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Jacob Darwin Hamblin

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Let there be light … and bread: the United Nations, the developing world, and atomic energy's Green Revolution

Jacob Darwin Hamblin*

Although President Eisenhower's 1953 'Atoms for Peace' speech typically is associated with the promotion of nuclear power, it also recommended other peaceful uses of the atom, including applications in agriculture. 'Developing' countries in particular took a keen interest in food preservation, grain disinfestation, fertilizer studies, insect control, and mutation breeding, all using irradiation. A conflict of philosophies emerged at the United Nations between the Food and Agriculture Organization (FAO) and the International Atomic Energy Agency (IAEA). The IAEA stood accused of promoting a narrow range of technological solutions, ignoring more sensible but less sensational techniques, and tempting the poorest countries of the world to achieve 'modernization' with unproven technologies. The present essay outlines the origins of FAO/IAEA conflict and collaboration in the 1960s, and explores the failed effort of plant geneticist Ronald Silow to stop what he saw as the IAEA's hijacking of agriculture at the UN.

Keywords: Ronald Silow; Atoms for Peace; International Atomic Energy Agency; Food and Agriculture Organization; Green Revolution; agriculture

Introduction

Raving to journalists about a 'fraudulent conspiracy' at the United Nations, retired plant geneticist Ronald Silow seemed to have reached his wit's end in the early 1970s.[1] Few listened to his accusation of gross misconduct at the Food and Agriculture Organization (FAO) and International Atomic Energy Agency (IAEA), because his words defied belief. For years, he said, both FAO and the IAEA had silenced him and hid information from member nations; they promoted unproven agricultural uses of atomic energy in developing countries, despite the techniques being disavowed in richer countries; they wasted millions of dollars of the poorest countries' money so that a few American and European scientists could continue projects that their own countries had cancelled. Worst of all, they suppressed all dissent about the promise of atomic energy in agriculture – he was the proof of that. Most dismissed him as an embittered former employee. Silow's opponents brushed him off as an annoying obstacle in implementing atomic energy techniques in agriculture, the obvious path that all countries, especially those of the developing world, needed to take in order to develop modern scientific land cultivation.

Today's readers might be more sympathetic to Silow's views, because of widespread skepticism about the relationship between science, technology, and the process of modernization. Rather than embrace a causal relationship between innovation and social progress, most historians appreciate that scientific agendas and technological artifacts reinforce the priorities of those who design or promote them.[2] The field of modernization theory has come under intense scrutiny by scholars who recognize the exertion of influence through ostensibly universal notions such as 'modern,' 'advanced,' or 'cutting edge.'[3] Recent work

*Email: jhambli@exchange.clemson.edu

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on the 1960s Green Revolution – when famine-threatened Asia was 'saved' by scientific knowledge of plant breeding, irrigation, and fertilizer – has shown how the historical narrative was constructed by foreign relations goals, taking into account the spectacle of providing science and technology to those in need.[4]

Although it is less well-known, atomic energy also had its 'Green Revolution' in the 1960s, and its history reflects the vision of modernization emanating not only from foreign policy, but also from the far-reaching apparatus of the United Nations and its specialized agencies. Atomic energy was a symbol of American mastery of nature's terrible power, and it was a gift that Americans promised to bestow upon the world – echoing the Hebrew prophet Isaiah, to turn swords into plowshares. In his 'Atoms for Peace' speech at the end of 1953, US President Dwight Eisenhower laid out atomic energy's future – fissionable material to be pooled internationally, peaceful uses of nuclear reactors to be offered, and an international agency under the United Nations to ensure that all such peaceful applications would be accomplished without tempting others to develop a bomb.[5] The International Atomic Energy Agency was born four years later, and it began to coordinate atomic energy activities globally. Many of its efforts were in agriculture – fertilizer studies, insect sterilization, food preservation, grain disinfestation, and mutation plant breeding.[6] By the late 1960s atomic energy claimed its place in the narrative of the Green Revolution, having provided the means to develop the amber-colored variety of Sonora-64 wheat. According to this narrative, the wheat's widespread planting and marketing in India as Sharbati Sonora prevented an apparent famine and delayed a Malthusian crisis.[7]

Behind the conventional story of scientific ingenuity triumphing over nature lay serious questions about the role of atomic energy in the poorest countries of the world – the countries dubbed 'developing' by the UN. Why did so many path-breaking efforts to apply atomic energy to agriculture take place in developing countries? Did the UN, through its specialized agencies, encourage atomic agriculture at the expense of other methods? Atomic energy was a vision of modernization that reflected US foreign policy – why did the UN fall so fully in line with the promise of atomic energy, proffered first by Eisenhower and then by the IAEA? From the late 1950s onward, the United Nations endorsed and promoted an array of agricultural uses of atomic energy. The two most pertinent agencies, FAO and the IAEA, worked in unison, even creating a special FAO/IAEA Joint Division in 1964. The IAEA's official history suggests unity of purpose between the two agencies and a refreshing lack of controversy compared to national pursuits.[8] The archival records of the FAO/IAEA Joint Division tell a different story. They suggest a controversy more intense than any national one, and a bitter personal conflict with consequences for all the UN member nations. The controversy revolved around an individual, British plant geneticist Ronald Silow, and his failed effort to prevent – in his view – the IAEA from hijacking UN work in agriculture around the world.

Through the lens of Silow's experience, extensively documented in FAO's archives in Rome, we can begin to comprehend the tangled history of UN involvement in agriculture, science and technology, and the developing world. This essay does not resuscitate Silow as a hero; he made some poor choices, and the reader can be the judge, but his adversaries also were guilty of hiding information, suppressing ideas, and keeping issues invisible to the general public. On one level, this is Silow's story: a tale of an unlucky and difficult individual who saw himself as the sole voice for the developing world, but whose career, reputation, and influence completely disintegrated in the late 1960s. Behind his individual story we can discern a sharp philosophical divide about the UN's role in fostering modernization. On one hand were those who put their faith in rational planning to maximize efficient use of resources and expertise; they wanted UN policy guidelines for all the specialized

agencies, to ensure that science and technology served the goal of economic development. On the other hand were those who resisted conforming to such guidelines and instead put science and technology first, supporting local scientists to do world-class research and local officials to implement new projects – in this case by encouraging programs designed to apply atomic energy to agriculture.

The clash between these two competing visions played itself out in the early years of the FAO/IAEA joint division. Regardless of the veracity of Silow's more audacious allegations about the IAEA and FAO, he believed that the original sin of the joint division was its unwillingness to establish an overriding policy to align science and technology with prudent economic development. To Silow, the atom was promising, but not uniquely so. Despite the status of atomic energy applications as prestigious, modern technologies, promoting them did not seem to be true modernization. Instead, such promotion smacked of opportunism – by the IAEA and by individual scientists, politicians, and contractors – cloaked under the name of development. The IAEA supported atomic energy applications in agriculture with no explicit rationale beyond its own mandate to promote the atom. This was deeply frustrating to other UN officials, especially at FAO. Through its conferences, its laboratories, and its generous research contracts, the IAEA seemed less interested in planned development and more interested in promoting particular technological solutions and pursuing particular scientists' research agendas. Spurning the wide range of options outside atomic energy, the IAEA did not appear to be a true partner in the process of development, despite its financial support for projects in the developing world. The IAEA justified its actions by claiming that it did not force countries to take its money, and that developing countries were free to make their own choices without having them dictated by the UN. If developing countries believed that 'modern' meant 'atomic,' it was not the responsibility of the UN to disabuse them of that notion.

The end result of this clash was that the IAEA, a relatively new international agency, succeeded in reshaping the UN toward a particular technological path of modernity. The IAEA won major battles in its struggle within the UN system, particularly against FAO. First, it secured its dominance in all UN affairs dealing with atomic energy in agriculture, despite FAO's annoyance that it tempted developing countries to divert their resources toward dubious, unproven solutions. Second, it took total control of the FAO/IAEA Joint Division by excluding, suppressing, and containing its FAO member (Silow), a process that Silow fought tooth and nail. Third, it successfully brushed aside the major critique of its international activities. The IAEA refused to address Silow's principal objection that promoting atomic energy in the developing world was fundamentally irresponsible, and that the UN should include atomic energy only as one of a range of agricultural possibilities for developing countries. By centering this objection on Silow, from whom even FAO officials tried to distance themselves, the IAEA established a culture at the UN that virtually disallowed skepticism about atomic energy in agriculture, giving the appearance of unanimity and thus of international endorsement.

Fiat panis, fiat lux

The initial reaction at the United Nations of Eisenhower's Atoms for Peace speech was enthusiastic, and the specialized agencies each tried to carve out a place in atomic energy affairs.[9] The inclusion of agriculture in his vision of a nuclear future especially tantalized the Food and Agriculture Organization (FAO). Its director-general, the Indian Binay Ranjan Sen, needed little imagination to connect the promise of nuclear energy to the fulfillment of its own mission, embodied by the agency's motto *fiat panis* – let there be bread.[10] FAO's

plant production experts saw possible avenues for utilizing isotopes in fertilizer studies, and for using irradiation to preserve food, control insects, and generate new seed varieties. The leading voice for FAO in the realm of atomic energy was British plant geneticist Ronald A. Silow. Before coming to FAO, he had made a name for himself at the Cotton Research Station in Trinidad, in the British West Indies. Silow co-authored the final report of the research station, published as a book in 1947, and it became a standard for agricultural genetics.[11] The book drew attention to the role of man-made environments in facilitating evolutionary change. With his two co-authors, Silow wrote that human beings had been the primary influence upon plant evolution.[12] Through the United Nations, Silow and others now were in a position to bring scientific expertise to bear on such changes, combining the goals of FAO with Atoms for Peace.

Because of the potential consequences for agricultural management, Silow expected FAO to play a major role in international coordination of research, training of experts, and advising national governments.[13] Already the research lacked focus and coordination, Silow pointed out in 1956 after visiting laboratories in several countries. The Germans were advancing in meat irradiation, the Norwegians were trying to extend the storage life of fruits and vegetables, the Danes were more interested in agricultural tracers, while the Swedes and Norwegians alike had begun a major program in radiation-induced mutations for breeding. FAO scientists hoped to do even more. Silow believed that 'we are only at the very beginning of a very important and rapidly expanding new phase in human experience,' and that FAO could lead the way.

After the creation of IAEA in 1957, a turf battle consumed both agencies as the IAEA delved deeply into agriculture. Eisenhower had been very clear to mention agriculture in his Atoms for Peace speech; not only did agriculture fall into the agency's provenance, but also agriculture seemed the most sensible way to introduce economically relevant atomic energy into areas lacking the infrastructure and expertise required for nuclear-powered electricity. From a modest support of nine student fellowships in 1958, by 1963 it had supported 130 fellowships, several training courses, exchange professorships, laboratories, research contracts, conferences, and original research at its own Seibersdorf Laboratory in Austria.[14] The IAEA sponsored the use of radioactive phosphate to determine how much of it was taken up by the crop from fertilizer in a wide variety of soils, in seven countries from Hungary to the Philippines.[15] The first IAEA technical assistants were sent to Thailand and Tunisia in 1960, and more followed. In Southeast Asia the IAEA hoped to use radiation to control diseases, such as *cadang-cadang* in coconuts.[16]

The new agency's escalation of agricultural activities disturbed FAO, whose leaders felt that IAEA had asserted a dubious claim of agricultural expertise. FAO found itself treated as a junior partner despite its longer history and wider experience in a variety of techniques, not just atomic ones. Its scientists resented a series of 1959 conferences sponsored by IAEA – in the United States, in Poland, in Argentina, and in Austria – in which food irradiation was discussed, without much (or any, in some cases) consultation with FAO. At one IAEA general conference, a delegate from South Africa noted a 'crisis of confidence' regarding the IAEA, resulting from the latter's claim of universal competence.[17]

After a prickly period of interagency bickering, the IAEA and FAO in 1960 agreed to sponsor jointly a symposium in Karlsruhe on the genetic effects of radiation on seeds. Scientists presented an array of research: Swedish scientists discussed varieties of barley and mustard, while Italian scientists declared victory in improving wheat – stronger straw, higher pest resistance, thicker protective wax coating, and other positive characteristics.[18] Clearly, breeders had found a powerful tool. American researcher Arnold Sparrow, who

presented data on the sensitivity of plants to radiation, said the Karlsruhe symposium marked the 'end of an era' in radiobiology, with a new one just beginning.[19]

Amid acclamations about a new scientific era, the turf battle continued. The IAEA trumpeted the Karlsruhe symposium as a major aspect of the peaceful uses of atomic energy, while FAO linked it to its Freedom from Hunger Campaign, launched in 1959. Sterling Cole, the director-general of the IAEA, praised the conference as an exemplar of cooperation across disciplines, across frontiers, and between international organizations. Diplomatically he described FAO as the leading exponent of all questions dealing with food and agriculture while IAEA was the agency 'to whom the predominant role in the field of atomic energy has been allotted.' Cole pointed out that in the three years since his agency's inception, most had come to the realization that power generation from the atom, while desirable, was a distant possibility in most countries. He saw agriculture as a way in which to 'direct our attack on hunger and disease,' while reaching out to the peoples of the world not ready for power reactors.[20]

Behind the enthusiasm at Karlsruhe was the continuing bitterness of FAO leaders who felt that the relatively inexperienced IAEA was trying to run the show, and worse – doing so as showmen rather than as rational managers. FAO scientist Gösta Julén pointed out that irradiation was just one more way to produce changes in varieties. Maybe one out of a thousand mutations might produce a useful plant trait. No one, Julén insisted, should interpret these irradiation successes as a reason to replace classical breeding experiments with irradiation studies.[21] Ronald Silow agreed. Calling the IAEA work 'haphazard' and 'chaotic,' run by staff 'with little or no contact with world needs in agriculture,' Silow predicted that it would soon reach an 'explosive point' at which governments would no longer tolerate it.

What began as a turf battle was becoming a serious divergence in outlook: the IAEA was promoting atomic solutions, whereas FAO saw itself promoting sound agriculture, possibly using the atom. Increasingly FAO began to perceive a major conflict of interest between the IAEA and the countries of the developing world. This seemed all the more apparent when assessing the IAEA's scientific advisory committee, comprised of very highly-placed scientists in national atomic energy establishments – John Cockcroft (UK), Isidor Rabi (US), Vassily Emelyanov (USSR), Bertrand Goldschmidt (France), Homi Bhabha (India), and Wilfrid Lewis (Canada). They knew little of agricultural practices, but their prestige and their well-funded activities in agriculture threatened to drown out FAO's. The IAEA's high-profile 'omnibus' conferences made it difficult for FAO to get good people to attend its more specialized meetings.[22] Silow complained that the wide range of applications that the IAEA promoted made it impossible to develop a rational program of effort. It appeared that the IAEA was doing what it could to promote everything under the sun (or rather, under the atom), but without a rigorous plan of action or a defined agricultural policy.[23]

Despite the criticism, the variety of apparently ground-breaking applications of atomic energy in agriculture proved too tempting for the IAEA to pass up. One was the sterile male technique, a 'biological' form of pest control requiring the irradiation and weekly release of hundreds of millions of insects. Rendered sterile, these would out-compete existing males for females. By the early 1960s, the method met with stunning success when the US Department of Agriculture used it to control the screwworm fly in North America.[24] The IAEA proudly embraced the sterile male technique and promised more 'biological' pest control in the future. The leading agriculture scientist at IAEA, the American Maurice 'Mac' Fried, believed the screwworm success could be applied widely – the Mediterranean fruit fly, the tse-tse fly in Africa (carrier of sleeping sickness), the mosquito (carrier of

malaria), and even the common housefly.[25] Journalists devoured the IAEA promises. After Fried spoke along these lines at the 1964 Conference on the Peaceful Uses of Atomic Energy, *New York Times* writer Walter Sullivan asked, 'Will the screened porch be obsolete a generation from now?'[26]

The IAEA was even more enthusiastic about grain and food irradiation. Since the end of World War II, international bodies including FAO had struggled to find ways to save grain shipments from destructive infestations. Depending on the country of origin, as much as half a shipload of crop might be lost by the time it reached its destination. Scientists in the USA and Europe proposed irradiation of grain to kill or sterilize the stowaway organisms, and of food to lengthen shelf-life and kill harmful bacteria such as salmonella in meat and eggs.[27] Because many of the foods carrying salmonella originated in developing countries, and these countries often lacked proper sanitation facilities, the IAEA targeted them first. Were it not for salmonella, Maurice Fried stated, countries like Thailand could be important sources of animal foods such as eggs, poultry, and pork, for markets in Europe and the USA. With the help of atomic energy, such countries soon would possess valuable export goods that presently perished far too quickly to be significant.[28]

FAO looked upon these predictions with dismay. Director-general Sen criticized IAEA's actions, seeing an ebullient new agency stepping far outside its own realm of expertise and trampling on FAO's efforts around the world. He wrote to IAEA's director-general, the Swede Sigvard Eklund (who replaced Cole in 1961), pointing out that IAEA's unilateral activities in the area of food and agriculture had become a matter of concern to member governments.[29] Within FAO, scientists complained that the IAEA had capitalized on the fact that 'the term "atomic energy" began to assume almost magical powers to the uninitiated.' FAO scientists believed that only they had the expertise to use both the old and the new techniques, and to judge the appropriateness of one or the other. After all, the IAEA was only capable of developing sound practices insofar as they involved the use of atomic energy.[30]

Recognizing that their conflict of interest was unlikely to end, the two directors-general attempted a compromise. They set up the FAO/IAEA Joint Division for Atomic Energy in Agriculture in 1964, but if Sen hoped to increase FAO's influence with this arrangement, he made a grave error in judgment. FAO's independent voice in the field of atomic energy would never recover. In a personnel swap intended to mark the compromise and diminish inter-agency rivalry, IAEA made its top agricultural scientist, Maurice Fried, an FAO employee, and FAO likewise moved Silow to the IAEA, but the whole division stayed at IAEA headquarters in Vienna, closer to the Seibersdorf Laboratory where much of the IAEA-sponsored research was carried out. When Silow and a couple of staffers arrived in Vienna, Fried gave them a welcoming party in which they drank Austrian wine and sang Viennese songs. As IAEA staffer Björn Sigurbjörnsson later recalled, 'our colleagues interpreted this as a celebration of our victory over them. Maybe this was not so far from the truth: we had stayed in Vienna and our beloved chief, Mac Fried, continued as our boss.'[31] When Fried was appointed the joint division's director, rather than Silow (who became deputy-director), giving the appearance but not the reality of FAO dominance, the seeds of intense personal conflict began to germinate.

The meltdown of an atomic bureaucrat

In little more than a year, Ronald Silow made many enemies at IAEA and kept open the festering wound in the two agencies' outlooks toward agriculture in the developing world. Having moved to the IAEA headquarters in Vienna himself, he gained a much clearer idea

of the extent of the agency's activities and, in his view, its blindness toward sound agricultural policy in the developing world. In early 1966 he sent a report to the IAEA's director-general and to Fried, his boss in the joint division, and copied it to all his former colleagues at FAO. He claimed that FAO and its member governments were 'being seriously misled,' and that the IAEA had misspent US$1.5 million between 1962 and 1966, about half a million of it from the already cash-strapped coffers of developing countries.[32]

Silow's report was the first of many extremely long-winded memoranda against the joint division's work. The essence of Silow's argument was that the developing countries explicitly had asked FAO not to encourage them to adopt techniques until they had been proven feasible by the industrialized countries. Yet the joint division had done the opposite, using the developing world as an experimental zone for ideas that industrialized countries were not willing to adopt. Silow alleged that these projects were being promoted by atomic energy advocates who had already lost funding battles at home – in other words, these projects had been discontinued in industrialized countries but were promoted as 'modern' and 'advanced' in the developing world. The IAEA justified such experiments, Silow observed, by 'continued reiteration of transparently excessive claims' about the usefulness of atomic energy in agriculture – but transparent only to trained scientists in industrialized countries. He argued that such wild promises had motivated FAO to develop its own program in atomic energy in 1954, to ensure that governments received objective advice. With the creation of the joint division, however, those efforts were now overshadowed by the IAEA's extravagant claims and expenditures.[33]

Unsurprisingly, scientists at FAO reacted more positively to Silow's objections than did scientists at IAEA. Silow had criticized the IAEA's programs on soil fertility, saying that studies of fertilizer uptake with radioactive tracers were unlikely to give definitive results. FAO scientists guardedly said that more study was needed to evaluate this, but they did agree that programs in grain disinfestation through irradiation – about which Fried had spoken so optimistically – would be premature in developing countries, since they had not even been approved in industrialized countries.[34] As for inducing mutation with irradiation as part of plant breeding experiments, FAO scientists agreed with Silow that atomic energy was simply a tool to increase variability, hardly a panacea for plant breeders. J. Vallega, the director of the Plant Production and Protection Division, concurred with Silow 'that it is very dangerous to induce developing countries to concentrate on these techniques which can divert them from specific objectives, forcing them to invest substantial amounts of money and hampering practical results.'[35] For any plant breeding program to work effectively, the leader needed to be a specialist with training in agronomy, plant breeding, and seed production.

The IAEA leadership saw Silow as a troublemaker in their midst. Miffed at his interagency exposé, director-general Sigvard Eklund suggested a new assignment to him, that he should write a report documenting the history and development of the use of nuclear techniques in food and agriculture.[36] This reassignment sidelined FAO influence completely – especially because Fried technically was now the FAO member. In the meantime, alone and isolated within IAEA, Silow reached out to FAO for help. In August 1966 Silow wrote to director-general Sen, in a 26-page handwritten letter complaining that his IAEA colleagues had begun to make personal comments disparaging his role in the development of FAO's work, and to question his competence to comment on scientific matters. He lamented the fact that, as a senior person, his former supervisors had all left FAO – and indeed, he seemed to have few allies left, and only enemies within IAEA. FAO's director-general was his only hope. He pleaded for help, 'after 35 years of productive and recognized service, in increasingly responsible positions, almost all in or on behalf of developing

countries, under conditions that were often by no means easy, and sometimes entailed considerable risk to my family.'[37]

Although Silow looked for allies at FAO, director-general Sen kept his distance. His reasons for doing so are obscure. Why did he abandon FAO's influence over the joint division, as well as Silow personally? Perhaps he was more concerned with ensuring FAO's name remained in the joint division than with influencing its work. Perhaps he realized he had been outmaneuvered and did not wish to do battle with IAEA and its powerful proponents in the USA and Europe. Or perhaps he just sensed that Silow made a poor choice as an ally. Regardless, in a strange reversal, Fried henceforth became the principal FAO voice in atomic energy matters. Instead of helping Silow, Sen delegated the lengthy letters (which Silow had marked as confidential) to subordinates to read, to pick out any important points requiring his attention. So Silow's personal appeals, because they were in letters mixed with his policy objections, reached an audience of mid-level functionaries at FAO. Ultimately this hurt his reputation further, and indeed made him a laughing stock.

These letters also were circulated to a special Consultant Group that advised the FAO/IAEA Joint Division. The group was formed to give the division the kind of policy coherence that Silow had said it lacked. It was made up of prominent scientists, Sir John Cockcroft (UK), A.W. Lindquist (USA), A. Gustafsson (Sweden), and C. Dakshinamurti (India). Cockcroft met with Silow, but the meeting had little impact except to confirm what the consultants already had heard from Fried and others. Fried observed that the consultants often spoke about Silow in official deliberations and in informal conversations. Fried wrote that 'from a subjective point of judgment' he and others 'had the definite impression that the members of the Consultants' Group were acutely and quite fully aware of the extreme unhappiness of Dr Silow and that the Consultants undertook to satisfy themselves with respect to the scientific and technical matters at issue.'[38] In other words, Silow was perceived as a depressed and emotional man whose objections had little relevance to the matters at hand. Although the group recognized the 'somewhat different' outlooks and philosophies of FAO and IAEA, its 1966 report fully endorsed the IAEA's manifold plans for the future, invoking the world protein crisis as a justification. If the group had a criticism, it was to lament the vast areas of applications that the division was not yet able to support adequately, such as biochemistry and plant physiology.[39]

After the Consultant Group issued its report, the problematic relationship with FAO increasingly materialized around Silow rather than the agency as a whole. The group dispensed with Silow's criticisms simply by calling them 'unjustified.' In the opinion of the US member A.W. Lindquist, the Consultant Group served to 'clear the air' between FAO and IAEA, with each side seeming more conciliatory than in the past. This was no surprise, since 'FAO' now meant 'Fried,' and Silow was marginalized, undoubtedly the butt of gossip and disdain. 'Regarding Dr Silow, we all feel sorry for the man,' Lindquist wrote. 'He has written numerous highly critical and unjustified letters to many people. His last 30-page letter went beyond good taste and was really acrimonious.'[40] Leaving Silow aside, the Consultant Group envisioned a much more intensified effort to incorporate atomic energy into agriculture.

The belittling of his competence strengthened Silow's resolve to lash out against the heady confidence of the IAEA. He formally requested that the Consultant Report be withdrawn from distribution and publication because it sidestepped many of the views within FAO, while completely disregarding his own. In March 1967 he wrote to both Sen and Eklund with a 49-page memorandum reiterating the philosophy of FAO that techniques should not be encouraged in the developing countries until they had been proven to be successful in industrialized countries.[41] He pointed out that, because of stark policy

differences, IAEA attitudes toward him had become 'vindictive' and 'hostile.'[42] The execution of his responsibilities on behalf of FAO, he stated, 'has led to the virtual termination of normal professional life for me for the past two-and-a-half years since being transferred to the IAEA staff.'[43] He was not allowed to travel to relevant conferences, he was excluded from policy discussions, and he was an object of ridicule. 'I have been almost completely isolated from my professional contacts, both inside and outside the United Nations family, and from my agricultural profession of a previous 35 years standing.'[44]

No one listened. Silow's decision to take the report as a personal affront, not to mention his poor judgment in crafting such long and vitriolic diatribes, hardened IAEA's stance against him. Such unprofessional behavior made it difficult for FAO director-general Sen to back his policy recommendations.

Forcing the pace with white elephants

After Silow fell from grace, he moved the controversy from an inter-agency turf battle toward an increasingly ugly dispute about the motivations of the IAEA leaders. Silow claimed that the agency bowed to commercial demands and forced the pace of atomic energy research in the areas least appropriate – developing countries. For example, he related the story of Isochem, an US company that made industrially useful isotopes from radioactive waste.[45] In 1967 Isochem openly worried that production was beginning to outstrip demand, and that new markets for isotopes in the western world were hard to come by. Such isotope production had turned into a 'white elephant' doomed to failure. Thus they increasingly looked to foreign markets, especially in the developing world. For Silow, such 'sales pressures' translated into 'programmatic pressures' in international agencies.[46] As another example of this rushed pace, Silow observed that the only major buyer in the USA for irradiated food was the Department of Defense, and that the USDA hesitated to approve irradiated foods despite over $20 million in research in the USA.[47] Yet with IAEA guidance, the Tanzanian government recently agreed to cooperate with an American firm to build its own $4 million irradiation plant to produce sterilized beef for domestic consumption, with isotopes provided by Atomic Energy of Canada. This plant was intended to start production in 1969, even prior to the first US one.[48] Silow objected: 'There should be at least three years commercial production and consumer experience with such a radically new process, in a country like the United States with almost unlimited resources for technical and economic evaluation of the process, before thought is given to transferring such an extremely complex technology to countries in the very early stages of their technical and economic development.'[49] He accused these atomic energy enthusiasts of trying to 'force the pace' of development in areas where even the slightest unforeseen circumstance could cause the breakdown of an entire operation.

Similarly, Silow felt that IAEA-backed disinfestation programs followed on the heels of failed ones in rich countries. Information that was being furnished to developing countries was biased in favor of atomic energy, he believed, leading the UN agencies to an 'untenable' and 'embarrassing' position. The Canadian government already spent $1.5 million on potato irradiation but considered it unpromising. Yet the United Nations now was planning an even higher expenditure on grain irradiation in Turkey – according to Silow, it 'will inevitably fail' and it would be inappropriate to convey any hope of economic viability to the Turks. A grain irradiation facility being constructed at Iskenderun would operate at costs at least five to seven times higher than grain disinfestation using other methods.[50] Beside that, the facility at Iskenderun could handle less than 1% of the country's total grain, 'and even if the radiation process were economically viable there – which it cannot be – there are no

other known locations in Turkey where it could be used.' That location ostensibly had been chosen because of the prevalence of a particular pest – the khapra beetle – but there was no entomological evidence making it particularly suitable for irradiation. In fact, there was no commercial potential for grain irradiation there 'or anywhere else in the world.' The Turks, according to Silow, would be better off diverting the money away from atomic energy and committing it to a more conventional fumigation program, which could be carried out in farm granaries and regional storage depots, where the major problems with beetles arose.[51]

Silow suspected that atomic energy scientists had failed to gain adequate support at home and were carving out a haven at the UN.[52] He suggested that in the US Department of Agriculture the atomic energy advocates were outnumbered, and the disaffected scientists had gone to the IAEA (Fried was a former USDA scientist). He also pointed to the recent history of the UK's Wantage Radiation Laboratory, which had curtailed studies of grain irradiation. If the British government saw that such activities were not worth the resources, why should a developing country go forward with them? Silow implicitly accused British scientists of using international organizations to extend their research programs after their home countries had cancelled them. Wantage's work had been supervised by Henry Seligman. After the British government reduced the agricultural program to about a third of its previous size and eliminated several projects, Seligman moved to the IAEA as a deputy director-general and started up the IAEA's Seibersdorf Laboratory in Austria. His former boss in the UK, Cockcroft, became the chairman of the Consultants Group that advised the FAO/IAEA Joint Division.[53] Silow noted, 'the grain irradiation project, which was terminated for good reason by the UK Government at the Wantage Research Laboratory, was immediately reconstituted in virtually identical form here on the international level.'[54] This characterization is not far from the one made decades later by IAEA's official historian, David Fischer. In a footnote he observes that Seligman and another physicist, the Italian Carlo Salvetti, had been 'dissatisfied with the direction their establishments were taking and sought scientific refuge in the IAEA.'[55] Silow claimed that when he and FAO had insisted on responsible policy controls, he had been 'silenced and discredited.'[56]

Having little more to lose, Silow alleged that he had been pressured to acquiesce in the IAEA's decisions, and that professional ostracism had become the penalty for not doing so. In one letter he suggested duplicity on the part of IAEA's director-general, Sigvard Eklund:

> Dr Eklund, you will remember that my criticisms were continued in 1966 because no effective action was taken on my earlier suggestions on this matter … following which you had told me that no option was given to me but to agree always with the Director of the Division … . You will remember that during your discussion with me … I agreed to your proposal, only for the time being, in order to give you the time that you said you needed to correct the situation quietly … .

Instead, Silow observed, the programs had continued and Silow had been humiliated.[57]

Writing of 'untold damage' to developing countries, Silow claimed the IAEA carried the 'moral responsibility for having raised false hopes' in the developing world. He pleaded to Sen and Eklund, 'Clearly some way needs to be found of ensuring that in future when the validity of expensive and highly controversial proposals is under consideration, an extremely limited group of individuals and interests do not act singly or jointly in various combinations at different times as originator, plaintiff, defendant, witness on both sides, advocate, clerk of the court, and sometimes even as judge, as well as expert adviser to

all of them.'[58] The many examples – Iskenderun, Tanzania, the Wantage Laboratory, and the others Silow had raised – 'the herd of other expensive but dying "white elephants"' – were born of the forced marriage between atomic energy and agriculture by national governments, by foreign policy initiatives, and now the IAEA.[59]

In April 1967 Silow tried to take a public stand with his ideas by submitting a paper to the IAEA General Conference.[60] Silow's strategy in the paper was to outline the objections to irradiation made by experts within the USA, particularly the President's Science Advisory Committee (PSAC). It had issued a report in 1967 titled 'The World Food Problem,' in which it suggested that there was some uncertainty about whether or not irradiation imparted toxicity to food. PSAC had stated that '[t]hese and other problems indicate that radiation is not likely to have a significant application for food preservation in the foreseeable future.'[61] Leaning on PSAC's conclusions, Silow discussed experiments showing toxic effects in organisms raised on irradiated food. Symptoms included reduction in cell growth and cell division rates, increased rates of mutation, and also chromosome breakage. These effects had been observed in fruit flies, rats, mice, and cultures of human tissue.[62] Silow noted how important it was to resolve such serious questions before the UN supported worldwide adoption of food irradiation. Doing so in developing countries, especially, was 'clearly entirely premature and unwise.'[63]

By pointing to the conclusions of US experts, Silow dared the IAEA to contradict the US President's Science Advisory Committee, but the IAEA rose to the challenge, citing other Americans and casting doubt on the competence of the person who had prepared some of the PSAC statements – belittling him as a mere employee of Campbell Soup Company. The US Army already had contradicted PSAC, claiming that food irradiation was wholesome, and the IAEA chose to back the Army's claim. The IAEA also cited Glenn T. Seaborg, the Nobel Prize-winning chemist – and chairman of the US Atomic Energy Commission – who had complained in a letter to PSAC that massive feeding experiments (of animals) had shown no evidence of harm. Members of Congress's Joint Committee on Atomic Energy also challenged PSAC. To the IAEA, this meant that the PSAC report serving as the basis of Silow's argument had been 'published without consulting the American authorities in the field of food irradiation.'[64] These 'authorities' were the AEC, JCAE, IAEA, and the US Army, all of which had interests in promoting rather than questioning the applications of atomic energy.

In fact there was more support in the USA for Silow's claims than the IAEA wished to admit. Earlier that year (1967), the US Public Health Service's Commissioner of Food and Drugs, James L. Goddard, had urged caution. It was one thing to be enthusiastic, he said, but quite another to mislead people about the current state of the art. 'It can be very discouraging for industry executives and the consumer as well,' Goddard said to a meeting of specialists in Oak Ridge National Laboratory, 'to be led in any way into thinking that this or that process for this or that commodity is in effect today, when this may not be the case.' He reminded them that the USA played a leadership role in food production. 'Our laws are taken to be model laws. Our business practices are imitated … our experience with irradiated food processes will be not only carefully watched – as they already are – they will be carefully copied as well.' That meant that the USA bore a heavy burden not just for Americans but also for the world, and that their standards of safety often translated directly into international standards. Change for the sake of change was not sufficient, Goddard claimed. 'The burden of proof is heavy – but it does weigh upon the innovator.' In the case of irradiated foods, such proof must come from an objective analysis of the best food policy, rather than prejudiced advocacy of one method over another.[65]

Such arguments were music to Silow's ears, but they did not appeal in the slightest to the IAEA. It devoted some 25 pages to refuting Silow's criticisms, picking them apart on technical matters to demonstrate that past research was justification for optimism rather than pessimism. It again pointed to research successes in the USA and reported commercial successes in the USSR, where the Ministry of Health already had approved irradiated food for consumption. It called the USSR 'one of the most advanced countries in the industrial application of food irradiation.' Evidence for the latter was based on a single paper by V. Rogachev at the Food Irradiation Symposium at Karlsruhe in 1966.[66] The IAEA denied the need for agricultural policy: 'The decision as to whether technical assistance shall be suspended does not lie with Dr Silow. He should know better than those he criticizes that technical assistance is requested by Governments and that the IAEA is the servant of the Member States and not in a position to dictate what assistance is best for them.' The IAEA asked: when countries like India, Pakistan and Argentina started to build plants with their own money, having faith in the future of atomic energy, why should the Agency correct their views and deny them technical assistance? Such attitudes denied the necessity of the kind of supervisory agricultural policy for which Silow had been calling.[67]

In the end, Silow's document never saw the light of day and was suppressed within the UN specialized agencies. IAEA director-general Eklund wrote simply to FAO director-general Sen, 'It is clear that statements in the papers will not stand critical examination and I do not consider it appropriate to give any of the documents broader distribution, for instance as a document for our General Conference.'[68] Eklund had tried to sideline Silow before; but doing so over a document that simply repeated US scientists' arguments marked a decisive step to quash dissent. Because it had come from the much-derided Silow, he got away with it without reproof.

The IAEA was embarrassed when later that month (August 1967), *Nucleonics Week* revealed that several senior executives of the British company building the grain irradiator in Turkey had resigned. The company was struggling because its biggest contract – the plant in Turkey – had stalled. The project was on hold because of 'considerable public apprehension about the grain irradiator, reportedly stirred up by anti-Western elements.' The government in Ankara, *Nucleonics Week* reported, was preparing to mount a publicity counter-campaign in favor of the plant prior to its construction.[69] To Silow, this suggested that the Turkish government was being misled. Why would it strain its already thin resources to promote a project that could not possibly improve economic conditions, even in the face of domestic resistance? The IAEA, he believed, was complicit in Turkey's poor judgment by encouraging it to make the wrong choices and by shielding Turkey from FAO assessments that the grain irradiation plant was fundamentally ill-advised.[70] From IAEA's perspective the Turks had become hysterical, concocting conspiracy theories that the plant was going to sterilize the whole population. According to the official IAEA history, the project died because of 'public fears and lack of understanding about the purposes of radiation.'[71]

Fortunately for his enemies in the IAEA, the mandatory retirement age forced Silow out in March 1968. His place as deputy-director already had been assumed not by another FAO scientist but by an IAEA insider, the decidedly pro-atomic Björn Sigurbjörnsson, an Icelander and a devotee of Maurice Fried. According to prior arrangement, Silow returned to FAO, where the retirement age was slightly higher, but his return entailed a demotion in rank and a move to a new assignment – which Silow interpreted as yet another move to silence him. Though more familiar territory, FAO no longer offered friendly faces. Director-general Sen was gone, replaced in early 1968 by Addeke Hendrik Boerma of the Netherlands. His outlook contrasted sharply with Silow's and complemented the

technophile leanings of atomic energy advocates.[72] Maurice Fried had cultivated allies at FAO, including its assistant director-general for agriculture, Otto E. Fischnich. Like Fried, both Boerma and Fischnich saw Silow not as attempting to help the UN but rather as personally invested in destroying the joint division's program.[73] His agitation as an employee, combined with an increasingly acrimonious relationship with his colleagues, poisoned the work environment and removed all possibility of rapprochement. Director-General Boerma noted with regret that Silow continued to take up everyone's time with petty questions of rank.[74] Skepticism toward atomic energy in agriculture, for better or for worse, was associated with him personally, and his pariah status hardly invited others to join him.

Atomic energy and the Green Revolution

The Green Revolution ultimately gave the IAEA the public relations boost to continue its program of supporting atomic energy in agriculture. The Green Revolution is the name given to a period of stunning increases in cereal production, made possible by the postwar work of plant breeders such as the American Norman Borlaug and their patrons, the Ford and Rockefeller Foundations. Praised for his 'Yankee ingenuity,' Borlaug had helped to transform Mexico's economy, making it self-sufficient in wheat through the use of high-yielding varieties that thrived under diverse environmental conditions, responded well to fertilizer, and were short enough not to topple over. Soon others began to grow the Mexican wheat, sparking the global Green Revolution, as the journal *Science* put it, 'throughout the broad latitudinal range from Turkey to Paraguay.'[75] Giddy predictions followed of eradicating world hunger, of fending off population pressures, and of solving the problems of the developing world through high technology.[76]

The IAEA was quick to point out the important role of irradiation to induce mutations, which added to the gene pool from which scientists could cobble together further miracle seeds. Borlaug had done extensive trial-and-error tests over many years, which should have supported Silow's position that atomic energy techniques were not necessary. However, Indian buyers showed little enthusiasm for the small quantities of Mexican wheat (called Sonora 64) that made it to market because apparently they did not like the color (they 'found the reddish hue unpalatable,' one writer observed). After subjecting the wheat to ionizing radiation, Indian scientists led by geneticist Monkombu S. Swaminathan found an acceptable mutant with a more appealing amber color. After rechristening the wheat 'Sharbati Sonora,' the Indian Agricultural Research Institute (led by Swaminathan) launched a large scale campaign of planting, with intensive use of irrigation and fertilizer. The astonishing yields convinced other farmers to do the same, made Swaminathan famous, and gave the IAEA the example of success its leaders craved. It also provided the appearance of Indian ingenuity; the Indians claimed that along with the change in color Sharbati Sonora also yielded higher protein than the Mexican variety. India's State Minister for Food Anna Saheb Shinde observed, 'The farmer has gained faith in science. This is the corner turned.'[77]

Although radiation had changed the color of the wheat from red to amber, the protein 'miracle' had nothing to do with atomic energy. Ronald Silow was quick to point this out when the FAO/IAEA Joint Division used the Green Revolution to justify further expenditure to develop high-protein varieties of grain.[78] Silow doubted that Swaminathan had found a mutant with higher protein quantity, and said that such experiments should not be encouraged in any event. If a country wanted higher protein wheat or rice, they ought to breed for that character as Borlaug had done, rather than hope that radiation would spontaneously

produce a miraculous mutant. Mutation breeding ought to be left to those countries best able to afford it; then, as in the case of the Mexican wheat, seeds with desirable traits could be transferred to the developing world. When Indian scientists toned down their claims about increases in protein content, Silow became convinced that Swaminathan was a fraud and that the IAEA was covering it up.[79]

Emboldened by the revelation that the Indians had exaggerated radiation's contribution to protein increase, Silow fought more vigorously than ever, piling on example after example about international agencies supporting research fruitlessly. He continued to oppose FAO approving funds for irradiation programs, whether potatoes in Chile or strawberries in Vietnam. He complained the joint division was propping up institutes in places like Iran, where previously enthusiastic backers such as the Central Treaty Organization (CENTO) had become disillusioned, withdrawing their support – yet still the UN encouraged them. Even if the IAEA could argue that such projects were requested by developing countries, Silow argued, it was difficult to believe that they would have done so spontaneously, without prompting or encouragement from the IAEA. After a heated discussion with Fischnich and his assistant, during which the assistant said that Silow thought he 'knew everything about everything,' he fired off a vitriolic memo to them suggesting that they were just coming to heel with the IAEA. They were content to throw insults at Silow while believing blindly in the rhetoric of atomic energy enthusiasts. 'The world history of food irradiation is one long story of excessive claims of its economic value and repeated financial failure and bankruptcy, without a single commercial success, coupled now with lack of confidence on the part of the public health authorities in the data, purporting to demonstrate the safety of irradiated foods, that have been given to them by the promoters of food irradiation.'[80]

Silow's descent at FAO continued, culminating in a bizarre spat in which he lost access to secretarial services and had to continue his memos in handwritten letters. His secretary had taken ill and Fischnich did not deem Silow's work important enough to warrant a full time replacement, but rather encouraged him to use Fischnich's own secretary or his assistant's secretary. In practice this meant that Silow had to submit everything to his principal adversaries at FAO, and the secretaries might sit on his letters for days before typing them – or rather, spend days typing them, as his memoranda often were quite long. So he just hand-wrote them, which undoubtedly undermined his authority further, added a sense of desperation to his pleas, reduced the likelihood of the memos being read because of his poor handwriting, and made him an object of ridicule.

Soon Silow made it even more personal, by narrowing his critique to a few individuals within IAEA and FAO around whom, he claimed, a number of 'professional and administrative irregularities' revolved. He accused one (without naming him) of falsifying his degree and lying about his affiliation to a university, and accused Fried and Sigurbjörnssen of covering it up. He also accused them of making public claims that could not be justified by scientific data. They had taken Swaminathan's claim about increased protein content and promoted it as truth, he alleged, without having verified it. In the meantime, other geneticists had shown that the Indian claim was grossly exaggerated. Further he accused them all of conspiring to hide proposals from him until it was too late to stop them from being approved, and of routinely rejecting his criticisms out of hand. He said their unceasing promotion of atomic energy in agriculture, despite the skepticism in their home countries, had given rise to a crisis in confidence from the developing world – first in the staff, then in FAO, and ultimately the whole UN system.[81]

Finally Silow's adversaries had enough. Fried wrote a long condemnation of Silow, attaching a handwritten note to Fischnich with the observation 'This is much stronger than

the form of my usual answer but it is all true and somehow a stop has got to be made.'[82] Fried saw himself accused of presenting false information about the protein content of irradiation-produced amber-colored wheat. Technically, he claimed, FAO had not explicitly stated that Swaminathan had indeed increased the protein content. Because Fried had tape-recorded the meeting during which Silow said these claims had been made, he had evidence that the subject had come up only once and the claims had been duly qualified as still unsubstantiated. Thus, Fried wrote to Fischnich, Silow's basic accusation was false and he 'stands exposed as having deliberately lied to you.' Fried's descriptions of Silow were particularly bitter: he referred to Silow's 'crusade against the joint division,' calling him a 'self-appointed policeman.' Fried resented 'being asked time and again to answer fabricated and false, malicious and slanderous accusations by Dr Silow against myself, my staff, and the Joint Division's activities …'. Fried was tired of Silow and wanted some disciplinary action: 'I would now kindly request that a stop be put to this nonsense.'[83] One official suggested suspending him with pay for a few months, 'to keep him out of the building and worrying delegates,'[84] but ultimately, despite Fried's desire for punishment, FAO leaders decided to just wait for him to retire.

In the meantime, FAO concealed from Silow any activities that might provide him with further ammunition. One example of this occurred when another individual began to criticize atomic energy in agriculture. Oddvar Aresvik, who had been a professor of agriculture economics at the Norwegian University of Agriculture, worked under the Ford Foundation in Pakistan and Lebanon and was writing a book about his experiences. Upon finishing a draft, he sent a copy to his own country's FAO national committee for comments. From there it reached the attention of the FAO's director-general, Addeke Boerma. The manuscript was highly critical of grain irradiation, and the fundamental critique was identical to Silow's.[85] Aresvik felt that the UN's encouragement of such research led cost-cutting politicians in developing countries to make dubious choices in priority. It led to greater support for radiation research and the best scientists followed the money, leaving the huge store of existing genetic material understudied. National pride encouraged politicians to focus on such cutting-edge research, because 'they have got the impression that to be considered developed they have to have atomic reactors and institutes for irradiation genetics.' Aresvik acknowledged that the promise of irradiation was encouraging, and that perhaps it might lead one day to fantastic results, but there was no reason the burden should fall upon the developing world. 'I have no objection to rich countries,' he wrote, 'which are experimenting with moon rockets and similar projects, sacrificing large amounts on radiation genetics.' The UN should know better, and not encourage the tendency of politicians in developing countries to choose such large-scale, expensive 'white elephants.'[86]

FAO dreaded this kind of criticism coming from someone other than their 'exasperating' employee, particularly since any negative sentiments in the Norwegian national committee might spread elsewhere. Instead of responding to Aresvik's general point about whether such projects should be encouraged, Fried picked nits about whether the joint division had supported new institutes or just new buildings. He also cast doubt on Aresvik's assertion about the disproportional amount of government support between irradiation and traditional plant breeding, and he did not believe that irradiation researchers were paid more, as Aresvik had suggested. He criticized the notion that only rich countries should do research on it, calling this the 'spoon-feeding of crop varieties.' Instead, he claimed, local people should be encouraged to do it themselves, with cooperation of the best brains available locally and internationally.[87]

The discussion about Aresvik was supposed to go on behind Silow's back. Yet someone – accidentally or surreptitiously – took Fried's comments about Aresvik's draft and

delivered a copy to Silow. He saw the copy on his desk, reviewed its contents, then left his office for a time. When he returned, he found his secretary in an argument with Fischnich's secretary, who had come to retrieve the document without Silow's permission. She had the document in her hands and left. Outraged, Silow demanded to Fischnich that a copy be sent to him, bemoaning the 'increasing trend toward secrecy in scientific matters' at FAO in recent years. The existence of secrecy, he pointed out, was one of the surest indications that something was wrong with the program.[88] Fischnich did not comply. Kept in the dark, Silow was unable to engage with Aresvik's manuscript. Aresvik himself seems to have been cowed by Fried's hostile critique, as his subsequent books on agriculture in developing countries were not especially critical of atomic energy.[89]

At this point Silow was fighting FAO's efforts to retire him, at the mandatory age of 62.[90] As a last-ditch effort to derail atomic energy in agriculture, he penned a 38-page memorandum to the director-general, reiterating all the objections he had amassed over the past half-decade and requesting that Boerma withdraw FAO's support for a projected 20-nation cooperative project under FAO, IAEA, and the European Nuclear Energy Agency. The long memo had the air of desperation: handwritten, with crossed-out paragraphs, repeating examples from one page to the next. It also seemed as if composed by a megalomaniac: 'I ask you that you please do not fail to provide me at my residence by 22 December 1970 evidence acceptable to me that you have complied effectively and successfully …'.[91] The only response he received was a two sentence reply from Fischnich acknowledging receipt of the memo and stating that the project was indeed worthwhile.

In 1971 FAO closed the book on Ronald Silow. After a further memo to the director-general, Boerma decided it did not need to be answered.[92] After all, now Silow was writing as a private citizen and could be ignored. In subsequent years, Silow's name surfaced from time to time in letters to the editors of newspapers, criticizing the scientific and economic bases of atomic energy in agriculture. His legal action against FAO for his treatment in (and removal from) the FAO/IAEA joint division, along with his request for the withdrawal of the Cockcroft group's report, had come to naught in late 1969. The International Labour Organization's Administrative Tribunal determined that Silow's superiors had the right to remove him, because he had openly criticized them and circulated his criticisms within the two organizations. The remaining complaints were dismissed, and his appeal went nowhere.[93] In 1972 Silow tried to attend an FAO meeting on agriculture and was barred from doing so; his subsequent complaint to the ILO Administrative Tribunal was dismissed.[94] In a desperate move in 1973 Silow contacted a BBC correspondent with a story about 'fraudulent conspiracy' at FAO to continue research on false science – referring to the increase of protein in wheat by irradiation.[95] After that, his voice faded into insignificance.

Conclusion

The laudable aim of the IAEA, turning a terrible weapon into a force for good, masked an unforeseen consequence: unlike other specialized agencies of the UN devoted to food, agriculture, science, culture, education, or public health, the IAEA's *raison d'être* would be to promote a particular set of technologies. That put it into inherent conflict with any other UN agency whose recommendations did not automatically rank atomic energy high in its list of priorities. Although nominally committed to the developing world, the IAEA's goal was not to foster development, but rather to promote peaceful uses of atomic energy. Its extensive programs in the name of 'development' rankled those in other UN agencies who considered themselves committed to a kind of development that was planned, rational, and

detached from particular scientific agendas and technological choices. Ronald Silow failed to win this argument, and FAO failed to lend him the support he needed; so Silow made it his life's ambition to bring down what he saw as the IAEA's misguided and even corrupt agricultural empire. His adversaries were stronger than he; they kept him in the dark, outmaneuvered him, silenced him, and ignored him. What began as a legitimate conflict of philosophies between two agencies ended up seeming an irrelevant point raised incessantly by a desperate saboteur inside the UN system.

With Silow gone the FAO/IAEA Joint Division freely stated its desire to promote the use of atomic energy in the developing world. Its long-term vision for food and agriculture presumed that the developing world increasingly would rely on advanced science and technology, and this ought to include nuclear techniques.[96] Because of Swaminathan's success in India, plant breeding was its *cause célèbre* in the late 1960s and early 1970s, but its pet projects changed over the years. The most persistently controversial one has been in food irradiation.[97] As Sigurbjörnsson once wrote: 'It has been said that without the Joint Division, this technology would not be pursued at all!'[98] In the 1970s some critics argued that biotechnology, in particular DNA manipulation, would make mutation breeding obsolete; and indeed the joint division diverted its energies in the 1980s toward supporting nuclear techniques (mainly tagging) in biotechnology. The joint division today is most proud of its work in the 1990s on insect control through the sterile male technique, and it resented FAO's resistance to the idea over the years. Sigurbjörnsson wrote, 'cultivating good relations with FAO took a lot of time and a lot of effort,' and many of the joint division's projects were underappreciated or even completely unnoticed by FAO officials.[99] Such resentments, directed from Vienna to Rome, reinforce the reality that the 'Joint Division' was never more than an IAEA instrument. FAO never had direct influence over it; in the troubled first years of its existence, its principal struggle was to shut up the 'exasperating' FAO member, Ronald Silow.

As for Silow himself, his name quite literally has been erased from the history books. David Fischer's official history of the IAEA merely notes that, at the creation of the joint division, 'an unhappy and unwilling FAO official was transferred to the staff of the IAEA.' He does not describe the controversy at all, and concludes mildly that '[a]lthough it took several years before the effects of previous disputes wore off … the practical and common sense concept reflected in the Joint Division proved to be a great success.'[100] In *Personal Reflections*, a companion volume to Fischer's history, Björn Sigurbjörnsson relates the story in greater detail, but also omits Silow's name.[101] This is not because he considers Silow unimportant; on the contrary, he describes at length how the IAEA fought for its program's survival in the late 1960s because of a certain unnamed person. He describes how, before major conferences at which this man had planned to criticize them, IAEA staffers would prepare for battle:

> We all stayed in the same hotel. Mac Fried held strategy meetings and we, in effect, divided the delegations between us and made contacts … . This was certainly not very ethical but in the face of hundreds of memo pages which had been distributed to delegates by our adversary, our choice was either to fight or give up – which would have certainly meant the end of the Joint Division.[102]

Although there is no mention here of Silow by name, Sigurbjörnsson suggests that the joint division's coherence and unity probably was due in part to the constant need to defend itself against this unnamed 'adversary.'

The UN's effort to encourage studies of agricultural and food uses of atomic energy in developing countries has not yet received serious attention from scholars. This article

attempts no lionization of Ronald Silow, nor does it offer a scientific critique of food irradiation, fertilizer studies, induced mutation, or any of the myriad techniques, but it does revisit the question Silow raised – the question his enemies were content to ignore: was the UN shaping developing countries toward a particular vision of modernity that subsumed their interests to a single agency's goals and/or individual scientists' research agendas? It seems natural that the IAEA would see a bright future for atomic energy; that other UN agencies should fall into step is perhaps more surprising. This essay has shown how the supposed FAO/IAEA consensus was created, by presenting a better picture of the conflict between the two agencies and by revealing how the controversy was brushed aside by identifying it with one troublesome individual. Silow handled the issue ineptly, by lashing out and creating enemies. Sigvard Eklund, Maurice Fried and others handled it more successfully but perhaps wrongly, by alienating and isolating Silow rather than engaging him, and by suppressing his objections so that he could not influence others. This did more to create a bitter foe than to address the issue about the developing world, and even IAEA scientists later admitted that it was ethically questionable. The truth is that the IAEA avoided engagement with Silow not just because of his personal vendetta but also because his argument for UN agricultural policy oversight – which at one point also was FAO's argument – might have shut down most of the IAEA's activities in agriculture. Development was only a secondary objective at the IAEA. Implementing legitimate peaceful applications of atomic energy always was the first priority. These activities made up a large share of what the IAEA had to offer poorer countries, especially because nuclear reactors for electricity seemed entirely unrealistic. To abandon food and agriculture would have been to undermine a crucial component of 'Atoms for Peace' that specifically targeted the developing world. Because of its inherent commitment to atomic solutions, any real engagement with the issue of misleading developing countries may have been impossible.

Notes

1. Silow's discussion with the BBC is mentioned in an unauthored and undated memorandum in Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
2. Seeing the links between science, technology, and politics is so commonplace now that it finds wide expression among scholars in a variety of disciplines. Historians of cold war science, for example, question the impact of military patronage on scientific agendas; an influential example is Forman, 'Behind Quantum Electronics.' Sociologists point out the difficulty in separating objective facts from the human beings creating them; see Latour, *Science in Action*. Historians of technology routinely emphasize technology's ability to compel certain actions even when seeming to empower people. Two influential examples include Thomas Hughes's study of technological systems and Lewis Mumford's critique of authoritarian tendencies in technology. See Hughes, *Networks of Power*; and Lewis Mumford's two-volume *The Myth of the Machine*, published as *Technics and Human Development* and *The Pentagon of Power*. For examples of the political stakes of technological choice in the nuclear realm, see Hecht, 'Political Designs'; Bess, 'Ecology and Artifice.'
3. In international relations, exportation of science and technology may appear innocuously as technology transfer, manpower training, or foreign aid; yet these usually reflect the values and norms of the governments sponsoring them. Even modernization's most noted proponent, Walt Rostow, recognized that his vision of 'modern' was intended to compete with the vision of the future emanating from the Soviet Union. See Rostow, *Stages of Economic Growth*. On Rostow and others, see Latham, *Modernization as Ideology*. An excellent overview of the intellectual trends behind modernization theory can be found in Gilman, 'Modernization Theory.'
4. Nick Cullather, 'Miracles of Modernization.' See also Perkins, *Geopolitics and the Green Revolution*.
5. Recent studies emphasizing the propaganda value of Atoms for Peace include Chernus, *Eisenhower's Atoms for Peace* and Osgood, *Total Cold War*.

6. Few of these applications have received much of attention from historians. An exception is food irradiation, which has remained controversial for decades. James Spiller has pointed to the international endorsements by the UN as useful arguments in the favor of food irradiation advocates over the years. See Spiller, 'Radiant Cuisine.' Nicholas Buchanan argues that food irradiation was a 'cold war science,' aimed at consumers but offering little benefit to them; yet scientists, he argues, gained benefits in the form of funding and prestige. See Buchanan, 'Atomic Meal.'
7. Most discussions of the Green Revolution in India emphasize the importance of the Mexican wheat, and particularly the success of the amber-colored variety of it. For an example, see Paarlberg, *Toward a Well-Fed World*.
8. The IAEA official history is Fischer, *History of the International*. On the FAO/IAEA Joint Division, see chap. 10.
9. On UNESCO's struggles to identify its purpose in promoting peaceful atomic energy, see Hamblin, 'Exorcising Ghosts.' At the suggestion of the USA, the UN convened an international conference in Geneva to explore the myriad peaceful uses of atomic energy. The conference itself, as historian John Krige has put it, was a 'masterpiece of marketing,' featuring a functioning nuclear reactor built by the USA. Both sides of the cold war conflict used the meeting to promote their roles in turning the atom into a positive force in the world. See Krige, 'Atoms for Peace.' On the Soviet activities at the Geneva conference, see Josephson, *Red Atom*. Nuclear-powered electricity was only one such application. In his 'Atoms for Peace' speech, Eisenhower had identified the provision of 'abundant electrical energy in the power-starved areas of the world' as the special purpose of the future IAEA, but he also noted that its most important responsibility would be to devise ways in which fissionable material would be allocated to pursue peaceful pursuits, particularly 'agriculture, medicine, and other peaceful pursuits.' The speech is reprinted in Cantelon et al., *American Atom*, 96–104.
10. Sen also tried to capitalize on the 1954 US Agricultural Trade Development and Assistance Act – later dubbed 'Food for Peace' – by integrating it into his projects, culminating in the Freedom from Hunger Campaign, launched in 1959. The cool attitudes of American diplomats to this idea, as historian Amy Staples has noted, reinforced the view that the Americans were less interested in development than in bilateral programs to dump their surpluses. Atoms for Peace provided another opportunity for FAO to address global food concerns by claiming a stake in a popular foreign policy initiative. Staples, *Birth of Development*.
11. The research station had been operated by the Empire Cotton Growing Corporation since 1926, acting as a clearinghouse for all the world's varieties of the genus Gossypium (cotton). The corporation subsequently moved its research operations to Africa. Silow's contributions to the book focused on the long evolution, inter-species competition, and natural and human selection trends in cottons over the centuries. See Hutchinson et al., *Evolution of Gossypium*. These authors traced the origins of certain South American cottons directly to India, a controversial point that proposed the crop was transported by humans across the Pacific prior to European contact via the Atlantic. For reflections on these theories, see Arnold, 'Joseph Burtt Hutchinson.' Genetic and cytological studies later would counter some of its claims about pre-Columbian cotton migrations. Still, American geneticist Bentley Glass said that the book 'takes its place among the most important books on plant evolution,' adding further that 'no student of evolutionary processes can afford to be less than thoroughly acquainted with the facts presented here and also with the authors' lines of thought.' See Glass, 'Review of *The Evolution of Gossypium*.' For arguments countering the book see Gerstel, 'Chromosomal Translocations,' and Phillips, 'Cytogenetics of Gossypium.'
12. The authors wrote that the relationship between man and plants represented 'a true symbiosis, man being dependent for food upon his plants, and the plants benefiting by the clearing and weeding of the land, and the storing and sowing of the seed,' Hutchinson et al., *Evolution of Gossypium*, 133.
13. R.A. Silow to F.L. McDougall, 18 Apr 1955, Folder 'ACC Subcommittee on Atomic Energy,' Box 10TAC344, FAO Archives.
14. On Seibersdorf's origins and early work, see Suschny, 'Agency's Laboratories.'
15. M. Fried, 'Application of Radioisotopes and Radiation Sources in Agriculture, Food Production and the Food Industry with Special Reference to I.A.E.A.'s Work,' paper for World Food Congress, 19 April 1963, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
16. Caused by a plant virus, *cadang-cadang* ravaged coconuts in the Philippines in the early 1960s. Prior to its appearance in 1961, there were 250,000 coconut trees on San Miguel Island; by 1965, only 80 trees still bore fruit. Riker, 'Plant Pathology and Human Welfare.'

17. Ronald Silow, memorandum for record, 30 October 1959, and Ronald Silow, undated draft, Folder 'ACC,' Box 10TAC344, FAO Archives.
18. FAO/IAEA Press release, 'Better Wheat and Barley Through Irradiation Reported at IAEA–FAO Symposium,' August 11, 1960, Folder 'ACC,' Box 10TAC344, FAO Archives.
19. FAO/IAEA Press release, 'Beginning of the New Era in Radiobiology, IAEA–FAO Meeting Successfully Concluded,' August 12, 1960, Folder 'ACC,' Box 10TAC344, FAO Archives.
20. FAO/IAEA Press release, 'Atomic Energy Against Hunger, Joint IAEA–FAO Symposium Opens at Karlsruhe,' August 6, 1960, Folder 'IAEA/FAO Symposium on the Effects of Ionising Radiation on Seeds,' Box 10TAC344, FAO Archives.
21. FAO/IAEA Press release, 'Better Wheat and Barley Through Irradiation Reported at IAEA–FAO Symposium,' August 11, 1960, Folder 'IAEA/FAO Symposium on the Effects of Ionising Radiation on Seeds,' Box 10TAC344, FAO Archives.
22. R.A. Silow to A.H. Boerma, 27 Sep 1960, Folder 'ACC,' Box 10TAC344, FAO Archives.
23. R.A. Silow to Frank W. Parker, 14 October 1960, Folder 'IAEA part III,' Box 10TAC342, FAO Archives.
24. Although this turned out to be premature (the screwworm would return in subsequent years), the method itself was vindicated. Perkins, 'Edward Fred Knipling's.'
25. M. Fried, 'Application of Radioisotopes and Radiation Sources in Agriculture, Food Production and the Food Industry with Special Reference to IAEA's Work,' 19 April 1963, WFC/63/EP/IAEA/III.C, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
26. Sullivan, 'Use of Radiation on Insects Hailed,' 81.
27. Irradiation in the service of food and agriculture had been one of the six fields of inquiry in the American National Academy of Sciences' 1956 report on the biological effects of atomic radiation, and the results had been very encouraging. Committee on the Effects of Atomic Radiation on Agriculture and Food Supplies, 'Agriculture, Food Supplies.'
28. M. Fried, 'Application of Radioisotopes and Radiation Sources in Agriculture, Food Production and the Food Industry with Special Reference to IAEA's Work,' 19 April 1963, WFC/63/EP/IAEA/III.C, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
29. B.R. Sen to Sigvard Eklund, 9 August 1963, Folder 'IAEA part V,' Box 10TAC342, FAO Archives.
30. Gordon Wortley to O.E. Fischnich, 27 September 1963, Folder 'IAEA part V,' Box 10TAC342, FAO Archives.
31. Sigurbjörnsson, 'Conception, Birth and Growth,' 199.
32. R.A. Silow, 'Appraisal of the Programme of Work of Atomic Energy in Agriculture,' interoffice memorandum, 20 January 1966, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
33. R.A. Silow, 'Appraisal of the Programme of Work of Atomic Energy in Agriculture,' interoffice memorandum, 20 January 1966, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
34. Edouard Saouma to O.E. Fischnich, 3 February 1966, Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
35. J. Vallega to O.E. Fischnich, 4 February 1966, Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
36. Sigvard Eklund to Orvis V. Wells, 5 February 1966, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
37. R.A. Silow to B.R. Sen, 15 August 1966, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
38. M. Fried to O.V. Wells, 25 October 1966, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
39. 'Report of the Consultant Group Appointed to Review and Advise on the Programme and Activities of the Joint FAO/IAEA Division of Atomic Energy in Agriculture,' 29 September 1966, Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
40. A.W. Lindquist to Mr Phillips, October 1966, Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
41. R.A. Silow to Sigvard Eklund and B.R. Sen, 14 March 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
42. Ibid.
43. Ibid.
44. Ibid.

45. Ibid.
46. Ibid.
47. On this controversy see Spiller.
48. R.A. Silow to Sigvard Eklund and B.R. Sen, 14 March 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
49. Ibid.
50. Ibid.
51. Ibid.
52. Ibid.
53. Ibid.
54. Ibid.
55. Fischer, *History of the International*, 132.
56. R.A. Silow to Sigvard Eklund and B.R. Sen, 14 March 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
57. Ibid.
58. Ibid.
59. Ibid.
60. R.A. Silow to S. Eklund, B.R. Sen, and O.E. Fischnich, 14 April 1967, 'The Joint FAO/IAEA Programme in Food Irradiation,' Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
61. 'Comments on "The Joint FAO/IAEA Programme in Food Irradiation," by R.A. Silow,' unnamed author, August 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
62. R.A. Silow to S. Eklund, B.R. Sen, and O.E. Fischnich, 14 April 1967, 'The Joint FAO/IAEA Programme in Food Irradiation,' Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
63. Ibid.
64. 'Comments on "The Joint FAO/IAEA Programme in Food Irradiation," by R.A. Silow,' unnamed author, August 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
65. James L. Goddard, 'Good Science and Good Food,' extracts from speech February 1967, attached to R.A. Silow to S. Eklund, 24 August 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
66. 'Comments on "The Joint FAO/IAEA Programme in Food Irradiation," by R.A. Silow,' unnamed author, August 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
67. Ibid.
68. S. Eklund to B.R. Sen, 15 September 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
69. The company was Nuclear Chemical Plant, Ltd., and its parent was John Thomson Ltd. Extract from *Nucleonics Week* 8 (August 1967), 33, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
70. R.A. Silow to S. Eklund, 24 August 1967, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
71. Fischer, *History of the International*, 378.
72. See Staples, *Birth of Development*, 121.
73. 'Comments on the memorandum of 11 September 1967 by Dr Silow,' n.d., unnamed author, Folder 'Dr Fischnich/Dr Silow 1963/1967,' Box 10ADG351, FAO Archives.
74. Director-General to Otto Fischnich, n.d, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
75. In the late 1960s, West Pakistan became a wheat exporter, while India's annual yields rose from 12 million tons to 21 million tons. In defiance of gloomy Malthusian predictions, India's cereal crops were growing more rapidly than its population. See Brown, 'Nobel Peace Prize.'
76. Skeptics pointed out the Green Revolution's inherent limitations (the need for government subsidies, expensive irrigation and fertilizer, and an open door to devastating species-specific diseases). Paddock, 'How Green is the Green Revolution?'
77. As Don Paarlberg later wrote, 'the Rockefeller people had the grace and wit to buoy up the Mexicans and the Indians rather than claim credit for themselves.' Paarlberg, *Toward a Well-Fed World*, 110. Shinde is quoted in Culliton, 'Wheat and Revolution.' India had taken a dramatic

national turn in the mid 1960s that was very conducive to promoting 'cutting-edge' research such as mutation genetics. After the death of longtime Prime Minister Jawaharlal Nehru in 1964, the new (but brief) regime under Lal Bahadur Shastri wanted a more aggressive program to address his country's food needs. The path he took was in crop intensification, using technology to maximize yields. Shastri's Minister of Food and Agriculture, C. Subramaniam, saw atomic energy as a crucial component of this. He had written to FAO's director-general, his countryman Binay Ranjan Sen, that India was 'deeply interested in exploiting atomic energy to the fullest possible extent for the betterment of human welfare,' and wanted FAO's help to increase production on existing land through a program of what Subramaniam called 'scientific cropping.' Atomic energy seemed so promising, particularly in plant breeding and radioactive tracer studies, which his ministry decided to include in its Fourth Five Year Plan a major expansion of such research. Hoping for FAO assistance in gaining funds, Subramaniam reminded Sen that India was 'in a stage of transition from a traditional to a progressive agriculture,' and that it needed at least one national institution capable of using these modern research tools. See C. Subramaniam to Binay Ranjan Sen, 18 October 1966, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives. After Swaminathan's subsequent successes, mutation studies in India acquired a momentum of their own, needing little encouragement from international agencies. At a time of population pressure, famine threats, and war – India was at war with Pakistan in 1965 – food security through a dynamic and aggressive line of genetic research became a central part of India's vision of future national security. The importance of Mexican wheat to Indian national security is emphasized in Perkins, *Geopolitics and the Green Revolution*, 242.

78. Silow's successor as deputy-director of the joint division, Björn Sigurbjörnssen, rushed to defend protein improvement with irradiation. He pointed also to the fact that irradiation undertaken in India had changed the seed color of the Mexican wheat variety Sonora-64 in a matter of three and a half years. 'It is very difficult to match this by using any other technique of breeding,' he said, and added: 'I see no reason why developing countries should be deprived of a proven method of efficient plant improvement.' He believed that a shift toward plant protein improvement programs in the developing world was fully justified. Björn Sigurbjörnsson to O.E. Fischnich, 2 April 1969, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
79. R.A. Silow to O.E. Fischnich, 21 March 1969, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
80. R.A. Silow to T.E. Ritchie, 30 April 1969, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
81. R.A. Silow to O.E. Fischnich, 19 September 1969, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
82. Maurice Fried to O.E. Fischnich, n.d., Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
83. Maurice Fried to O.E. Fischnich, 25 September 1969, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
84. The handwritten comment to Otto Fischnich, signed but not decipherable, is next to a typed letter from O.E. Fischnich to A.H. Boerma, 19 November 1969, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
85. Arne Lachen to A.H. Boerma, 5 January 1970, Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
86. Aresvik, draft book manuscript, attached to Arne Lachen to A.H. Boerma, 5 January 1970, Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
87. Maurice Fried to O.E. Fischnich, 16 January 1970, Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
88. R.A. Silow to O.E. Fischnich, 29 January 1970, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
89. Aresvik, *Agricultural Development of Turkey*.
90. He argued that it was not right to do it while he was still awaiting action on his legal case from the ILO Tribunal, but this point fell on deaf ears. R.A. Silow to O.E. Fischnich, 4 February 1970, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
91. R.A. Silow to A.H. Boerma, 16 December 1970, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
92. O.E. Fischnich, note, 14 January 1971, Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.

93. International Labour Organization, Administrative Tribunal, Twenty-Second Ordinary Session, Silow v. IAEA, Judgment No. 142, 3 November 1969, available at http://www.ilo.org/public/english/tribunal/fulltext/0142.htm (accessed June 2, 2008).
94. International Labor Organization, Administrative Tribunal, Thirteenth Ordinary Session, In re Silow (No. 5), Judgment No. 205, 14 May 1973, available at http://www.ilo.org/public/english/tribunal/fulltext/0205.htm (accessed June 2, 2008).
95. Unauthored, n.d., Folder 'Dr Fischnich/Dr Silow 1968/1973,' Box 10ADG351, FAO Archives.
96. 'Nuclear Applications in Food and Agriculture: A Joint FAO/IAEA Contribution,' n.d., Folder 'Jt FAO/IAEA Division,' Box 10ADG351, FAO Archives.
97. One reason for the controversy, Garrett Hardin once wrote, was that 'no one *desires* irradiated food,' but that commercial interests simply want to use it to gain financially. For Hardin, that meant that the burden of proof for its safety ought to lie with the industry; meanwhile the practice should be forbidden. Hardin, 'Food Irradiation.' The controversy was alive and well in the 1990s, when public health scientist James H. Steele observed that 'these antis prey on the fears of nuclear destruction which have hung over the world since 1945 …'. See Steele, 'It's Time for Food Irradiation.' The issue was revived in the late 1990s when some advocated irradiation to combat *E. coli* and other contaminants. See also Lutter, 'Food Irradiation.' For the charge of 'scaremongering,' see Grierson, 'Safe Food.' Also in the 1990s, as the definition of 'organic farming' was contested, irradiation was one of the key methods (along with genetic modification and the use of sewage sludge) that many advocates wished to disallow under the rubric of 'organic.' See Fisher, 'Organic.'
98. Sigurbjörnsson, 'Conception, Birth and Growth,' 208.
99. Ibid., 204–5.
100. Fischer, *History of the International*, 434.
101. Sigurbjörnsson, 'Conception, Birth and Growth,' 198.
102. Ibid., 199.

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