Harvard University, expounds in his book, “Innovation and Its Enemies” (Juma, 2016), on an interesting issue surrounding coffee – one of the world’s oldest innovations. Coffee is native to the highlands of Ethiopia and then spread to the Middle East and Western Europe. It was first cultivated in the Yemen during the 15th century but at that time Muslim opponents to its use questioned whether coffee should be allowed to stimulate our bodies, claiming that the product should be considered as potentially risky until proven safe. This shows just how old the precautionary principle concept is. Another interesting text is “Du jugement qu’on doit faire des accidents futurs”, in “La logique, ou l’art de penser” (Arnauld & Nicole, 1996). This was written by scholars of the Jansenist movement centred on Port-Royal, France at the end of 17th century, when science as we know was emerging at the forefront of the Industrial Revolution. In the text, scholars were already proposing that the correct moral attitude is not to surrender to fear of potential danger but to master it by calculating the probability that unwanted consequences will arise. If something is dangerous, you apply logic to weigh up the situation and decide whether to take precautionary measures or not.

Another example of fear, or contempt of innovation occurred in Nottingham in the 19th century with the cotton industry. New, mechanised textile businesses took over established mills which remained convinced that they were the only ones with the true knowledge and understanding of the beauty of their businesses. Such events happens every day, and now we see that opponents to biotech agriculture are destroying what the solutions proposed by plant genetic engineers, and we have to learn how to overcome this opposition. It is clear that the only way forward is for both sides to reflect, discuss, and to come to a consensus and scientists need to listen to opponents of the technology and refrain from a dismissive “I know better” attitude.

It is a pity that during their education scientists and engineers are rarely confronted with how to deal with human feelings. For thousands of years ago people have been talking about the mind and the soul, and while the mind and the body were sometimes opposed, in trying to resolve the conflict, religion has been of enormous help for many. This contrasts to the situation in science, which these themes have only recently been approached through neurobiology. For example, neurobiologists seek to examine the basis of emotional feelings such as which parts of the brain are activated during praying, its importance and meaning, and if it has a meaning, defining it. Science seeks to discover facts, but how those facts are interpreted are another matter altogether. Very often life-scientists keep to their narrow path because of the ethics of science – that research has to be carried out well and properly, and that your peers should criticize you when you do not adhere to ethical norms. However, scientists must remember that they can contribute a very limited part of the total work and that we are all in this together. Each in his specialty should look to communicate, and to be aware of what this communication is bringing. Looking into the future we should work together to understand human ecology, how the lives of humans are intimately bound together, how we live with the planet, and our relationship with all other living organisms.

There are three major points that help one to understand opposing views: science, society and economy. Science gives the facts to society, which chooses these that facilitate society’s expansion, and economy provides the production. One may criticize this capitalist scheme, yet many alternatives have been tried. Currently we are left with the appalling choice of how it can be made more acceptable for society while not coming back to slavery. One can discuss how to improve the present scheme, but to destroy it would risk

the return of slavery. Possibly one can find better solutions through economy but should be solutions that do not entail violence.

Overpopulation is an important issue to be considered. The shame of poverty and hunger seems to leave many of us indifferent. I wonder if it is due to our resilience to hardship, which is sometimes necessary yet other times can mislead us? The eradication of this plague will require a fundamental shift in the way we perceive the world and our place in it. Rationality tells us that the whole of humanity should be able to share equally the economic, social and cultural benefits of our natural resources. Solutions though require the necessary political will and commitment of all nations and will require concerted actions of different segments of society including public sector science.

As has already been pointed out by other speakers, the problem of nutrition is not simply the amount of food available, but also its quality. If the nutritional quality of food is poor, then it becomes a mere staple food, without the necessary vitamins and micronutrients such as iron and zinc that we require. This can lead to developmental problems in children, such as stunted growth and reduced neurological (brain) development. In some countries up to 50% of children may be affected. It is a tragedy for our societies that many are excluded due to improper nutrition, an enormous responsibility to use science, sociology and economy to try and combat this situation. People and society must be organized such that the full amount of food and knowledge are available, and so we can live together without fighting. We must develop economy that is encompassing and acceptable to everyone, which is why growth rate is so important. If you talk to people who survived all of the horrors in Auschwitz during World War II they will tell you that they survived because they looked to things such as a tree or a sunrise, which gave them emotional and physical strength to carry on. We have a world worth saving, and it can be saved, but we must resolve to cease fighting each other and to stop destroying resources.

Two professors of philosophy at the University of Ghent, Etienne Vermeersch and Johan Braeckman, wrote a controversial book about the history of philosophy named “*The River of Heraclitus*” (Vermeersch & Braeckman, 2015). As most people are not versed on this subject, one is likely to be confused by the many bright minds giving conflicting views. Heraclitus wrote that you can never swim twice through a river because the water has changed in the meantime. This book is brilliant because the authors are so successful in analysing what all the different philosophers have said. They show where the philosophers were wrong but do not say where the truth is because that is not possible – there is no universal truth. Society itself is continuously changing, revolutionizing human thinking, which in turn transform society.

This virtual cycle is also true for life sciences. The dawn of molecular biology marked by great enthusiasm with the discovery of DNA as the genetic material. Scientists were so thrilled that called the directional information flows from DNA → RNA → protein the central dogma of molecular biology. Although the directional information persists, we now know that the flow is much more complex than though at the beginning. The concept of one gene one protein is over simplistic. Pieces of DNA can jump, RNAs have regulatory functions, proteins regulate RNA editing and protein modifications are the rule. As an example, in the model plant *Arabidopsis* there are between twenty and twenty-five thousand genes, but they make more than a million different proteins when protein modifications are taken into account. This shows how science is complicated and that in science there is no such a thing as a central dogma. Another example is the flaw concept that the genome is a blueprint for building a body. With epigenetics, christened by Waddington in 1942, we started the understanding of pathways used in embryological development which are then switched off to prevent disturbance. Yet, under stressful situations

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