Eight Maids a'Milking

by Tony Noland

"… and that concludes my presentation. I'll be happy to answer any questions you might have."

Meixu Liao smiled and turned her hands out, palms upwards. Americans typically saw this combination of facial expression and body language as conveying relaxed confidence and honest openness. She hoped it would quell any urge to ask difficult questions. The part of the data that she'd shown them should be enough to win them over, but Daniel Jackson was a very sharp man. You don't get to be head of the biggest agribusiness conglomerate in the world by being a pushover.

One of her scientists turned on the lights and started fussing with the computer. Meixu stood with her smile and her open hands while the Americans looked at her and at each other. They were all waiting for Jackson to speak. Her own boss, Xianhu Fong, that fat idiot, looked at the Americans, almost bouncing out of his chair with the desire to "facilitate". All of her own scientists were busy scribbling notes so they wouldn't have to look at anyone.

Jackson spoke without looking at the notes and handouts in front of him. "Doctor, thirty-seven million dollars is a lot of money."

She put her hands together and dropped the smile. She set her face to a serious, almost grave expression. If Jackson was only going to focus on the money, this would be easier than she hoped.

"Yes, Mr. Jackson, it is." she said. "NovoGenerica has shown a great deal of faith in me and my team. I hope that what I've shown you today has justified that faith. The research -"

Fong interrupted her, "We are very, very, very grateful for all of your

support! It's a tremendous statement of activity!” He actually stood up to deliver this little speech to Jackson, using his very best English. Meixu knew her gritted teeth weren't showing on her face; she had too much practice putting up with the Director's fawning. Fong was a buffoon, but his antics were useful at times. However, Jackson was unlikely to be distracted. He had a personal interest in this work, having grown up on a dairy farm. That had made him an important champion of her work, but it also made her present situation very dangerous. This had to be handled delicately.

Jackson returned Fong's bow with an inclination of his own head, then said, “Thank you, Mr. Fong. Please, Dr. Liao, you were saying?”

“I just wanted to acknowledge what NovoGenerica's funding has meant for this institution,” she said. “From our days as the old Xiaoqueng Women's College, we've grown into a world class research center. The investment from your company has been pivotal in that growth. Equally important, of course, has been the excellent leadership of Mr. Fong,” she said, bowing and thinking of Fong's cousin the Party Assistant Secretary General. “None of the research we've conducted or, if I may say, the successes we've achieved, would have been possible without this mutually beneficial collaboration with NovoGenerica. Mr. Jackson, I know that you personally have been our chief supporter, and I am grateful for that.”

“Dr. Liao, in explaining our various research investments to my board of directors,” Jackson said, “I don't have to work too hard to sell them on the benefits of genetically modified crop plants, cloned livestock or proteomically enhanced biofuels. These are technologies they understand. Despite all the pressure from the anti-GMO groups and the animal rights activists, the board members can readily see the advantages of basic research in these areas. After all, our mission is to advance agribusiness technologies to provide the food, feed, fiber and fuel of the future.” He repeated the tagline from their

latest ad campaign, sounding as though he'd written it himself. Perhaps he had, she thought.

“Doctor, your original work in transgenic nanofiber synthesis was also fairly straightforward. However -” he lifted his copy of the executive summary “- the board has raised a number of questions about your latest reports on the cell culture-based bioreactors. Based on your spending patterns, it would appear that the majority of your efforts in the last three years have been directed to this research.” He set down the report and took off his reading glasses.

“So why don't you cut all this bullshit, Dr. Liao, and tell me what it is you've been doing with our money.”

In the silence that followed, Meixu could tell by the color of their faces which of her people had a good grasp of idiomatic English and which did not. Fong, feeling the sudden change in the room, snapped his fingers at his interpreter, who began whispering into his ear.

“What is it you'd like to know, Mr. Jackson?” Meixu said. She might still be able to survive this.

Jackson looked at one of his assistants, the accountant. Kevin something. The man pulled up a sheaf of notes from his attaché and cleared his throat.

“In the last three years,” he said, “nineteen million, eight hundred thousand dollars were spent on something called AIS, the Advanced Intermediate System. What exactly is this project? You describe the results from it in rather glowing terms and you discuss how critical it is towards the development of the full bioreactor. However, you never actually say what this system is, or why it's so important.”

Podelski, she thought. Kevin Podelski.

“Mr. Podelski, more than twelve years ago NovoGenerica asked me to use genetic engineering to produce fibers with certain unusual properties. With your support, we developed entirely new technologies and then expanded on them. We altered the proteome of mammary gland cells in our clonal herd of cows, so that the milk would contain the oligomeric building blocks of the synthetic fibers you wanted. Those eight transgenically modified cows were designed, created and, I might add, hand milked by my staff of scientists. With those eight animals, we successfully converted conventional livestock feed into nanofiber strands with a tensile strength almost eight thousand times that of molybdenum steel wire.

“Ultimately, however,” she continued, “we want to have a machine-based system that will not involve actual livestock. By suspending in vitro cultures of the proteomically enhanced mammary gland cells in nutrient solutions, we will be able to scale up production to make it economically feasible.”

“We understand the goals of your research, doctor.”

“Then you will also understand that we cannot go directly from live cows in straw-filled pens to stainless steel tanks fed by pipes and pumps. Intermediate stages of technology are necessary, and that is the AIS. I believe my reports on the AIS have been fully descriptive with respect to the materials and methods. As to the budget for that project, there were a number of basic technological hurdles that we had to overcome. All of the accounting details are in the appendices, spreadsheets F and G.” Please let the bluster work, she thought, please let it work.

“Yes, Dr. Liao,” Podelski said, “you were very informative in your reports. The documentation on the AIS runs to more than four thousand pages. In fact, it is so informative and so descriptive that

the scientists on our end can't make heads or tails of it."

He flipped through the papers. "This project has everything from animal cloning to genomic enhancement to tissue grafting. The million and a half spent on mass spectrometers and proteomics sequencers I can understand, but there are expenses listed for magnetic resonance imaging, neuroanatomical modeling, an entomologist, a grab bag of everything under the sun. You've even got one mysterious salary line here for a guy who turns out to be an aerospace engineer! You work with cows, doctor — why did you need to employ entomologists and aerospace engineers?"

"They were consultants, not employees."

Fong rapped on the table and said, "Do not undertake evasions! Answer the question!"

Meixu frowned and said nothing. Podelski looked at Jackson, then closed his attaché.

"Doctor," said Jackson, his voice unexpectedly gentle, "there are some on my staff who have concluded that this AIS project is nothing more than an accounting vehicle, a slush fund that you are using to siphon off my company's money into a wide range of pockets."

He held up both hands to silence and forestall Meixu as well as Fong.

"If I thought that was the case, I wouldn't have traveled twelve time zones to be here. I would have simply pulled the plug on this place from my office in Kansas City. You've done good work for us in the past, doctor. You've accomplished things with cows that I never would have thought possible back when I was a kid milking two hundred head on my father's dairy farm. My company has profited

from this research relationship, and I would like for it to continue to do so.

“But,” he said, “I will break you right in half if I conclude that you are stealing from me. If this AIS is for real, I want to see it. Now.”

“Mr. Jackson, I hesitate to show you the AIS because of the nature of -”

“Now, doctor. Right now.”

Eye to eye, Meixu and Jackson were unmoving for long, long seconds, until the silence was broken by Fong rapping on the table again. “Dr. Liao!” he said, “This is unacceptable! You will escort Mr. Jackson to this laboratory at once! He is a most important friend of this institute, as you seem to forget!”

Meixu dropped her eyes to the floor. This was going badly, but there was still a chance. She said, “Very well, Mr. Jackson. The AIS runs around the clock; we can go see it immediately.” She moved away from the screen and handed the laser pointer to her assistant.

As the group gathered their papers and prepared to leave the executive meeting room, Meixu approached Jackson. Fong was leaning into him, blabbering a mixture of servile apologies and macho bluster. Perhaps if she'd shown the AIS to Fong, if he'd known what it was, he might have been counted on to help her hide it. It solved so many problems, it was the answer to everything. Wouldn't even he have understood how important it is? With an inward sigh she realized that it didn't matter if he had. Fong had no control over his own face. If he'd known, the horror of it would have overwhelmed the wonder and he'd have given it all away in the first twenty minutes.

Jackson caught Meixu's eye and let her stand for a moment while he

allowed Fong to vent. He interrupted the flow to say, “Absolutely, Mr. Fong, there is a great deal of truth in what you're saying. Let me have a look at this AIS, and then I would very much like to hear your views on the matter. I know you are a busy man, Mr. Fong, but can I impose on you for some of your time right now? My associate, Mr. Podelski, would benefit greatly from hearing your perspectives on this. Oh, Kevin? Kevin, Mr. Fong has some fascinating insights into the situation. You need to hear them.”

Before Fong quite knew it, Podelski had engaged him in conversation and led him into a corner of the room, away from Jackson and Meixu. “One of your scientists can direct everyone else, doctor,” he said. “I'd like to speak to you alone. Shall we?” He held the door for her. Like Meixu herself, Jackson carried no files or papers; that was what assistants were for. The two of them walked on, their footsteps echoing in the empty hallway.

“Mr. Jackson…” Meixu fell silent, not knowing how to begin.

“You're not getting ready to apologize, are you?”

She actually stumbled, she was so surprised. “Apologize? For what?”

He made a face, something that was not quite a grimace. “I didn't think so. Alright, doctor, where would be a good place to start with this? Ah, I know — tell me about the neuroanatomy. Why did you need MRIs of the cow's brains?”

She didn't hesitate. She knew a last chance when faced with one. “Because lactation is a function of the hippocampus. Oxytocin is synthesized in the hypothalamus and released from the pituitary glands, stimulating milk production. To get mammary tissues that produce milk all the time, not just after the cow has given birth, we needed to understand how to get control of the hormonal regulatory systems.”

“And did you?”

“Yes. We can use microelectrodes to stimulate key areas of the brain and make milk production a permanent condition.”

Jackson shook his head. “That's a dead end. Hormone control has been tried before. Cows can only produce milk for six or seven months before the metabolic drain kills the animal.”

“Not the way we do it.”

He looked at her, very sharply. She didn't elaborate.

“Alright, tell me about the entomologist.”

She took a deep breath, then said, “Spiders make silk from at least twenty different kinds of precursors. They excrete them in different concentrations using specialized structures within their spinnerets. What we see as spider silk is actually synthesized as these precursors combine. The spider can alter tensile strength, elasticity, UV resistance, a host of structural and performance criteria, all using a brain no larger than a salt crystal.

“For our work, we needed to be able to combine the subcomponent oligomers of the synthetic fibers in a precisely controlled way, so we used the spinnerets as a model system. Once we had the expertise in house, we… did something similar with the AIS. The transgenic cloning of the spinneret structures let us fine tune the fibers we were making through electrode stimulation. We got materials that were really astonishing. It was when we made lot number 679-C that we started thinking about space elevator applications.”

“About what? What did you say?”

“That batch had all the properties necessary for building a space elevator cable. Incredibly strong, cross-linked co-polymer fibers that were self healing. There was also some kind of autoassembling fullerene tube structure at the core of it that made it electrically conductive. We still don't quite understand how it works, but with some more tweaking, I'm certain we could improve the binding efficiency. That would allow it to generate enormous amounts of power simply by interacting with Earth's magnetic field, far more than would be needed to lift payloads to geosynchronous orbit.”

Jackson said, “But naturally, the fibers can't be made in bulk, and you'd need more money than God to build such a structure, right?” He sounded like a man trying not to get excited.

“Actually, we've already made ten thousand meters of it with the AIS. All of the small scale results are holding up. The engineering consultants said that construction of the space elevator would be expensive, but feasible.”

He stopped and turned to face her. “Are you serious? Screw space elevators. If this is for real, this is a power source, an unlimited source of free electricity! Don't you realize this is the most important advance in the history of biogenic nanotechnology! Why on Earth didn't you say all this in your report?”

“Because it was made using the AIS. I wanted to get the bioreactor working, and reproduce the fibers with that.”

“Goddamn it, doctor, if this stuff is as good as you claim, what are you waiting for? It sounds like your current system is good enough for us to establish ourselves as first to market; we can own the entire industry! You've already done the legwork for it — let's build a dozen or a hundred of these AIS things and scale up production.”

Meixu shook her head. “I don't want to make another AIS.”

“You don't… why the hell not?”

She swiped her ID across the lab's security panel and stepped through as the double doors opened. Jackson followed.

Every sense was assaulted. The noise was deafening, a clicking and buzzing cacophony of a thousand pumps, fans, and digital readouts. The smell was a mixture of vomit, manure and acetone. But the sight was what made Jackson's face turn pale. Suspended from the ceiling in the huge central bay of the laboratory was a glistening, bulbous thing, twelve meters long at least, a monstrosity of pink and gray flesh, covered in tubes, wires and small pieces of equipment.

Along the length of it, teats and udders erupted from all over its body. He couldn't even begin to count them all. To each was attached a miniaturized milking harness, linked with wires and tubes. A team of masked technicians were tending these, eight young women doing the milking, adjusting clamps and hoses. He approached one teat as closely as the smell would allow. Its tip was pulsing in time with the flashing lights on the controller. A single hair-like filament was being drawn from the teat. It was led up to a roller pulley and it disappeared into a maze of tubes in the ceiling. The same was being done at each of the dozens, hundreds of teats.

The effect was like seeing a hideous conglomeration of fleshy pink spiders, each an abomination of life and electronics, each fighting to spin its own little web, and everything being stolen from them, thread by thread.

After a long shocked moment, Jackson moved forward, approaching the end that had a cow's head.

A small forest of wires disappeared into its skull. Its eyes were covered by little glowing screens. IV tubes led from some unknown

source into the large veins of its neck. A thick, translucent tube snaked into a huge hole in its throat, permanently attached by what looked like staples and gray tape. He could see a thick sludge being pumped into the thing. As he stood staring, he saw the head twitch and the nostrils flare. He heard a sound, muffled and tortured, but it was unmistakably the moo of a cow.

Clipped to what was left of one ear was a metal tag: DAISY. The D and Y had been scratched out. Jackson stepped back.

“It almost looked like a normal calf when it was born,” Meixu said. “We'd spliced in the spider DNA hoping to restructure the four normal teats into spinnerets, but we never expected anything like this. It started changing with the onset of its first estrus, grew so large it couldn't support its own weight. We had to suspend it, then eventually cut off its legs to keep it from hurting itself. The wiring directly to the brain and the hypnotic visual inputs help keep it calm, but we keep it pumped with sedatives as a precaution. The IVs also supply the lactation hormones, antibiotics, everything the feeding tube doesn't.”

“My God.”

“Mr. Jackson, it's not that I can't make another one of these. It's that I don't want to. I know this is horrible, it's why I didn't want to show it to you. Anyone with experience on a conventional dairy farm must find this… Please believe me, I never meant to do this to an animal, I never intended this to happen, but the AIS is the key to everything! Entirely new fields of materials science, cheap energy, cheap spaceflight… I know I can make the bioreactor work! I can get everything that I'm getting now, but from unfeeling tissue cultures supported by pumped nutrient streams and artificial hemoglobin instead of from this poor thing. We can euthanize the AIS, put it out of its misery just as soon as the bioreactor is up and running.”

Jackson returned to the massive head, tried to look into the milky, bloodshot eyes. “How long will that take?” he said.

“Three years. Five years at the outside, I promise.”

Jackson reached out and, moving slowly among the wires, tubes and staples, he ran his fingers gently along the side of the face and up behind the ear. The head twitched, held in place by the clamps but still seeking out his touch.

“I'm sorry, girl,” he whispered. “Daisy, Daisy, I'm so sorry. Just a little while longer, girl, just a little while longer. I swear it.”