Introduction

During World War II German scientists attempted to harness nuclear fission chain reactions in order to create powerful new energy sources and weapons. This is one of the most important developments in recent history, not because of what the scientists did, rather because of how their efforts were perceived. Without the German uranium project and credible reports about its existence, it is difficult to imagine the United States government investing such great amounts of manpower, resources, and money into making such a futuristic weapon as the atomic bomb. If the American Manhattan Project and the nuclear attacks on Hiroshima and Nagasaki had not happened, it is equally difficult to imagine the Soviet Union making a comparable effort. Thus without the threat of "Hitler's Bomb" there is no atomic bomb in the summer of 1945, or nuclear arms race immediately thereafter. The world would have been a very different place.

The second part of the story, the debates and arguments during the postwar period surrounding the German wartime work on uranium, is also important, for it sheds light on how people deal with and learn from the past. Confronted with the terrible legacy of National Socialism, these German scientists had to justify, both to their fellow Germans and to foreign colleagues, having worked within the National Socialist state on weapons of such destructive power. Some of these colleagues were émigrés from Germany who had suffered great personal loss. The result was one of the most enduring and controversial legends in modern science: Werner Heisenberg and Carl Friedrich von Weizsäcker's 1941 visit with their Danish Colleague Niels Bohr in occupied Copenhagen. This book examines the history of the wartime research in Germany, connects this to the postwar criticism and eventual rehabilitation of these scientists, and sheds light on this legend.

Part I

The Bomb

1 Farm Hall

> I had a long talk with Professor Heisenberg, who is the most sensible of them, and he told me that their main worry was the lack of information about their families. He also said that they suspected that their potential value was being judged by the documents found at their institutions. He said that these did not give a true picture of the extent of their experiments which had advanced much further than would appear from these documents and maintained that they had advanced still further as a result of pooling of information since their detention. He begged for an opportunity of discussing the whole matter with British and American scientists in order to acquaint them with their latest theories and work out a scheme for future cooperation.
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> Major T. H. Rittner (June 15, 1945).[1]

Interned at Farm Hall

Two months after the end of World War II in Europe, while the conflict in the Pacific still raged, ten German scientists found themselves interned in an English country house called Farm Hall (see Figure 1.1). We know a lot about their time there because secret microphones had been installed in the walls and their conversations were overheard.[2]

After two weeks, the British officer in charge of the detained scientists described them as follows:

> [Max] von Laue: A shy mild mannered man. He cannot understand the reason for his detention. He has been extremely friendly and is very well disposed to England and America.
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> [Otto] Hahn: A man of the world. He has been the most helpful of the professors and his sense of humor and common sense has saved the day on many occasions. He is definitely friendly disposed to England and America.
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> [Werner] Heisenberg: He has been very friendly and helpful and is, I believe, genuinely anxious to cooperate with British and American scientists although he has spoken of going over to the Russians.
>
> [Walther] Gerlach: Has a very cheerful disposition and is easy to handle. He appears to be genuinely cooperative.
>
> [Paul] Harteck: A charming personality and has never caused any trouble. His one wish is to get on with his work. As he is a bachelor, he is less worried about conditions in Germany.

[Kurt] Diebner: Outwardly very friendly, but has an unpleasant personality and is not to be trusted. He is disliked by all the others except Bagge.

[Carl Friedrich] von Weizsäcker: A diplomat. He has always been very friendly and cooperative and I believe he is genuinely prepared to work with England and America but he is a good German.

[Karl] Wirtz: An egoist. Very friendly on the surface but cannot be trusted. I doubt whether he will cooperate unless it is made worth his while.

[Erich] Bagge: A serious and very hardworking young man. He is completely German and is unlikely to cooperate. His friendship with Diebner lays him open to suspicion.

[Horst] Korsching: A complete enigma. He appears to be morose and surly. He very rarely opens his mouth. He has, however, become more human since his arrival in England.[3]

Max von Laue, a Nobel laureate for physics, was the odd man out because he had not participated in uranium research during the war, although most of the researchers at the Kaiser Wilhelm Institute for Physics that he worked in did. The Allies interned the young scientists Bagge and Korsching because they had been working on novel uranium isotope enrichment processes. The chemist Otto Hahn, like Laue an older man, had been one of the first to recognize that uranium could be split, and during the war had continued to work on the consequences of nuclear fission. Paul Harteck, a physical chemist and aside from Hahn the only nonphysicist, had been one of the most important scientists, overseeing efforts to both enrich uranium isotopes and produce heavy water. The most important administrator for the working group was Kurt Diebner, an official in Army Ordnance. The Nobel laureate Werner Heisenberg, cofounder of quantum mechanics, contributed to the theory of

Figure 1.1 The House at Farm Hall.
Source: National Archives and Records Administration (NARA).

nuclear fission and of nuclear reactors. Along with Harteck, Heisenberg was one of most important scientists researching uranium in Germany. Karl Wirtz worked under Heisenberg designing nuclear reactor experiments, while Carl Friedrich von Weizsäcker similarly assisted Heisenberg with nuclear theory. Walther Gerlach belatedly joined the nuclear physics working group near the end of 1943, taking over as the administrator in charge of research on uranium as well as physics in general.

The scientists themselves were confident that they knew why they were in Farm Hall: with one exception, they had been involved in a wartime research project to harness the energy produced by nuclear fission, in other words, nuclear power and atomic bombs. As Weizsäcker told Wirtz: "These people have 'detained' us firstly because they think we are dangerous; [second] that we have really done a lot with uranium."[4]

Who Was a Nazi?

The fall of the Third Reich and the subsequent public revelations of atrocities and war crimes begged obvious questions: had these scientists supported racist and murderous policies, or tried to provide the Third Reich with powerful new weapons? In other words, had they worked for Hitler? Bagge and Diebner admitted to having been members of the National Socialist German Workers Party (NSDAP) but denied being "Nazis." Diebner claimed that he had only stayed in the NSDAP because, if Germany had won the war, then only Party members would have been given good jobs.[5] Bagge said that his mother had applied for his Party membership on his behalf but without his knowledge, which was unlikely to have been true.[6] Gerlach maintained that no one had to join the NSDAP. Once he had left the room, Bagge added in turn that Gerlach had known Hermann Göring personally and his brother was in the SS.[7] Other scientists like Hahn also distanced themselves from the Nazis. "See what Laue did against National Socialism and I think I worked against it too. We are both innocent."[8]

Heisenberg, who enjoyed by far the most prestige and had the most influence of the scientists at Farm Hall, defended Bagge to a visiting British scientist, Patrick Blackett, claiming that Heisenberg's younger colleague had never been a "fanatical Nazi." He also told Blackett that politically Wirtz had always been "on the good side, on our side."[9] This black-and-white dichotomy was typical of how the scientists retrospectively treated the Nazi question: one had either been a Nazi, or not. But Heisenberg drew the line at Diebner. After a British officer suggested that the scientists draft a memorandum on their political convictions, Heisenberg told Hahn that if the memorandum described a general anti-Nazi attitude and Diebner signed it, then Heisenberg could not conscientiously sign it as well. In the end, their memorandum avoided such political topics.

The British wardens at Farm Hall detected the lingering effect of National Socialist ideology on the scientists. Some detainees expressed grave concern that Moroccan French colonial troops were occupying Hechingen and Tailfingen. Bagge went so far as to say:

> And in the meantime my family will be dead. After all, I feel responsible for my family. I saw it for myself. The first day the French arrived in Hechingen and raped the women one after the other and a few days later they took me away. [A subsequent letter from Bagge's wife made clear that this was not true.] The day I had to leave, three Moroccans were billeted in the house--that's been going on for three months and I'm supposed to look happy here. I shall go mad. I can't stand it much longer.[10]

When the detainees were lent a copy of *Life* magazine containing articles on the atom bomb and a number of photographs of the scientists who had worked on it, Weizsäcker remarked that of course they were mostly Germans. The British commander noted that Weizsäcker's claim, which was in fact false, "merely emphasizes the conceit of these people, who still believe in the *Herrenvolk* [Master Race]." With the possible exception of von Laue, this applied to every one of the guests. As Jeremy Bernstein has pointed out, ironically many of the scientists portrayed were in fact Jewish.[11]

Even Heisenberg made a remarkable comparison between the Allied officials who had interned the Germans and were deciding their fate and some of the most infamous men in the Third Reich. While some officials were extremely friendly towards Heisenberg and his colleagues, on the other hand there were "obstinate people, these American Heydrichs and Kaltenbrunners" (the two men who served as second-in-command of the SS), who wanted to keep the Germans locked up in Farm Hall.[12] Indeed, the scientists expressed very different opinions about the worst excesses of National Socialism. Bagge argued that if the Germans had put people in concentration camps during the war – he did not do it, knew nothing about it, and always condemned it when he heard about it – and if Hitler had ordered a few atrocities in concentration camps during the last few years of the conflict, then these excesses had occurred under the stress of war.

In contrast, Karl Wirtz stated flatly that he and his countrymen had done unprecedented things. In Poland the SS had driven up to a girls' school, brought out the top class and shot them simply because the Polish intelligentsia was to be wiped out. Just imagine, he asked his colleagues, if the Allies had arrived in Hechingen, the small town where many of them had been evacuated during the last years of the war, driven to a girls' school and shot all the girls! "That's what we did."[13] Despite the apparently nationalistic and racist tone immediately after the war, the German scientists interned at Farm Hall probably would have been appalled at the scale and depth of the depravity demonstrated by some of their countrymen over the course of the "euthanasia" program, the war in the east, and the Holocaust.

However, the scientists' main concern was not who among them had been a Nazi. Max von Laue summed up their situation in a letter he sent to his son Theodore in the USA:

> We have always had excellent room and board here (like English military personnel, that is, better than the civilian English population), have books, newspapers, radio, a piano, and an exercise yard behind the house. Recently we have received new clothes and, as needed, shoes. Therefore we are doing very well, except for the fact that we have received no news from our families, and only today could send letters to them with some chance of being delivered.[14]

Laue wrote his letter on August 7, a day after the ten scientists' lives changed on hearing the news of Hiroshima. Indeed the discussion about Nazis now practically vanished as other questions occupied their minds.

The News of Hiroshima

When Hahn was the first to be told that the BBC had announced that an atomic bomb had been dropped, he was completely shattered by the news. He told the British officer that, since he had made the original discovery of nuclear fission, he felt personally responsible for the deaths of hundreds of thousands of people. Indeed once Hahn realized the "terrible potentialities of his discovery," he had contemplated suicide. Once Hahn was calmed down with the help of "considerable alcoholic stimulant," he joined the rest of the scientists for dinner and announced the news.[15]

Several of the scientists were hit hard by the revelation. Gerlach argued that, if Germany had had a weapon that would have won the war, then Germany would have been right and the others in the wrong, and asked rhetorically whether conditions in Germany were better now than they would have been after a Hitler victory? When he left the room later that evening, he went straight to his bedroom and began to weep. Harteck and Laue tried to comfort him. The British described Gerlach as acting like a "defeated general, the only alternative open to whom is to shoot himself." In a subsequent conversation with Hahn, Gerlach admitted that he was depressed by the fact that the Americans had outdone the Germans.[16] While Hahn could not understand why Gerlach was taking it so badly, Heisenberg explained that Gerlach was the only one of them who had really wanted a German victory. Although he recognized the crimes of the Nazis and disapproved of them, Gerlach was working for Germany. Hahn replied that he too loved his country and for this reason had hoped for its defeat. Indeed Hahn claimed that he "would have sabotaged the war" if he could have.[17]

Hahn's colleagues also feared for his safety. At 2 a.m. Laue knocked on Bagge's door, saying, "We must do something; I am very worried about

Otto Hahn. This news has shaken him horribly, and I fear the worst." They stayed awake for a long time, until finally they were able to tell that Hahn had fallen asleep. Laue also told the much younger Bagge: "When I was young, I wanted to do physics, and I have witnessed world history. I can really say that, in my old age."[18]

Their initial reaction as scientists, at a point in time when they had not heard many details about the Allied atomic bomb, was disbelief.[19] Heisenberg asked if the report had mentioned uranium, and when this was denied, he concluded that it had nothing to do with atoms and suggested that the story came from "some dilettante in America who knows very little about it." Soon thereafter Heisenberg had a puzzling discussion with Hahn. Heisenberg began by doubting that the Americans could have tons of pure uranium isotope 235, one of the materials used in atomic bombs. Hahn then objected that in the past Heisenberg had told him that one needed only very little uranium 235. A little more than a week after Hiroshima Heisenberg presented a better calculation but still failed to provide an accurate estimate.[20]

After they had all listened to the 9 p.m. news broadcast together, there was no longer any doubt. Five hundred million British pounds had been spent and 300,000 Japanese were dead. The Americans and British had atomic bombs. It was now very clear why they had been detained, why they had been hidden from the world, and why they could not send letters to their families.[21] Because of the enormous amount of effort and resources required, Heisenberg and his colleagues remained skeptical that the Americans had either managed uranium isotope separation on a large scale, or that they had been able to produce element 94 (plutonium) in a nuclear reactor, the two paths to an atomic bomb. The BBC news reports of Hiroshima were not specific and contained very little scientific information.[22] Indeed much of the confusion found in the Farm Hall transcripts arguably has more to do with the Germans' lack of information and desperate desire to believe that they had not been completely outdone, than with any lack of scientific or technical understanding on their part. However, as more details gradually trickled in, they were eventually forced to admit that the American-led Manhattan Project had far outstripped their now apparently modest efforts.

The next step these scientists took in dealing with the news was to discuss and debate whether they could have built atomic bombs. Bagge admired the courage of the Americans to risk so many millions of dollars. Harteck added that they might have succeeded if the highest authorities had been prepared "to sacrifice everything."[23] Heisenberg argued that the turning point was the spring of 1942, when they were able to convince political authorities that it could be done, with the result that for the first time large funds were made available for their research. However, he added they also would not have had the "moral courage" to recommend to the government in the spring of

1942 that they should employ 120,000 men "just for building the thing up."[24] Weizsäcker added that, even if they had gotten all the support they wanted, it was still not clear that they could have gotten as far as the Americans and British: Even if the Germans had put the same energy into it as the Americans and had wanted it as much as they did, the Americans would have destroyed the German factories.

Indeed Weizsäcker tried to shift the discussion by arguing that what was important was not how far the Germans had advanced, rather the fact that they had been convinced that it could not be completed during the war. In response, Gerlach, Harteck, and Heisenberg distinguished between what they called an "uranium machine" (nuclear reactor) and atomic bombs: although they had not thought bombs could be built during the war, they had also been convinced that a uranium machine was possible. In the end the Allied air superiority also put that goal out of reach. After Heisenberg subsequently had read the British White Paper on the Manhattan Project, he told a visiting British physicist that it never would have been possible for Germany to do anything on that scale.[25]

The final stage in the collective construction of a legend came when the scientists asked themselves whether or not they had wanted to do it? Early on, Wirtz simply stated that he was "glad we didn't have it." Weizsäcker took the lead in constructing a consensus, arguing that instead of making excuses for why they had failed, they should admit that they had not wanted to succeed: "The reason we didn't do it was because all the physicists didn't want to do it, on principle. If we had all wanted Germany to win the war we would have succeeded." Hahn immediately replied that he did not believe that but was thankful that they had not succeeded. Heisenberg admitted that "at the bottom of my heart I was really glad" that they ended up working on a uranium machine and not a bomb. Heisenberg subsequently told Hahn that, if they had been in the same moral position as the Americans and had said to themselves that "nothing mattered except that Hitler should win the war," then they might have succeeded. But they did not want him to win.[26]

The emerging argument was summed up by Laue in his letter to his son:

> The main question is naturally, why did Germany not get the bomb…. 1) The German physicists would never have received such resources as England and the USA made available. Neither the personnel, nor the money would have been available in nearly as large a dimension. For this reason no physicist seriously considered requesting such resources … 2) Our entire uranium research was aimed at creating a uranium machine as an energy source, first of all because no one believed in the possibility of a bomb in the near future, second, because basically none of us wanted to place such a weapon into Hitler's hands.[27]

On the other hand, Bagge told Diebner that: "it is absurd for von Weizsäcker to say he did not want the thing to succeed. That may be so in his case, but not for all of us."[28]

Once they had learned enough from the radio and newspapers about the first atomic bombs, the older members of the group began crafting a written statement with the clear message that the Germans had worked on uranium machines, not atomic bombs. Bagge noted in his diary that this story received considerable but not complete support. Heisenberg and Gerlach composed a text, which after a few difficulties was signed by all. The key passage read:

> By the end of 1941 the preliminary scientific work had led to the result that it would be possible to use nuclear energy to produce energy and thereby power machines. However, at that time the technical potential available to Germany did not appear to satisfy the preconditions for the manufacture of a bomb.[29]

Conclusion

Farm Hall was a psychological crucible for these scientists, who asked themselves several important and fundamental questions that have concerned historians, scientists and others ever since:

(1) Did the Germans know how to build atomic bombs?
(2) Could the Germans have built atomic bombs?
(3) Did the Germans try to build atomic bombs?
(4) Had they been Nazis?

Farm Hall left all these questions open. This book will try to answer them.