Code for Tomorrow

Some said that the least promising students were assigned to the most dangerous experiments, but Bernardo didn't believe it. Last year, Katya Riesling was the brightest light in the program. This year, all that was left of her occupied a dozen specimen jars in Dr. Repp's freezer. Fatalities were rare, but they happened. Katya took her chances, and she lost.

They were all taking their chances. Earning your certificate in life extension technology -- lextech for short -- required serving as an experimental subject. While it was true that deaths were unusual, you'd almost certainly be changed in some way, usually some way you didn't appreciate. Conrad, Bernardo's roommate, was covered in thick fur from head to toe.

Dr. Repp himself still had that big tumorish looking thing hanging off the side of his head, a souvineer of his student days.

If you got very lucky, you'd change in some positive way -- maybe even live longer -- but that was about as rare as dropping dead. Despite the risks involved, though, the program always had plenty of applicants. Your certificate from the Lexstar Research Institute, the equivalent of a doctorate, guaranteed you a position at Lexstar Corporation. Lexstar held the patents that gave it monopoly control over lextech, so working at Lexstar made you rich. Very rich.

Bernardo did his best to think about being rich as he rode the elevator up to Dr. Repp's office. It was his turn now, and it wouldn't do to think too much about what could go wrong. It probably would be no worse than what they'd done to Conrad. Forget about Katya and those jars.

Dr. Repp looked up from his desk when Bernardo entered. The misshapen sack of grey flesh that dangled from the side of Repp's head jiggled. It probably could have been removed by a plastic surgeon, but Repp wore it like a badge of honor.

"Mr. Colón, please take a seat."

Bernardo sat. Repp glanced down at the monitor embedded in the surface of his desk.

"You've been here six months. Your DNA profile is acceptable, and your stem cell cultures are doing well. It's time for you to become a real member of the team."

"Yes, sir. I'm ready."

“Good. I’m including you on the most important project we’ve worked on in years. Maybe the most important ever. It’s not just traditional lextech, it’s brand new, and it’s a fantastic opportunity if you get in on the ground floor. Sound interesting?”

“Yes, sir, very interesting.”

“Good. You’re assigned to me, both as test subject and lab assistant. Mr. Wilkes can brief you tomorrow morning, and we’ll talk some more when I show you around the lab in the afternoon. Just tell Wilkes you’re taking over for Katya Riesling.”

The foundations of lextech were laid at the turn of the century, in the early days of stem cell research. Almost as soon as it began, though, the research came under attack, tangled up in controversies over abortion. Lawyers being lawyers, other issues were added to the mix as well.

One of the worst roadblocks in the way of research came as a surprise to everybody. A fetal rights group sued to stop an experiment involving embryonic stem cells. The group’s attorneys argued that embryos must not be subjected to “untested medical technologies” because embryos cannot give informed consent. The suit failed, but not before several courts took turns reinterpreting “informed consent.”

Under the new interpretations, the first human subjects of an experimental therapy had to have “substantial understanding” of what was to be done to them, and why. In practice, that meant a bachelor’s degree in one of the biological sciences, or

a closely related field. When animal research was complete, and it was time to move on to human experimentation, researchers were left with no experimental subjects but themselves -- and their graduate students.

The stem cell research controversy faded when it became clear that fetal stem cells and those left over from *in vitro* fertilizations were clinically useless. To be medically effective, a stem cell had to have the same genetic makeup as its recipient. Stem cells had to be obtained by SCNT, somatic cell nuclear transfer.

In SCNT, the nucleus of an egg cell is destroyed, and replaced with the nucleus of a body cell that already contains a full set of chromosomes. Another name for SCNT is cloning, but that word never was mentioned at Lexstar. People always think of duplicating entire human beings when they hear the word cloning, and cloning for reproduction was both illegal and socially unacceptable.

Cloning for therapeutic purposes, on the other hand, finally was accepted by all. The religious authorities concluded that SCNT was not conception, so the resultant zygote was not a person. (It followed that a cloned human being has no soul, making cloning for reproduction doubly abhorrent.) The courts ruled that cloned cells were legally parts of the person from whom they were cloned, even while being cultured in a separate location. As long as nothing more complex than a blastocyte developed before the stem cells were harvested, both church and state were content.

Lexstar Corporation held the patents on the onetime Holy Grail of stem cell research, a system of gene tagging that prompted the growth of pluripotent stem cells into specific types of specialized tissue. The cures for problems such as diabetes, Alzheimer's, Parkinson's, heart failure, spinal cord injuries, and other once catastrophic ailments were handled by subsidiaries or licensed to other corporations. Lexstar itself concentrated on the gradual deterioration that accompanies aging.

Individuals wealthy enough to undergo the full Lexstar treatment program currently could have firm skin and muscles, enhanced blood circulation, restored sexual potency, and the energy, eyesight, and endurance of people half their age. Along with those immediate effects, clients could expect an additional ten to twenty years of life. It was incredibly expensive, and none of it was covered by any sort of insurance, but business was excellent.

Bernardo wanted his piece of the action, and if he had to endure bizarre skin coloration, ceaseless flatulence, or sudden breast development to get it, he didn't care. He didn't care if he had to grow a goddamned tail. He was in it all the way.

But all the way to a set of specimen jars in Repp's freezer? Don't think about that. Sure, it happened to Katya, but it won't happen to you. Repp won't make the same mistake twice. And, according to Repp, getting in on this research is the chance of a lifetime.

Wilkes arranged a line of bottles on a shelf in size order, then stepped back to view his work. Dissatisfied, he switched the positions of two of them, then switched them back. Bernardo saw the problem immediately. One bottle was taller than the other, but its volume was not as great. From what he knew of Mr. Wilkes, he might have a long wait before the lab management officer even noticed his presence.

Repp and Wilkes were classmates in the early days of the Institute, and both were experimental subjects when Lexstar first tried to persuade stem cells to become new skin, fat and muscle. Eventually, the company learned how to undo wrinkling and other cosmetic problems of aging skin, but not without some trial and error. The experiment on Repp was an obvious failure, but the experiment on Wilkes was seen as a partial success. The experimental therapy did wonders for his skin tone. but turned out to have some unexpected side effects. Not all the modified cells developed into new skin. fat and muscle. Some grew into brain structures that left young Wilkes with colorful hallucinations and some very unorthodox thought patterns. The skin toning process still needed some refinement.

The answer to Wilkes' most immediate problem, an inability to discriminate reality from fantasy, was brain surgery. The affected brain structures were surgically excised, and that ended the hallucinations and bizarre ideas. Unfortunately, the surgery also excised every last shred of the young man's imagination. It was the end of his career as a scientist, but he was

kept on at Lexstar to supervise the day to day maintenance and supply of the laboratories.

After watching three or four minutes of bottle rearranging, Bernardo dared to interrupt. “Excuse me, Mr. Wilkes?”

Wilkes turned around and noticed Bernardo standing there. He abandoned the bottles and redirected his attention.

“Yes?”

“I’m Bernardo Colón. Dr. Repp says I’ll be taking over for Katya Riesling.”

“Good. She died, you know, and Dr. Repp’s lab was thrown off schedule.”

“Dr. Repp says you’ll brief me on what I need to know.”

“Oh. Well, here’s what you need to know. Plurogenic human stem cells develop into multigenic human stem cells, which then develop into specialized, single purpose cells which form the various structures of the human body.”

“Uh, I’m aware of that, Mr. Wilkes.”

“Yes, you are. But there’s more. Dr. Repp has evidence that stem cells can be triggered to develop into structures that don’t currently appear in human beings. Some are structures that once occurred in our hominid and pre-hominid ancestors. Others are structures that might appear in future stages of human evolution. In brief, the human genetic code contains instructions for all sorts of structures that don’t currently manifest themselves. Dr. Repp wants to produce some of those structures and see what they do.”

Bernardo felt a sinking sensation in his stomach. This went far beyond hair replacement or skin toning. What kind of unknown structure would Repp try to grow in him, and what eventually would appear? What actually happened to Katya Riesling?

"Um, Mr. Wilkes, what kinds of structures do you think Dr. Repp has in mind?"

Wilkes knotted his brow. "I can't imagine. I really can't imagine."

Bernardo could imagine all sorts of possibilities, but Repp did nothing to soothe his student's anxieties when they met in the lab that afternoon. The doctor was far too excited by the potential impact of his discovery on the world of science to concern himself with its potential impact on Bernardo.

"It's still commonly believed that most of our genes do nothing but occupy space, and that just a small fraction have a function in heredity. Junk genes. That's what they taught you in college."

"Yes, sir."

"Well, they're wrong. Or anyway they're missing a big part of the picture. Most of those unexpressed genes are like genetic memory, sort of a recapitulation of our history as a species. I suspected it about four years ago, and did a few experiments to confirm it."

Bernardo instantly thought of his furry roommate. "Was Conrad Berry one of your subjects, sir?"

“Conrad the monkey boy. Absolutely. I thought some ancestral genes might have commercial potential, but I was wrong. We replaced a little too much hair on Mr. Berry. Then there was Harris Epstein. Did anyone ever mention him to you?”

Bernardo steeled himself to hear of another death. “No, sir.”

“He left the program a couple of years ago. Foolish, if you ask me. Anyway, he left with a fully functional appendix. I always wondered what those were for, and I finally found out they were for marking territory. Secreted a pheromone into the stool so that its odor would warn off competitors. Nobody would go into the men’s room after Epstein used it. Too intimidating.”

“Why did he leave the program?”

“Went to law school. All of a sudden, he decided he could make a fortune practicing law. It was nothing I did. There were a few other experiments, but management decided there wasn’t any real commercial potential in traits we obviously don’t need anymore.”

“When are you going to publish? You’ll revolutionize the whole field of genetics!”

“Probably never. Nobody else is bothering to study junk genes, and management thinks it’s a bad idea to go public. After all the trouble over abortion they don’t want to start a whole new fight over evolution. Anyway, I’ve moved on. The year before last, data from animal experiments suggested that some of those unexpressed genes carry evolutionary *potential*.

Not instructions for yesterday or today, but code for *tomorrow*. If the traits we've outgrown are worthless, what about traits that won't appear for another million years?"

Bernardo lay awake that night, trying to imagine what kinds of new traits humanity might develop over the next million years. Extrasensory perception? Lungs that could breathe polluted air? How could anyone even begin to guess accurately? If the futurists were any good at their work, everybody should have a flying car and a silver jumpsuit by now. Or there should be world government and mining operations on Mars. Or the human species should be extinct.

Of course, the million year figure was just Repp talking off the top of his head. There was no way of knowing just how many years of evolutionary potential were stored in the human genome. Over a million years, human beings could evolve into a different species entirely. What happens to a person who grows a body part belonging to a different species? Is that what killed Katya?

It kept coming back to Katya, back to those jars in Repp's freezer. Something killed her, and Bernardo had to know what it was. It was usually a bad idea for students to ask questions that might make their mentors uncomfortable, but Repp was the one with the answers.

"Tomorow," he thought. "Tomorrow I'll ask."

The research center was very quiet at six in the morning. Bernardo never expected Repp would be there so early, but after

laying awake all night he could not spend another minute in bed. He punched in with the overnight security guard, and rode the elevator up to Repp's office.

The doctor was in. Bernardo knocked at the office door.

"Mr. Colón. Come in and have a seat. I expected you to have more questions, but not quite so soon. What can I tell you?"

"There's just one thing, sir. I mean, I have complete confidence in you, but I still feel I need to know . . ."

Repp interrupted. "You have to know about Katya Riesling. Naturally. We don't have all that many fatalities here, so you have to know."

"Yes, sir."

"Well, no matter what you might have heard, I really do believe in informed consent. I was planning to tell you what I know over the next few days, but now is as good a time as any, and it won't take very long. I still don't know why she died."

As promised, it was a short story. Physically, there was nothing wrong with her. She died in perfect health while listening to a Bach sonata, her eyes closed, and a slight smile on her face. A very complete autopsy showed nothing suspicious, much less fatal. Only two things differentiated Katya Riesling from other healthy young women. One was her death. The other was the enlargement of her *corpus callosum*, the bundle of nerves that forms the main connection between the left and right hemispheres of the brain.

“I thought it made the most sense to concentrate on structures related to brain function,” Repp explained. “I still think so. Adaptations of other parts of the body would be adaptations to a changed environment, and it doesn’t make sense to trigger an adaptation we don’t need yet. A more advanced brain, though . . . Well, Katya found it intriguing. Think of what someone might accomplish with a more advanced brain.”

“Did you know you’d be expanding her *corpus callosum* when you tagged those genes to activate her stem cells?”

“Not exactly. Remember, we’re dealing with 3.2 billion nucleotides in the human genome. I did some clustering studies, and we knew we’d be modifiying neurons somewhere in the brain, but we didn’t know where. Katya was a full partner in the decision to try it, though. I didn’t force it on her, or threaten her with expulsion, or anything like that. And I won’t force it on you either. There are other experiments that need human subjects.”

Bernardo’s first inclination was to bail out immediately. No senior researcher *ever* offered a student the chance to say no to an experiment and still remain in the program. The experiment Repp had in mind had to be *very* dangerous. On the other hand, being involved in the research presented extraordinary opportunities.

“Anyway,” Repp continued, “we took one of her stem cell cultures and tagged that sequence of nucleotides to turn on the gene. When the cells changed from pluripotent to multipotent

pre-neuronal, I injected them. Five weeks later, we could see the change on her MRI. It was very exciting."

Later, back in his room, Bernardo scribbled notes summarizing what Repp told him. Every new neuron Katya developed improved communication between the two hemispheres of her brain. While it was true that the differences between the two hemispheres were far smaller than people once believed, improving their ability to work in tandem had a marked effect on Katya's intellect. Within six weeks, her score on the Miller Analogies skyrocketed, and her insights into functional genomics and proteomics were so perceptive that Repp accepted her as a colleague rather than as a student.

The neurons forming her *corpus callosum* continued to multiply. After three months, they were more than doubled, and she lost all interest in genetics and genomics. If Repp pressed her, she dispensed brilliant solutions to nearly impossible problems, but tossed them off with a casualness that suggested she found them impossibly dull. She spent her time listening to music, especially Bach, Sainte Columbe, and Josquin Desprez.

And then, one day, she died.

What would it feel like to have super intelligence? What could you do with it? What would you <u>feel</u> like doing?

Probably, it depended on the individual. There were all sorts of things you could get with super intelligence -- power, wealth, every kind of pleasure. Maybe a few would try to save the world, in one way or another. Anyway, whatever you wanted,

probably you could find a way to get it. Katya had that opportunity, though, and did nothing but sit around listening to music until she died.

Bernardo was convinced she didn't have to die. If she was that smart, she could have found a way to keep herself from dying. It seemed that she didn't care if she died, or maybe she wanted to, for some reason. Probably, he thought, she just got too smart. Everything must have bored her, and living with ordinary human beings was kind of like living with monkeys. Nobody would ever understand her. And she was a woman, don't forget. Women always want relationships, and who could relate to a woman with a five thousand IQ?

It was a bad idea, he concluded, to let yourself get as super-intelligent as she was at the end of her life. If she stayed as she was after the first two months, her life would have been perfect. Lextech would have paid her a fortune in salary and research funds and stock options. She even would have had a normal appearance, and been able to mix with people from outside the company. Outsiders were a lot less tolerant of the physical abnormalities so many Lextech researchers displayed.

The proper approach, Bernardo believed, was to inject smaller batches of tagged stem cells at intervals, not all at once.. The growth of the <u>corpus callosum</u> would be much slower, and you could stop it before it went too far. Under those circumstances, he decided, he would be more than willing to be Repp's guinea pig. The plan made perfect sense, and Repp should

be willing to give it a try. He would find out when he saw Repp the next morning.

Six months later, Bernardo sat in his study, listening to Bach's *Goldberg Variations*. Now it was clear why Katya spent so much time listening to music, especially Bach. The music had a complexity that could occupy his thoughts for a while, still the constant clatter of associations and ideas. It brought peace, and let him focus on that bright, tantalizing cognition that continued to elude him.

Repp liked the idea of trying a more gradual approach to enlarging the *corpus callosum*, especially since it coincided with his own thinking. So far, the results were excellent. After three months, the physiological change to Bernardo's brain matched what Katya displayed at six weeks. One last dose of tagged stem cells was administered. Neurons continued to grow for five more weeks, then grew no more.

Bernardo was content, but not in the way he would have predicted six months earlier. He had his new home, but it was not the oriental pleasure palace he once envisioned. It was a relatively small apartment, with no furnishings beyond the bare necessities and one small Renoir. Lexstar, to be sure, appreciated and rewarded his recently brilliant work. If he still wanted the sports cars, yachts, jewelry, and everything else from his adolescent dreams, he could afford to buy them. He no longer wanted them, though.

Officially, he was still a student, but he would have his certificate in three or four months, as soon as his laboratory requirements were complete. Cell cultures need time to grow. Except in name, however, he was a respected member of the research staff. The work he defined for himself was challenging, and sometimes his experiments failed. He liked that. Life can't be enjoyed if everything is too easy.

Three others recently had begun the same treatment used on him, so he soon would have companions on his own level. Two of the others were young women. The third was Dr. Repp, who preferred not to be eclipsed by his students.

Sometimes he would think back to the person he was before his stem cell therapy. Even by comparison with others his age, the old Bernardo was pathetic -- pathetically selfish, pathetically materialistic, pathetically self-deluding. The old Bernardo never could have found contentment. The old Bernardo would have gone on struggling for more and more wealth, so he could buy more and more things that could never make him happy.

More important, the old Bernardo never had a clue that there was something else, something important. Something marvelous waited to be discovered, and the search for that something was the center of the new Bernardo's life. It continued to evade him, but eventually he would find it, with a little help from Bach and Dufay and Ives. He had to know it, and someday he would.

Dr. Repp completed the set of computer generated tests, then checked his score and time. One hundred percent correct, and ninety-two seconds faster than the previous week. Better performance than when he was in his early twenties, back when his genius peaked. Most of his career consisted of elaborating a few brilliant insights from his youth. Now those insignts would return, but to a brain packed with knowledge and experience. When he reached Bernardo's level, he would accomplish truly amazing things.

One very important insight already had come to him, though. The new therapy had enormous potential for abuse, especially in the hands of the kind of people who made up Lexstar's top management. Repp kept his reports to the brass vague and incomplete, downplaying the success achieved with Bernardo. Since they were corporate types, not scientists, it was easy enough to distract them with other work being done in his lab. All they understood or cared about was profit.

Repp also had some concerns about Bernardo. The young man continued to be communicative and responsive, and seemed to be enjoying his work, but something was wrong. He spent more and more time listening to that music, just like Katya Riesling, and sometimes he drifted off into his own world. Bernardo said he was looking for something, or trying to understand something, but could not describe what it was. He didn't even *know* what it was, but he knew he had to find it.

It was disconcerting. Repp considered temporarily halting his own therapy, but the prospect of thinking with such clarity

and intensity was too much to give up. Perhaps he would skip the final batch at three months. As for the two women currently undergoing the therapy, he would let them decide for themselves after another two weeks. By that time, they certainly would be bright enough to make their own choices.

Bernardo woke from his dream and knew that, on some unconscious level, he had it. Now he must coax it to the surface, let it dance across his cerebral cortex, flit along every axon, and flood his synapses with its pure white light. He imagined the tinkling of a celeste, the passionate exhalation of a cello, the airy flight of a chorus of trebles carried aloft by their own perfection.

The bed disappeared from beneath him, and for a moment he panicked, terrified by the immensity all around him. His hands grasped at nothing, and then he was back in the simple solidity of his bedroom. He rose from his bed, showered and shaved, then drank a large glass of orange juice. He would not be going to the lab today.

Hunting through his collection, he produced an elderly recording of fourteenth century *ballades* by Guillaume de Machaut. The unusual rhythms and harmonies spilled into the room like sunshine. Bernardo sat on the floor, his back resting against a white painted wall, and let himself be carried through the antique intervals to a place where sound was indistinguishable from light, and both were pervasive as gravity. He extended his bioelectrical field, contracted it, extended it again.

There was pounding at the door of his apartment, still hovering at the edge of his perception. Absently, he stretched out a ribbon of thought and swung the door open. Repp stumbled through the opening.

With each contraction, his energy field became tighter, brighter, more intense. Here it was, the discovery, the revelation. Somewhere impossibly distant there was shouting, pleading. Wake up. Wake up. But it was impossible to be more awake, more attached to all that truly is. Energy collapsed to a point, impossibly radiant, and burst free of the ignorance that constrained it. Now it shot off among the stars.

Somewhere, impossibly far away, the last echo of a voice was saying, “Dammit, lost another one.”

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