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To Bee, or Not to Bee: A Commentary on International Neonicotinoid Regulation

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ABSTRACT

Amidst a time of dramatic climate change and exponential population growth, sustaining food production, and the pollinators essential to that production, has taken on increased importance. The current global system of industrial agriculture, however, relies on chemical pesticides, including neonicotinoids. A growing number of studies convincingly demonstrate that neonicotinoids are killing bees and their colonies. With bees and other pollinator populations in danger, an integral part of the world's food system is at risk.

This paper focuses on the dangers of neonicotinoid use and the need for international neonicotinoid regulation. The paper analyzes the emergence of neonicotinoids in the global agrochemical market, their negative impact on the health of pollinators, and the current legal regulations that govern neonicotinoid use. It recommends greater use of multilateral, international agreements to more comprehensively regulate neonicotinoids to protect bees and other pollinator populations. Other environmental treaties, such as the Montreal Protocol and the Stockholm Convention, provide accessible frameworks for cooperative regulation. If international communities act quickly, there may still be time to sufficiently protect pollinator populations from further catastrophic harm from neonicotinoid use. Bees and other pollinators are essential for global food production, and this paper provides a path forward for policy-makers and law-makers to better protect these species from the harms of neonicotinoids.

KEYWORDS: *international law, neonicotinoid, multilateral agreements and conventions, pollinators*

INTRODUCTION

The humble bee. Reminiscent of past farming methods, pollinators, like the bee, have remained an intrinsic part of food production, despite the global shift to industrial agriculture. Bees, butterflies, and other pollinators play a critical role in transferring pollen from one plant to the next. This small task allows for the reproduction and flourishing of crops across the world, yet many have taken it for granted. Human activity and the use of certain chemical pesticides have endangered pollinator communities. Colony Collapse Disorder Syndrome, the sudden death of a significant proportion of a bee colony, has become a well-known term in the twenty-first century. Many reasons have been offered to explain why pollinators are so threatened, but the scientific research continues to return to the same one: neonicotinoids.

Neonicotinoids are a class of insecticides that seek to protect crops like corn and soybeans from being decimated by insects. The chemicals impact the acetylcholine receptors in the brain of the arthropods, such as sap sucking or burrowing insects, that attempt to consume the crops. Neonicotinoids were once highly touted in the pesticide market, but the scientific community has become increasingly concerned over their effects on bee populations. Typically, scientists are most concerned about the effects of the three most-used neonicotinoids: imidacloprid, clothianidin, and thiamethoxam. While neonicotinoids have been around since the 1980s, the last twenty years especially have been filled with controversy surrounding their effects on pollinators. Neonicotinoids were designed to be less harmful than previous legacy pesticides, but their continued use has led to increasing concern.

International law has a role to play in regulating neonicotinoids, protecting pollinators, and ensuring safe food production. The collaborations that have already occurred in the global regulation of various pesticides and climate change show that international law can have a productive role in spurring and synchronizing environmental action. Even though the European Union already has enacted a ban on prominent neonicotinoids, opportunities for more cohesive global neonicotinoid regulations still exist. Whether it is an international agreement like the Stockholm Convention on Persistent Organic Pollutants or simply a meeting to share research among scientists, progress can be made on regulating neonicotinoids through international cooperation. International regulation can better protect pollinator populations from a potential serious harm before irreversible damage occurs. Moreover, without proper pollinator protections in place, food production may greatly suffer over the longer term. Therefore, countries should seek to cooperate internationally through a multilateral agreement or convention on neonicotinoid regulation to conserve pollinator populations.

This paper has three parts. The first section describes neonicotinoids, their increased usage, and the scientific uncertainty over their effects. Following that overview, the paper evaluates the current state of neonicotinoid regulation. Beginning with the history of pesticide regulation, the paper centers discussion on the precautionary principle and what actions (in Europe and elsewhere) have been taken to regulate neonicotinoids. Finally, the paper analyzes how international law could help sufficiently regulate neonicotinoids. Shared research, multilateral treaties, and neonicotinoid alternatives are all potential approaches to remedy the effects of neonicotinoid use. The paper concludes by explaining how international collaboration on neonicotinoid regulation could help stabilize food production and pollinator populations alike.

I. A GROWING CONCERN

Neonicotinoids were born in an era following greater awareness of the potential dangers of pesticides. After Rachel Carson's nonfiction work Silent Spring was released in 1962, pesticides like DDT faced global backlash for their toxic effects on humans and wildlife. Society had reasons to be wary of new chemicals, but the need to produce a consistent harvest and minimize the impact of pests on crops remained. Thus, agrochemical development continued. The first neonicotinoid to be used as an insecticide was imidacloprid, which was patented in 1985. As neonicotinoids entered the global insecticide market in the 1990s, the agriculture industry began to recognize their potential benefits. By 2008, neonicotinoids made up 24% of the international agrochemical market. Over 120 countries were employing neonicotinoids for greater than 140 crop uses. In a short span of time, neonicotinoids had become a dominant feature of industrial agriculture.

The commercial success of neonicotinoids relates to both their versatility and potential for specificity. A variety of crops can be treated with neonicotinoids, such as vegetables, cotton, and corn. In comparison to other insecticides, neonicotinoids are applicable for more forms of mitigation, like seed treatments, soil applications, or even irrigation water systems. The ability of neonicotinoids to target sucking insects has been just as valuable. Insects like aphids, beetles, and white-flies frustrate farmers because they feed on the roots and leaves of important crops. To prevent this, farmers use neonicotinoids to eliminate sucking insects from their fields. Neonicotinoids specifically target the nervous system of sucking insects to kill them; this is key because it makes neonicotinoids less deadly to vertebrates than previous legacy pesticides or persistent organic pollutants. Also, the way neonicotinoids target the insect's nervous system eliminates the risk that insects will develop resistance as a result of a prior resistance to other insecticides like pyrethroids or hydrocarbons. Thus, farmers can be more confident that neonicotinoids are killing the intended insects to protect their crops. These characteristics of neonicotinoids have made them prominent in the international agrochemical market and on farms worldwide.

The rise of neonicotinoids, however, has not been without controversy. Since the mid-1990s, beekeepers have noticed a possible connection between neonicotinoids and injury and death within their bee colonies. A 1994 French investigation noted that the most common neonicotinoid, imidacloprid, along with a different insecticide (fipronil), was especially toxic to bees. As the world entered the twenty-first century, beekeepers witnessed an increased loss of bees within their colonies. In 2006, one beekeeper determined that 360 of his 400 hives were bee-less, a loss well above the average of 15% from one year to the next. Similarly, in 2012-2013, one study found beekeepers reporting a 45% loss of bees in their colonies. The losses received public recognition, being denoted with names like "Beepocalypse" and "Beemageddon." The European Food Safety Authority and other institutions commenced further studies to better understand the causes of the bee colony deaths. By 2018, the European Food Safety Authority concluded that neonicotinoids present a threat to honeybees and wild bees. The trend of bees dying had turned into a regular connection between neonicotinoids and the pollinator populations involved in agroecology.

The value of bees and other pollinators relates to their role in both agriculture and ecosystems. Pollinators assist with the sexual reproduction of both crops and wild plants, helping to regenerate crops from year to year. A Proceedings of the Royal Society journal found that "fruit, vegetable or seed production from 87 of the leading global food crops is dependent upon animal pollination." While these crops only make up 35% of the global crop production, those 87 crops are a significant part of agricultural and food systems. Looking at bees specifically, honeybees are "the most economically valuable pollinators of crop monocultures worldwide." For some nut, fruit, and seed crops, their yield could falter by over 90% in the absence of honeybees. Global agroecological systems remain, at least somewhat, dependent on honeybees and other pollinators to survive.

Considering the link between bee deaths and neonicotinoids, further research is a logical next step. Many researchers have produced studies on the various insecticides within the class to better understand the relationship between pollinators and neonicotinoids. Unfortunately, many of these studies have generated competing or confusing results, leading to uncertainty as to what the full effects of neonicotinoids are. For example, in 2014, the United Kingdom Centre for Ecology and Hydrology commenced a study at the request of Bayer AG and Syngenta (neonicotinoid producers) to determine the effects of clothianidin and thiamethoxam on bees in different countries. Worker bee populations exposed to the neonicotinoids decreased in Hungary and the United Kingdom the following spring. In Germany, however, no long-term effect was noticed. Results like these have been challenging to decipher and analyze. With these uncertainties, industry and science leaders have been at odds as to how to best regulate neonicotinoids, if at all. The debates have led to regulations in some regions, such as Europe, while other regions, such as the United States, have not been as keen to act. Still, even in regions where action was taken, years of debate and research were required before the current regulations were put in place. It has been a largely slow process for a contentious issue in the agroecological field. The differing research findings remain a puzzle for scientists attempting to better understand how to ensure safety for pollinators involved in agriculture.

II. THE CURRENT STATE: WHERE IS NEONICOTINOID REGULATION TODAY?

Despite the uncertainty, some organizations, such as the EU, have already enacted regulations on neonicotinoids. Beginning with a 2012 European Food Safety Authority study that showed high risk for European bee populations, neonicotinoids were hotly debated in the EU. In 2013, the EU ordered a moratorium on imidacloprid, clothianidin, and thiamethoxam, the three most prominent neonicotinoids. Companies like Bayer AG and Syngenta were staunchly opposed to neonicotinoids restrictions, believing that there was insufficient scientific evidence to support regulation. Nevertheless, five years later the EU banned the use of imidacloprid, clothianidin, and thiamethoxam in member states. The ban followed years of debate surrounding the application of the precautionary principle and the validity of existing research. Still, despite these steps taken by the EU, international collaboration on the regulation and trade of neonicotinoids has proven insufficient. Whether differing priorities, scientific uncertainty, or a lack of communication is at fault, countries have not shown a sense of urgency in confronting neonicotinoids. The regulations from the EU are a starting place, but the international community has not fully exercised their potential to regulate neonicotinoids at the present time.

In the United States, neonicotinoid regulations have been generally uncommon with minimal staying power. In 2014, neonicotinoids were banned on National Wildlife Refuges in the US, but this decision was reversed in 2018. Instead, neonicotinoid use on farms would be evaluated on a case-by-case basis. There has been some progress, however, as the Environmental Protection Agency canceled the registration of 12 neonicotinoid products in 2019. Currently, the EPA is suggesting additional management measures and restrictions on neonicotinoids, including halting the spraying of imidacloprid on residential turf. These recommendations still fall far behind those currently employed in Europe, but it does represent a gradual movement towards restricting neonicotinoid use. Whether the new US presidential administration and corresponding EPA leadership expands on these recommendations is still to be determined.

A. Past Precedent

Traditionally, international agreements have played a significant role in the regulation of pesticides. The influence of Carson's Silent Spring led to an international condemnation of pesticides, like DDT, for their toxic effects on ecological and human communities. DDT falls into the larger class of persistent organic pollutants (POPs), which persist in the environment for excessively long periods of time, endangering the air, water, and soil of the area.The longstanding conflict with POPs culminated in the Stockholm Convention on Persistent Organic Pollutants, which sought to ban numerous POPs internationally. 115 countries signed the convention in May 2001, denoting a global desire to reduce the harm of pesticides on citizens and nature. The Stockholm Convention did, however, note that international rules regarding liability and redress associated with the movement of POPs across international boundaries needed to be expanded. This represents that in many ways, international environmental law continues to struggle with the transboundary decisions that are still relevant with current pesticides like neonicotinoids. Overall, though, the Stockholm Convention is an example of a large multilateral treaty being used to unify action on pesticides and environmental harm. More recently, the Paris Agreement in 2015 sought to coordinate unified international action on climate change. While the agreement does not necessarily relate to pesticide regulations, it does speak to the ability of international law to produce wide-scale environmental action. International environmental law and agreements continue to be of use to states seeking to be better prepared for the ecological challenges of the twenty-first century.

Furthermore, the United Nations has historically been a player in pesticide regulation. The UN Food and Agricultural Organization accepted an International Code of Conduct on the Distribution and Use of Pesticides (the "Code") in 1985. The Code was designed to decrease the risks associated with pesticide use. The rationale for adopting the Code also involved narrowing the historical gap between industrialized and developing nations regarding pesticide use. Developing nations were frustrated that even when industrialized nations would realize that a particular pesticide was dangerous and imposed domestic regulations, the trade of that pesticide to developing nations did not stop. As a result, developing nations were exposed to toxins and health hazards that had been outlawed in the industrialized world. The Code employs broad language with standards that are not legally binding. Conduct standards in the Code include the responsibility for governments to overview pesticide use and distribution domestically and offer assistance abroad, as well as the responsibility for industries to provide sufficient pesticide testing and labeling. For accountability, consenting governments are instructed to report back to the Director-General of the UN Food and Agricultural Organization. While the Code in its initial form was a helpful international framework for addressing pesticide regulation, it had a key shortcoming that needed to be addressed. The Code failed to institute the principle of "prior informed consent," meaning that developing countries did not have the option to decline imports of restricted or banned pesticides from industrialized nations. However, the Code was amended in 1989 to account for prior informed consent, thus increasing the scope and effectiveness of the Code in how it relates to developing countries. Overall, the Code, while not legally binding, demonstrates that equitable pesticide regulation involves working with developing nations to ensure that a disproportionate burden of chemical harm is not placed upon them.

B. The Precautionary Principle

However, regardless of the context of a multilateral treaty or an organization code, international environmental law has remained confused on the use of the precautionary principle in its agreements. The definition of the precautionary principle varies depending on the context, situation, and who is asked. Environmentalists contend that the precautionary principle is an obligation to ensure the complete safety of a new technology, product, or procedure before it can be employed. The 1998 Wingspread declaration, born from a group of North American and European environmentalists attempting to operationally define the precautionary principle, supports this perspective, as it errs on the side of caution if there is any possibility of risk to environmental or human health. On the other hand, weaker concepts of the precautionary principle have also been used in international law. The UN Conference on Environment and Development produced the Rio Declaration in 1992, which states that scientific uncertainty should not prevent cost-effective measures being taken, thus adding an economic caveat to the definition. The disagreement surrounding the precautionary principle has hindered its ability to become a staple in international customary law. Nevertheless, this has not stopped the precautionary principle from being referenced in courts. In 1999, the Southern Bluefin Tuna Cases (New Zealand and Australia v. Japan) debated whether a lack of scientific certainty should prevent action to address the possible overfishing of the southern bluefin tuna. The courts concluded that a precautionary approach was necessary to help protect the population of the southern bluefin tuna, and measures should be taken regardless of the absence of undisputable evidence. While the implementation of the precautionary principle is not without controversy, it remains a relevant discussion point in international environmental law.

In relation to neonicotinoids, the precautionary principle has emerged as the foundation of regulatory discussions. Even though it is not consistently underscored, the precautionary principle has been the primary perspective in EU regulations like the 2013 moratorium on imidacloprid, clothianidin, and thiamethoxam. Since the EU has been more likely to utilize the precautionary principle over the past three decades than the United States, it makes sense that there is a difference in neonicotinoid regulations between the EU and the EPA. The EPA has made new neonicotinoid management suggestions, but legally binding bans and moratoriums do not appear to be urgent at the present time. Resolving differences, at least somewhat, on the validity of the precautionary principle will be imperative to any potential multilateral agreement on neonicotinoid regulation. Without a working agreement on the definition of the precautionary principle, the present divide between politicians, scientists, and industry will persist, and more pollinators will be at risk because of it.

III. THE PATH FORWARD: THE ROLE FOR INTERNATIONAL LAW IN NEONICOTINOID REGULATION

To protect global pollinator populations, international law should be employed to regulate neonicotinoid production, use, and trade. The current scientific uncertainty that has plagued prior neonicotinoid discussions can be alleviated by sharing research across international boundaries. Past precedents of the Montreal Protocol, Stockholm Convention, and the Paris Climate Accord offer examples of what a multilateral convention or treaty could look like. Alternatives to neonicotinoids can be evaluated for safety, affordability, and effectiveness in protecting humans, crops, and pollinators alike. International law's capacity to create multilateral treaties and conventions between states provides a path forward for tangible neonicotinoid regulation. Should individual states and regions attempt to regulate neonicotinoids on their own, they will not be as successful at instituting long-lasting and effective change for pollinator species. Inequitable worldwide trade of neonicotinoids would persist, and research on finding safer alternatives for crop protection would not have as much support or urgency behind it. In contrast, the framework of an international convention would provide an opportunity for critical discussions about shared research, alternatives to neonicotinoids, and equitable regulations; neonicotinoid use could be managed before irreversible damage occurs to pollinator populations. Therefore, a multilateral agreement on neonicotinoid regulation is the best way to ensure safe food production for plants, pollinators, and people.

Firstly, the lack of scientific certainty surrounding neonicotinoids and their effect on pollinators can be helped by internationally consolidating research efforts. Studies such as the 2014 United Kingdom Centre for Ecology and Hydrology survey have demonstrated that sometimes bee populations are affected by neonicotinoids differently depending on the research and climate. Reports from Canada and Australia even suggested that bees were doing fine despite ample neonicotinoid use. These reports, however, are still isolated findings in the grand scheme of neonicotinoid research and do not represent the numerous frightening examples across the world of pollinator decimation. Continued research has resulted in the general consensus from groups like the European Food Safety Authority that neonicotinoid use is harmful to bees and other pollinators, but the conflicting previous studies have, nevertheless, made it challenging to convince industry leaders of such a conclusion.

A multilateral agreement to expand research globally could be helpful to these efforts. With an agreement in place between industrialized and developing nations, research could be funded from Europe to Africa to the Americas to fully understand the true effect of neonicotinoids on pollinator populations. Since there have been examples of differing conclusions from different regions, shared research could help with study design, technological resources, and interpretation of findings in areas with peculiar results. Research could also be conducted to estimate the current value of pollinators to global food systems and even attempt to quantify the impact of neonicotinoids on that value. Since neonicotinoids have been proven to persist in the environment long after action (such as the detection of imidacloprid, clothianidin, and thiamethoxam in France in 2018, five years after the 2013 EU moratorium), advancing research now is urgent if relevant action is to be taken. It would be short-sighted for nations to continue trying to conduct their own research when neonicotinoid use today will remain in the environment for years to come. By developing a more sufficient understanding of neonicotinoids with shared research, states have the potential to regulate or stop neonicotinoid use before an unmanageable level of harm is reached. Collaborative research efforts via international law would be a vital step in regulating neonicotinoid use and ensuring safe food production.

Moreover, the success of other environmental conventions can be used to as a blueprint for how to best coordinate a multilateral neonicotinoid agreement. One example is international regulation of ozone depleting substances. The Montreal Protocol in 1987 followed a failure in Vienna two years prior to adequately address the growing hole in the ozone layer due to chlorofluorocarbons (CFCs). In Montreal, parties attempted to learn from their mistakes and sought to have more productive conversations between industrialized and developing nations on how to implement CFC restrictions. Nevertheless, it still would take a 1989 amendment in London to establish a Multilateral Fund to legitimately financially support the reduction of CFC use in developing nations. Overall, it took years to best incorporate the precautionary principle, environmental concern, and equity concerns into a protocol.

With neonicotinoids, however, parties have the luxury of history. By reading about the shortcomings in Montreal, states can be better prepared to have constructive discussions about pesticide regulation regarding efficiency, equity, and environmental concerns. In the Stockholm Convention, provisions were put in place to ensure reliable data would be gathered about POPs for years after the convention. A Global Monitoring Plan was established through help from the United National Environment Programme and their Chemicals Branch of the Division of Technology, Industry, and Economics. Through this plan, baseline data was generated in developing countries, a major boost to the legacy of the Stockholm Convention. In constructing a multilateral agreement for neonicotinoids, states can advocate for a similar plan to be put in place. A neonicotinoids convention would more closely mirror CFCs and POPs regulations than climate change due to a more focused scope compared to the vastness of climate change legislation; this makes understanding the achievements and shortcomings of Montreal and Stockholm even more valuable. Altogether, a neonicotinoid convention or treaty would be far from unprecedented, meaning that states have the opportunity to learn from the benefits and drawbacks of previous environmental agreements.

A defining question of a neonicotinoid convention is where to implement regulations: production, usage, or trade. The Montreal Protocol struggled with the debate between regulating production and consumption, as the United States and Europe were on different sides of the issue. With the current divisive state of regulations across the Atlantic, it is likely that this question would persist in a present-day neonicotinoid convention. Deciding whether to regulate production or consumption also has definitive impacts on developing nations, as while they might use pesticides, pesticide production has more traditionally been found in industrialized nations. Trade is another key aspect to analyze and regulate. To have a successful multilateral agreement, the protocols of the World Trade Organization (WTO) should be considered. Industries, understandably, would not be thrilled with a neonicotinoid ban, and could complain to the WTO on the basis of the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) or the General Agreement on Tariffs and Trade (GATT). However, if regulations are implemented on the grounds of sufficient scientific evidence and with a goal of environmental conservation and safe food production, a complaint could be successfully refuted by the convention. Overall, considering production, consumption, and trade when thinking about where and how to regulate neonicotinoids is essential to an effective convention.

In an agreement, parties can also work to incentivize eco-friendly alternatives to neonicotinoids. One concern of an international ban on neonicotinoids is that farmers and agricultural workers would be left out to dry with decimated crops and diminished profits. However, an Environment International journal analyzed 2968 case studies associated with the 152 French authorized uses of neonicotinoids and found that "an effective alternative to neonicotinoids was available in 96% of the 2968 case studies." While the most common alternative was different chemical insecticides, that does not have to be the only option for farmers. A non-chemical neonicotinoid alternative was recognized in 78% of the 2968 case studies. It is entirely possible that a ban on neonicotinoids could result in a short term decrease in crop productivity, but incorporating research on neonicotinoid alternatives and incentivizing such alternatives in a neonicotinoid agreement could help alleviate some of that loss. The Montreal Protocol's Multilateral Fund, as established by the amendment from London, could be a relevant example for parties to emulate. An integral feature of analyzing and incentivizing neonicotinoid alternatives is giving farmers, agricultural workers, and developing nations a seat at the table to discuss how to best move away from neonicotinoid use. While these discussions can often be challenging, they can be key to avoiding the classic whack-a-mole game often found in pesticide regulation (regulate one chemical, but the alternative is worse). In total, alternatives to neonicotinoids should be addressed by a neonicotinoid agreement to ensure that agriculture systems can make an effective and efficient switch from neonicotinoids to new methods of farming.

CONCLUSION

International law can be useful in regulating neonicotinoid use and preserving global pollinator populations. Despite past uncertainties in the scientific understanding of the relationship between pollinators and neonicotinoids, it has become increasingly apparent that neonicotinoids are causing harm to bees and other pollinators. Further collaborative research, which can be organized via a multilateral agreement, can be employed to help better understand the relationship between the pollinators and neonicotinoids and the role of pollinators in agroecology. The EU's 2018 ban on imidacloprid, clothianidin, and thiamethoxam is a tangible starting point for discussions, but more action will be required to sufficiently protect pollinators. The value of pollinators to global food production is well-documented. Even though the precautionary principle is still controversial in terms of its relevance to customary international law, it seems logical that it would be employed to protect an intrinsic aspect in the production of 87 of the world's leading food crops. Without neonicotinoid regulation and recognition of the harmful effects of honeybee colony collapse disorder, the state of pollinator populations will continue to worsen. Additionally, parties in a multilateral neonicotinoid convention or agreement have the ability to learn from the past failures and successes in Montreal, Stockholm, and Paris. Thus, parties would have the opportunity to create one of the most effective and equitable agreements ever seen in international environmental law. Agriculture has changed over time, but the bee has remained a vital part of global food production. After all that bees and other pollinators have provided to humanity, it is an imperative that humanity provides pollinators with a safe way to enjoy the plants and life that humans do. Now, the international community faces a critical question: To bee, or not to bee?

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Cooper Sykes will graduate in May 2024 with a Bachelor of Arts in Environmental and Sustainability Studies and Bachelor of Science in Geography and minors in German and Water Resources Science, Policy, and Management. He strives to be a part of creating a more sustainable and just world, with passions in mapping environmental data and contamination utilizing geographic information systems (GIS) through a critical geographic lens. In his career thus far, Cooper has created geospatial representations of research on persistent pollutants from Dr. Marta Venier's Hites Laboratory, generated an ArcGIS web app containing crowdsourced data about roadkill in Indiana from the Indiana Nature Facebook Group, and served on the GeoPFAS and AFOmap teams at the US EPA. Outside of the classroom, Cooper loves classical music, playing the saxophone, cats, and smiling. Cooper hopes to work as a geospatial scientist in the environmental field as he continues his career.

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