SAN JOSE MERCURY NEWS

BLOOD TEST

THE TWO SCIENTISTS WERE COLLEAGUES AND CLOSE FRIENDS. BUT WHEN ONE BEGAN TO QUESTION THE ACCURACY AND EVEN THE HONESTY OF THE OTHER'S RESEARCH, THEIR FRIENDSHIP WAS DESTROYED.

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By Mike Weiss
Memo: MIKE WEISS is a staff writer for West.

Illustration: Photo, Drawings (3)

Caption: DRAWING: ILLUSTRATION BY JOE SAXE
[Man on high chair throwing down research papers. Scientist at bottom is picking up the papers and reading them]
[951015 WS 8; color]
PHOTO: BY MICHAEL SCHWARZ
Ned and Chiara Waller: Their close friendship with the Terstappens ended when Ned questioned Terstappen's research
[951015 WS 11; color]
COVER DRAWING: ILLUSTRATION BY JOE SAXE
Under close examination, a promising biotech breakthrough turned out to be nothing of the sort. Do the rich rewards of big science encourage carelessness and even fraud?
SCIENCE FICTION?
[Man looking through large microscope at scientist]
[951015 WS 1; color]
INDEX DRAWING: ILLUSTRATION BY JOE SAXE
In any pursuit in which the rewards are great, the temptations are great as well. And in biotechnology, in which a major discovery can mean millions for the scientists, the temptations can lead to carelessness and even deceit. The consequences can affect friendships as well as careers.
[Man in lab coat reading a paper]
[951015 WS 4]

THE CORRECTION was a mere 113 words long, buried in the middle of the British journal Nature. The language was so ambiguous that a reader could only guess at what might lie behind this rare admission of error in the world's most prestigious journal of scientific research:

"We retract the conclusion . . . that a single cell can give rise to both a haematopoietic microenvironment and haematopoietic stem cells. Flaws in the material covered . . . [led] us to misinterpret some of the critical results. Our subsequent attempts to confirm our key claim have been inconclusive."

Not a hint there of what could have gone so horribly awry with a scientific discovery that promised breakthroughs in bone marrow transplantation for cancer patients, new forms of gene therapy, and progress in solving the riddle of immunological diseases such as AIDS. No clue that the lab at Becton Dickinson Immunocytometry Systems (BDIS) in San Jose, where the original research had been done-research that Nature had at first called "a quite staggering result"-had been ripped apart by the controversy that led to the retraction.

No whisper of what one post-doctoral fellow at BDIS called "the F-word of science: fraud."

Not an intimation of the heart-pounding showdown meetings, the tearful nights, the damaged reputations.

Nothing to convey how the people involved are still struggling to understand whether the scientific "misinterpretation" was sloppy science or something far worse, intentional misrepresentation.

One hundred thirteen words. But not one about fortunes dreamed of in a field where scientists who made similar discoveries became wealthy overnight.

Least of all was there a way, even reading between the lines, to understand that behind the sophisticated science and the big business there was a story of friendship, loyalty, and the clash of values between two medical scientists at the cutting edge of cellular research, Leon W.M.M. Terstappen and Edmund Kemp Waller.

Terstappen, the highest-ranking researcher at BDIS, had done the original stem cell research with assistance from Shiang Huang, and published his findings in Nature in December 1992. His announcement at a plenary session of the American Society of Hematology that he had discovered a cell that develops into blood and bone had made him an authority, a hot scientific property in demand as a lecturer throughout the world.

Terstappen called himself "a visionary."

He hired his best friend, Ned Waller, to come to BDIS from Stanford and carry the research forward. Waller, who holds both an M.D. and Ph.D., trained at Harvard and Rockefeller University in New York, and prides himself on his meticulousness. "The devil," he says, "is in the details."

Not only were the two researchers professionally close but their wives also were dear friends. The Terstappens and the Wallers were neighbors in Palo Alto. They shared holiday celebrations and vacations. Each couple had three children of about the same ages who played together.

The men carpooled to work until the day Ned Waller blew the whistle on Leon Terstappen's faulty research and false claim.

So there is ample reason to agree with Gun Hansteen, who worked with and liked both men: "They were such very good friends," she says. "What makes it terrible is I don't think anybody really knows what happened . . . whether that was unchecked science or something other than that. . . . It was a tragedy, really."

THOUGH Terstappen and Waller were professionally acquainted, it was their children and wives who first drew them together. The Wallers' eldest son, Anthony, and the Terstappens' boy Wout attended a pre-school that required parents to help out.

Chiara Waller, who is from Italy, took an immediate liking to Jessie Terstappen. Like her husband, Leon, Jessie is Dutch. The women had a certain understanding as European wives who had followed their husbands' career trajectories to Palo Alto. Waller was a Stanford post-doc doing T-cell research. Terstappen was enjoying a quick rise at BDIS.

"Jessie is very private," says Chiara Waller. "So it was little by little with that friendship because things don't happen quickly, yes?

"My first impression of Leon was he was an easygoing guy. Really European. I related to him like one of my brothers. I felt we could understand each other without so many words."

In some ways Terstappen and Waller, born only a year apart in the mid-1950s, were a study in contrasts. Terstappen is tall, lanky, with strong features. Likable and quick to laugh, he is enthusiastic and has a commanding presence.

Where Terstappen was informal at work, wearing sandals to the lab, Waller favored white shirts and sharp bow ties. He was smaller, more compact. His characteristic habit is to raise his eyebrows and look at you ironically over his glasses. He gives the impression of a sincere, straightforward, highly intelligent man whose mind is in control of his feelings.

As he says of himself: "I'm good on facts but emotional content I have less memory for."

Chiara remembers that when the couples got together, "Leon and Ned had things to talk about in their field. That was something special. Ned could have a friend coming out of the children's connection."

At the end of 1992 Terstappen published his paper in Nature. Though the science was only partially clear to Chiara, it was evident that this was a watershed in the lives of her friends.

"That New Year's Eve we celebrated at our house," Chiara says. "Leon was very happy. . . . I said to Jessie, 'You must be so proud. Leon works so hard. Ned does the same thing. But it pays off if this is the result, Jessie. It's not that they're working for nothing.' "

Meanwhile, Waller's grant was coming to an end. He had been working in the lab of Stanford's Irving L. Weissman, a pioneer in stem cell research and the co-founder of Systemix Inc. Now Waller was negotiating for a job in Houston.

Chiara was happy raising her kids in Palo Alto, and the idea of moving to Houston dismayed her. She openly hoped that Leon might offer Ned something at BDIS. Sure enough, at the eleventh hour, Leon saved the Wallers from Houston by asking Ned to set up a new research team to carry forward and exploit the scientific and commercial applications of his discovery.

Chiara was overjoyed. She and Ned felt they could afford to buy a home for the first time. Despite everything that has happened since, she is grateful. "I still thank them," she says.

Waller, though, was ambivalent about joining the corporate world. "I was very cautious about leaving academia for a job in biotechnology," he says. "I guess I had a prejudice that academic life gave more freedom of investigation."

Before Waller began in April 1993, Terstappen told him that BDIS President Nagesh Mhatre had developed a plan to secure outside funding for a spinoff based on Terstappen's common stem cell research. When that happened, he said, Ned would become one of the founding scientists.

That was one reason for Ned to overcome his doubts. "Part of it was the upside potential if there was a successful spinoff. Part of it was I would be able to walk into a lab and hire six people without the need to apply for a grant. And part of it was that it was an exciting scientific discovery to work on."

TERSTAPPEN and Shiang hadn't been looking for a common stem cell, which made it all the more remarkable when they found it.

Stem cells constitute only 0.01 percent of the bone marrow and are very difficult to isolate in their pure form. Blood cells are continually replenished from these primitive yet protean cells: All other kinds of blood cells including red and white blood cells and platelets are offspring of stem cells.

As far as was known, blood cells and bone cells developed along two separate lines. Blood cells derived from a hematopoietic stem cell, while bone cells derived from stromal stem cells.

Although a few scientists had suggested the possibility of a common stem cell it was a minority belief. Shiang Huang was doing experiments when he began to see clusters, or buds, of round cells attached to a cordlike stromal cell. It was Terstappen, a gifted scientist blessed with a feel for what he was seeing, who identified the round cells as hematopoietic blood cells. Terstappen relied on morphology-that is, on the forms of the cells as they appeared.

It was an exciting moment.

If he was right the scientific and commercial significance was huge. The common stem cells could potentially be used to re-create the blood system of a person whose bone marrow has been destroyed by radiation during cancer therapy. Instead of having to remove two liters of blood or marrow for transplantation, as is now the case, you could take a tiny number of cells and grow them in the laboratory.

Irv Weissman, in whose Stanford lab Waller had been working, had patented certain stem cells (but not common stem cells) and made more than $20 million when the pharmaceutical giant Sandoz bought up a huge chunk of Systemix's stock.

Terstappen's discovery offered the possibility of beating the Systemix patent by patenting a more primitive cell.

But Shiang was concerned. They had sorted fewer than 1,000 of the fetal tissue cells with which they were experimenting, observing the growth structures of only 24 cells. To get more definitive proof, a complex and time-consuming set of experiments involving not merely the morphology of the cells, but their lineage-precisely how they had evolved, and from what sources-was needed.

"Too hurry-up, I think," Shiang says today. "I tried to tell Leon . . . Leon is so nervous, maybe some people will catch up. Because when we did the lab experiment sometimes we got nothing. Sometimes we got so many. . . . We didn't get it confirmed. It was just a suggestion."

Terstappen, though, steamed confidently ahead.

His suggestive research was compelling and important enough for a paper to be accepted by Nature. In it Terstappen and Huang claimed to have discovered a common stem cell.

The cell they identified displayed three antigens, or markers, designated as CD34+, CD38-, HLA-DR-. Stem cells with other combinations of markers had been discovered previously; Terstappen was saying that a stem cell with these three markers appeared to develop along both blood and bone lines.

"These data represent, to our knowledge, the first identification of a single cell capable of reconstituting the hematopoietic cells and their associated bone marrow microenvironment," they wrote.

The BDIS lawyer began preparing a patent application.

While Terstappen's work was hailed it was also greeted with normal scientific skepticism. Weissman, for instance, called the paper "beautiful," but also felt that a formal proof was lacking. "It was a remarkable feat, going against what most people thought," Weissman concluded after reading the paper. "Possibly he was right."

Weissman was also aware that Systemix and BDIS were now "in a race as far as the human stem cell."

Scientists have always competed with one another to be first, of course, but in an age when basic building blocks of human existence can be patented, the winner has financial incentives undreamed-of before there was a Silicon Valley and a biotech industry.

Ned Waller's new job would be to demonstrate that Terstappen was right by duplicating the results and carrying the research forward.

He and Terstappen negotiated an agreement that called for Waller to get a "substantial amount" of stock in the new spinoff, but the details were vague at best. Neither scientist was sophisticated when it came to business. Waller suggested a lawyer might be useful to draw up the contract. But Terstappen scoffed. Europeans do not run to a lawyer at the drop of a dollar as Americans do.

At the time it didn't seem to matter too much to the two friends, but as things turned out it was a harbinger of troubles ahead.

FROM ITS ATRIUM entrance on Qume Road near the San Jose-Milpitas border, to the fountains and plants that soften its corridors, to the roomy, well-equipped labs, everything about BDIS spoke of money, especially to someone like Ned Waller whose career had been spent in the functional confines of academic laboratories and hospitals.

So it was ironic that his first task at BDIS turned out to be scrambling for a government grant. The outside corporate investment Terstappen expected hadn't materialized. Waller and the six-member team he had assembled, including several people he had persuaded to come with him from Stanford, began to race against a short deadline for applying to the National Institutes of Health for a research contract.

In September, their common stem cell project was formally awarded $1 million, one of only three such contracts awarded by NIH for corporate research in 1993. The government had recognized the scientific significance of the project.

Waller's research began with the photomicrographs that were printed in Nature and submitted with the NIH application. Waller had never seen the original slides. It would have been insulting for him to ask to see them, as if he were questioning the published work.

"Some things you just take on faith," he says.

Thousands of cells would have to be sorted. The tools for doing this were a fluoresence-activated cell sorter which Becton Dickinson had patented, and a process called flow cytometry.

Based in Franklin Lakes, N.J., Becton Dickinson was BDIS' parent company. It was mostly in the business of producing medical and research equipment, generating $2.5 billion in annual sales, enough to land on the list of Fortune 500 companies. The Immunocytometry Systems division in San Jose generated about $150 million.

Waller arrived by about 9 o'clock each morning, after an early run, and stayed late. The work was exciting because it involved investigation and problem-solving, but it was also slow and repetitious. "By 10 or 11 at night sorting single cells can be tedious, like watching water drip out of a faucet," he says.

Eight months passed this way, from April to November 1993.

As he described those long nights on Qume Road he pulled down his thick, black-bound lab notebooks.

"I generated reams of data. Here. One. Two. Three. Four. Five," he counted out each heavy book.

Written in a small, legible script they contained a record of frustration and failure to duplicate the original research. The entry for August 19, for example, includes six sets of 100 cells each. And penciled in for each, a single word: "Nothing. Nothing. Nothing. Nothing. Nothing. Nothing."

"Experiment after experiment," Waller said. "On and on and on, but I never saw convincing evidence, which was concerning." In the end he would have sorted 30,000 single cells.

Meanwhile Leon Terstappen was traveling, speaking widely about his discovery, supervising other research projects as well as Waller's, and doing new work of his own.

Neither Terstappen nor others at the monthly research meetings-including Noel Warner, the vice president for research, and Nagesh Mhatre, the division president-expressed any particular concern.

Waller decided to seek an outside opinion from a man he trusted, a Stanford pathologist named Onsi Kamel. He and Shiang Huang, who sometimes worked with Waller, took their slides to Kamel's lab and asked him: "Do these look like hematopoietic cells to you?"

Kamel's answer was simple: No.

As the two BDIS scientists walked across campus back to their car Waller turned to Shiang.

"This is very troubling," he said. It was the first time he had voiced his concerns to a colleague.

"Leon thinks they're hematopoietic," Shiang replied.

"Yes, but we have to find out the truth of what they are."

Shiang had come from China to BDIS in 1990. He and his wife, Gui-Rong Guo, who now worked for Waller, considered Terstappen their benefactor. "Leon thinks they're hematopoietic," Shiang said again. "Never fight against your boss."

Waller said nothing to question the values of his Chinese colleague. He was fond of the young doctor with the round, open face and shock of black hair. But he thought: Loyalty is commendable, but do you walk off the end of a bridge for somebody because of loyalty?

"I was becoming increasingly frustrated by not seeing the core phenomenon. But sometime experiments are particularly difficult to perform," Waller says. "I went back and did more experiments."

THE TERSTAPPEN and Waller families were celebrating Halloween at Ned and Chiara's new home, the home that Leon's job offer had made possible. Leon's generosity had not stopped there. He had helped to install their new kitchen floor, working until 1 a.m. one Saturday that October laying Italian terra cotta tile for his friends.

Working late was nothing unusual. In fact at the Halloween party Chiara said to Jessie, "We really have to make our husbands go to work earlier so they can get home by 6 at night."

The women were drinking wine. "We were happy," Chiara recalls. Anthony Waller was recovering from chicken pox and Chiara had taken advantage of the sores to costume him as a scary Accident Man.

Jessie said she couldn't get Leon to start work earlier than 9, it wasn't his way. "But they'll do great things together." Chiara will always remember her friend saying that.

That was on Oct. 31, 1993. On Nov. 17, Ned Waller walked out of his first floor office at BDIS and saw a poster that Shiang Huang was preparing for the annual conference of the American Society of Hematology. It was exactly a year since Leon Terstappen had seized center stage with his paper.

What Waller saw now stunned him. On the poster was a photo he recognized. In Nature it had been described as hematopoietic stem cell progeny that were CD34+, CD38-, HLA-DR-. In other words, it had been the visual proof of Terstappen's discovery of a common stem cell.

But on Huang's poster, the source of the cells shown in the identical photo was labeled HLA-DR+. Obviously the same cell could not be negative and positive. Probably nobody in the world besides Ned Waller (and Shiang and Terstappen) would have instantly recognized the discrepancy.

Shiang wasn't around so Waller went up to Terstappen's office on the second floor. "Look, something's wrong," he said.

Terstappen agreed there was a seeming contradiction but he felt Shiang could clear it up. When Shiang returned to BDIS that afternoon, he was met by a very upset Ned Waller.

Shiang assured Waller that the photo in the layout was not the one he intended to use on the finished poster. It was part of a mock-up; the actual photo wasn't yet developed.

"That's good," said Waller, only partially reassured.

Waller thought this was a good time to review some puzzling material. He was holding Nature in his hand and asked Shiang to show him the original slides on which he had based the main findings in Nature.

"I've had such trouble," Waller said. Perhaps at long last a look at the original slides with Shiang would answer some questions.

They went to Shiang's cubicle. Shiang turned to Waller. Actually, Shiang said, the photo in Nature hadn't come from the progeny of DR- cells; it had come from DR+ hematopoietic stem cells. The published photo had not shown the actual finding. It had been meant only to represent their discovery.

"This is incredible, Shiang," Waller said. His thoughts were reeling. "It means the core data of your paper isn't true. Does Leon know this?"

"Leon knows, yes," Shiang answered. But, he added, Terstappen would deny knowing. Waller and Shiang marched upstairs to Terstappen and repeated their conversation.

Terstappen expressed great surprise. He immediately sought to shift the blame to Shiang, telling Waller that the paper had been based on Shiang's experiments. Terstappen said he had taken Shiang's word.

"He's the one who did the experiments," Leon Terstappen says today. "I was climbing the BD hierarchy, I had other responsibilities."

When his benefactor blamed him, it hurt Shiang's feelings even though he had been expecting it. He had believed all along that the paper had been rushed to publication without sufficient experimentation. He says he tried to caution Terstappen but Terstappen wanted to be first to publish, first to the patent office.

"Even though I have so much experience in culturing cells," Shiang says now, "I am still wondering. . . . I don't think Leon did this for fame or money. [It was] a mistake. I don't think it's on purpose to mislead."

At the time Ned Waller didn't know what to think. Everything was crumbling. "I had spent eight months on this," he says. "I had negotiated a big government grant. Now the author of the paper was telling me it was all not true."

And he felt vulnerable. He had a new mortgage and three small kids. "I was inside the company making a big stink about a very important discovery they had made."

Nonetheless, the paper in Nature was flawed-that was as charitable an interpretation as he could put on it at the moment. Nature had to be told. And the NIH. It was he, in the absence of Leon, who had signed the grant application. My God, he thought, other scientists in similar positions had been hauled before Congressional committees, their reputations ruined and their careers jeopardized.

By chance, Noel Warner, BDIS' vice president for research, was passing by. Waller hailed him and the three scientists repeated what they had been talking about. Terstappen seemed concerned to Waller.

Warner suggested they all review the raw data. Then they would meet in two days, on Friday afternoon. Meanwhile they should not discuss the problem with anyone else.

WALLER remembers going home that evening and telling Chiara that he was in a sense relieved because he had discovered why his efforts to duplicate the original research had been to no avail. He felt pained, yes, but sure that he was doing the right thing. That is his version of what happened at home that night.

"He had gone months coming home every night worried. And driving every day with Leon," says Chiara. "This worry was all building up."

One of the things that impressed Chiara throughout the ordeal was how Ned would come home emotional but by morning when he was leaving for work he would be completely under control. She attributed his strength in part to his being a doctor, an oncologist, who had grown accustomed to dealing with pain and death.

This night was the worst of all, in her memory.

"Ned was completely in pieces," she says. "He didn't know what to do. He said: 'I know why this doesn't work.' He told me the whole story.

"We were in tears when we asked the question-do we let it go or not? A friend is involved. And friendship is a value. Maybe the edge should be moved.

"I loved their children, beautiful children, I put them asleep in our bed. So if you look the other way, is that right or wrong?

"And Ned said: 'As a scientist I can't. Not even as a friend. It goes against everything.'
"When I understood from Ned it was a moral issue I said: 'You have to do what you have to do.'

"It sounds dramatic but that was the ultimate question-is friendship more important than truth?"

THAT NIGHT Shiang Huang and his wife, Gui-Rong Guo, who worked closely with Waller, also had a talk. Gui-Rong told her husband there had been an argument that morning in the lab between Ned and Leon. Maybe, Shiang thought, that helped explain why Ned was so upset.

Shiang believed that Waller was jealous of Terstappen. Maybe that was part of it, too. Waller was so upset he was using the scientific F-word: fraud.

Then, before the climactic Friday meeting with Noel Warner, Terstappen had a private talk with Shiang, who by now had a grasp of what his role was to be.

"I was just like a ball kicked by the major players," Shiang said recently. "My situation was so . . . what is the word? . . . I don't know. But worse than bad."

LEON Terstappen showed up Friday a few minutes late for the meeting and announced that he had "good news."

Shiang had told him, he continued, that he had been pressured so badly by Waller on Wednesday that he had misspoken. They all knew that Shiang's English was poor. Shiang had meant to say that he was uncertain which photo had been used in Nature and in the grant application, nothing more.

They would go back to their original research and find the right slides, Terstappen said. Then everything would be OK.

A few minutes later Shiang came in and repeated Terstappen's version of what had happened. It seemed to Waller that Terstappen and Shiang were in collusion. Recently I asked Shiang Huang if Leon Terstappen had pressured him to change his story.

He said: "I cannot answer that. I don't want to say."

Would he lie for his benefactor, I asked.

"At that time, yes," he said. "Today I don't think so."

As the meeting continued, Terstappen began to talk to Warner about the difficulties Waller had been having in replicating the original findings. Waller felt his competency was being questioned. Suddenly the burden of proof was shifting to him. He had to defend himself against the suggestion that he had gone off the emotional deep end, motivated by failure, frustration and perhaps professional jealousy.

Waller stayed cool.

He needed proof that he was right, and that the paper was fatally flawed. As the others continued to talk, building a sand castle of rationalizations, Waller was looking through an album in which Shiang had mounted photos. Portions of some of the photos had been cut out, as if they had been used in a collage. Such a collage had in fact appeared in Nature.

It was hard to tell from the cut-out photos just what was pictured in every photo. Terstappen had kept no notebooks of these most important experiments of his scientific life. He had left the record-keeping to Shiang.

"We didn't carefully keep records," Shiang says now.

But Shiang had kept the negatives for all the photos in the album. Ned found them stuck inside a flap. He began to hold them up to the light, one at a time. He found the originals of the photos used to document the Nature paper. And in none of them did the experiment begin with a DR- cell. The evidence of misrepresentation was in his hands.

And unmistakable.

Warner took possession of the damning album. In behalf of BDIS he agreed to contact Nature at once and begin negotiations for a retraction. And he asked NIH not to send the first installment of the grant because problems had arisen. Ned Waller had saved the government $1 million.

Waller found his hands trembling. His heart was heavy. Terstappen was his friend, his good friend. He liked Shiang, too. Now he was accusing one or both of grievous misrepresentation. The only question remaining was whether it had been intentional. How badly had Leon Terstappen wanted the gold ring?

That Friday afternoon Waller and Terstappen did not follow their usual practice of driving home together. The carpool was at an end and the friendship with it.

THE BDIS scientists spent the months from November 1993 to March 1994 rechecking the original research. Meanwhile Ned Waller and his team continued to sort cells, Waller having agreed to one last search for proof that the Nature paper was not false after all.

"When I checked it out," Leon Terstappen said recently in a telephone interview, "what I found was there was actually a picture in the manuscript that was mixed up, not belonging there. I don't know how it happened."

The entire episode, he said, "was a horrible experience," by far the worst of his professional life. He still believes that "the science was extremely important, showing things that nobody had seen before."

Terstappen laid blame in many places. "We couldn't finish the science," he says. "We didn't have the money. . . . What it really taught me is don't start anything without having proper funds and the future laid out."

Shiang Huang makes the same point: "I still think we haven't enough time to deny or confirm it. There's some very interesting experiments we didn't carry out."

They both say the misrepresentations in their paper were not intentional, but mistakes. And that some day someone may find a common stem cell such as they described.

A similar point is made by Irving Weissman of Stanford, whose scientific and financial success with stem cell research may have provided a tempting reason to rush to publication.

"The worst thing Leon Terstappen did was make an interpretation that probably 90 percent of scientists on Earth would have made. . . . He had been almost perfectly careful but not quite perfect. . . . I find no evidence of intent at all. If he was a little reluctant at the end stage to state that he was wrong, that's natural."

Terstappen described himself as a "visionary." He characterized Ned Waller as plodding, meticulous but unimaginative.

Waller is not pleased by that distinction. "I do think Leon was thrashing around, trying to find someone to blame," Waller says. "But I don't think now he was knowingly false. . . . It seems inconceivable he could have been so excited about this discovery if it was based on intentional misrepresentation.

"He himself had no notebooks, he had a different way of doing science. His wife told Chiara, 'Ned doesn't understand the way Leon works. Ned's very meticulous, he plods away. But Leon is making the great discoveries.'

"But in my opinion," Waller says heatedly, "if you do science you have to have the records of what you do. . . . Meticulousness by definition is what science is all about. . . . They viewed me as plodding. And picky. Picky. I remember Leon's wife saying, 'Ned is picky, it could well be true.' But Terstappen lacked meticulousness. And I would rather have verifiable fact. Give me verifiable fact."

The men never really talked over their grievances. As usual, they left the most heartfelt expressions to their wives.

"I felt Jessie wasn't to blame. She felt I wasn't to blame," says Chiara Waller. "We both felt sorry this was happening to us. She came over once. . . . It was clear we were both in pain. We had to tell each other this was very painful. But the children were there so it was very short.

"She trusted Leon. She said he was a good scientist who wouldn't do anything that was not right.

"I said: 'I think you're right to stick with your husband. I can't believe this is happening to us. I don't want to accuse your husband with you. I can't tell you, why did your husband do this?'

"Jessie's position was: 'Talk to Ned. Why is he doing this?' "

It's no easier today for Chiara than it was then.

"It's so hard," she says. "I still feel I'm close to Jessie. And I don't even know where she is."

THE TERSTAPPENS have relocated near Philadelphia, where Leon is vice president of research for a start-up called Immunicon. He left BDIS voluntarily in September 1994.

Shiang Huang was laid off in the spring of 1994, when BDIS reduced its research staff to almost nobody.

In the aftermath of the Friday afternoon showdown, Ned Waller decided he needed a lawyer. That seemed to bother Terstappen far more than Waller's blowing the whistle ever did.

"That makes to me one hell of a difference," Terstappen says. "Yeah, I felt betrayed. You bring in lawyers, yes, you feel betrayed because people cannot talk as normal friends."

Waller's lawyer, Jeb Boasberg, negotiated with BD. One thing Ned insisted on was that all the people he had persuaded to leave other jobs to join him at BDIS be retained while they looked for work elsewhere. To a person, they are grateful.

Waller also insisted on his right to publish two articles in the journal of the American Society of Hematology, Blood. The articles, published in May and July 1995, explained in scientific terms what had gone wrong with the original stem cell research at BDIS.

Boasberg praised the company's handling of the problem. "They recognized the problem, homed in on it and addressed it in a resolution oriented way. . . . You could see this as a truly win-win outcome.

"Here's the story of one man who stood up to scientific fraud and stayed true to his principles," he says. "And I think [BDIS] stood up and did the right thing."

As a protected whistle-blower Waller could have remained at BDIS indefinitely. But the company had curtailed its research to such an extent he would have had nothing to do that interested him. So he accepted a faculty job at Emory University where he continues doing research. He is also performing bone marrow transplants.

"My equity position now," he jokes, "is only in the truth."

PAIN AND GAIN is a theme Ned Waller returned to time and again during our interviews in Atlanta this summer. When he was a young doctoral candidate, he said, his adviser told him there was no learning without mistakes and mistakes were painful.

"What's your role?" Waller asked the adviser.

"To make sure you feel the pain," was the reply.

That is now the role Waller has taken on. It is why he insisted on the truth even at the cost of friendship and loyalty, why he demanded the retraction, the cancellation of the federal contract and his right to clarify the scientific failure in the journal Blood.

On my final evening with the Wallers, I was sitting with Chiara at the dining table of her new home in a densely wooded section of north Atlanta as she recalled how Ned decided at last to leave BDIS.

" 'Chiara,' she remembers her husband saying, 'It's clear to me now I can't work with their organization anymore. It's not just Leon. But the way the company handled it. I want to be in an environment where science is done well and there is trust.' "

As Chiara was talking, Ned walked into the dining room from where he had been cooking dinner on a barbecue.

"If there was one reason I agreed to talk to you," he told me, "it was because the company never really learned from this. It was the opportunity for them to say: What happened? How did it happen? What could have been done to prevent it? Nobody cared about that. . . . The company never used it as an opportunity to educate themselves."

Chiara said: "The sooner it becomes silence the better. It was a surrealistic feeling-is this happening, or not? Because I lived through those months and I remember very well. Everything is supposed to be fine now?

"I ask you: How does Leon feel?" She slammed her palm down onto the table. "What does the scientific community understand?" Slam! "Does anybody understand that people lost their job and their dream?" Slam!

IT SEEMED FAIR to ask Noel Warner about that. Warner is no longer vice president of research at BDIS but rather vice president of scientific affairs, perhaps reflecting the company's turning away from such research.

At first Becton Dickinson was unwilling to let anyone at the company speak to me. At last they agreed to let Warner be interviewed but with the proviso that he would speak only of facts, not opinions.

Warner squeezed me into his schedule for about 20 minutes on a Monday morning at San Francisco Airport, as he and the new BDIS President, Deborah Neff, were about to board a plane. Neff succeeded Nagesh Mhatre soon after the common stem cell fiasco. Mhatre is retired.

Warner told me he respected Ned Waller for what he had done. And he defended the company's promptness in informing NIH and Nature.

I asked Warner what the company had learned.

The question made him smile uneasily. He folded his hands over his chest. He glanced at Neff, but she offered no help. Then he gazed into the middle distance. Finally he said:

"I'm not sure I can characterize what we learned from it. It's happened in science many times that provocative new ideas do not always turn out to be what they seem."

But, I continued, what had BDIS changed about the way they do science to ensure such a painful and costly mistake would not happen again?

Again Warner paused. Finally he said: "I don't think I would say there had been any significant changes."