

True Life Science Fiction: Sexual Politics and the Lab Procedural

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Science/Sci-fi/Feminism

Science fiction writers and “science” have a dysfunctional relationship. The core audience for science fiction, especially print fiction, tends to be drawn from those in science and technology related employment, self-identifying geeks, “anoraks,” coders, nerds. Readers have a high tolerance for details of lab procedures, engineering problems, high energy physics phenomena, gadget specifications (astonishingly high, relative to the rest of the fiction audience)—yet many express indifference to the *content* of these demanding passages. “You wade through that stuff to get to the story and the characters,” is a typical comment. Meanwhile the writers, a group that includes many passionate amateurs, attempt to keep up with the future. Their preoccupation with “science” is an accident of the twentieth century, their *desire* is to be at the cutting edge of everything, dress codes, black holes, radical politics, melting ice caps. Science fiction writing lives poised on the edge of now, always about to be out of date. The vital element that research lab life shares with the genre could be that mood: the addictive stress of novelty, the pride of stepping out onto empty space—

The genesis of my novel *Life* was in the nineteen seventies, when science fiction took on the novelty of the Women’s Movement.¹ It was a paradoxical meeting. Defining feminist sf texts, notably Monique Wittig’s *Les Guérillères* and Joanna Russ’s *The Female Man*, were (and remain!) lyrical, intellectual, experimental, with passages of theory, a painful naming

of parts, at once too alien and too accusing to be ignored. The average recreational sf fan, male or female, was appalled. Yet the popularizers of this epiphany, the developers who made the novelty saleable and took the goods to market, were Ursula K. Le Guin and the late Octavia Butler—two US writers whose sheer quality and gravitas has had an immense and lasting impact on the genre. A third figure, using the pseudonym James Tiptree Jr (later outed as a woman called Alice Sheldon, which brought about her downfall), wrote novels and stories that combined startling sexual themes with devout sci-fi convention and swiftly collected every honor the community could bestow. It was a Camelot moment, a brilliant anomaly, soon buried.²

Iconic female futures speak bitterness. The most famous, the mainstream novel Margaret Atwood's *The Handmaid's Tale*, features affluent North American women reduced to the chattel status of Pakistani peasants by an ultra-conservative administration. Genre versions anticipated the same theme, i.e., of women crushed under the iron boot of patriarchy, sometimes dragged-up in role-reversal fantasy, sometimes unrelieved (Suzy McKee Charnas, *Walk to the End of the World*),³ sometimes in diptych with a sweet Red alternative (Marge Piercy's *Woman on the Edge of Time*). In the last pages of any of these novels a light glimmers ahead. But don't go there, for if you do, our Utopia will sound as fascist and covertly vengeful as any other; end here, it sounds hopeful... Issues of science and technology permeate these narratives, but the encounter is tragic. *Positive* feminist sf (Joan Slonczewski, *A Door into Ocean*; Vonda N. McIntyre, "Of Mist, Grass and Sand"; Kathleen Ann Goonan, *Light Music*)—imagining a ravaged planet restored by the new, experiments in reproduction and post-humanism, gender-neutral societies; high-tech symbiosis with the living world—is far less likely to be known outside the genre, or to be recorded in the academic canon. Feminism cast as daring scientific endeavor is not easily read as radical politics: the dissonance is too great; women are not supposed to occupy this space. And yet, as those writers of the seventies discerned and as we see all too clearly in this hell-bent, regressive young century, embracing futurism and assimilating *les accidents de féerie scientifique*⁴ (if only in art/drama/fiction) is our only hope.

I saw Joanna Russ's *The Female Man* (1975) in a bookstore in Singapore, where I was living at the time, and walked past it several times before

I picked it up. I found the expression “Female Man” disturbing, and I did not expect to be *disturbed* by the Women’s Movement. I expected feminist theory to tell me only things I knew already. Curiosity got the better of me, and I bought the book and discovered that Joanna Russ was none other than the writer of *When It Changed*⁵ — a new wave sf story, radically feminist yet impeccably science-fictional, that I greatly admired.

The Female Man is a hatchet job. It strips feminism of all sentimental illusion, exposes the (sf) writer as a daydreaming schizophrenic, and presents its women-only world as a dazzling high-tech playground, where duelists strut and genius “IQ” is advisable if not mandatory. I was an instant convert to Russ’s view of women as *human*, dangerous, powerful, and fallible. Overnight, the veiled women in the novel I was writing (set in a far-future South East Asia), stopped being piteous victims and became rulers of the hearth, who had abandoned the public sphere to their men-folk or “studs” of their own free will—with disastrous consequences.

Russ appeared to be a disillusioned fellow-traveler of US (regular flavor, not feminist) underground politics: of urban terrorism, secret maildrops, layers of deception—a world I deeply distrusted. She probably ruined my chances of a career in commercial sf, for which I thank her, sincerely; and she set me the task of stripping down my own, very different illusions.⁶ My writing was a means of naming the parts and, by building functional models, finding out by trial and error what happened when I discarded one unit or another. I produced a series of novels, reiterating in variant forms the only story feminist sf can tell.

But *The Female Man* had shifted my focus. I was no longer describing the battle of the sexes, speaking bitterness and imagining a more hopeful outcome. I was investigating the causes. What is femaleness, what is maleness? What exactly *happens* in the wiring of human sexual behavior? Is the dominance of a male-ordered culture (supported by the women, apparently of their own free will) one of the great problems of our world? Or am I just deluded? Like Ramone, the perennially angry-young-woman who shadows the protagonist’s career in *Life*, I did a huge amount of reading: at first seduced by the blank canvas of the question, then increasingly fascinated by the material itself, the naked equations of sexual difference.

By the mid-nineties the idea of *the female man*—the proposition that our treasured *difference*, the moral identity of women, cannot survive the success of feminism—had brought my fiction to a gender-neutral space that many sf feminists considered positively hostile. I was writing of a future in which the world had divided into two camps of a global low-intensity war: between the Traditionalists, fanatically intent on preserving hallowed male/female characteristics, and the Reformers, who were prepared to let the difference go into freefall. A lot of the Traditionalists were women, a lot of the Reformers were men. The don't-knows had a particularly hard time. There were some aliens too, who had no conception of the sexual other, the either/or, dark/light, active/passive divide: it was the challenge of their arrival that had triggered the gender wars.

As I came to the end of this project I knew it was time to move on from sf feminism. I had nothing more to say. But before I left town I wanted to do something with my research. I'd discovered a collection of articles from the first conference devoted entirely to sexual difference, in which I'd read Jennifer Marshall-Graves's original "SRY" paper, among other despatches from the front line.⁷ Drawn by her reputation among feminists, I had encountered Lynn Margulis's endosymbiotic theory and her stubborn fight to break down the establishment's resistance—on a point of doctrine completely innocent to lay-persons, yet *immediately* recognized by the priesthood as a challenge that shook the pillars of the universe. One meets the same bewildering acuity in all holy wars. I felt there was a story to be told, which would trace the checkered career of a visionary woman scientist and the equally checkered career of a controversial discovery. It would be a fantasy about something going on in the human sex chromosomes, the impossible made plausible by a wealth of technical detail. But crucially, vitally, this change in sexual molecular biology would turn out be profoundly important for all life on earth... And it would be nobody's fault, it would be something inevitable, neither good nor evil, working its way to emergence. (It was nobody's fault that Galileo saw the moons of Jupiter.)

There would be no alien invasion, no divine or demonic intervention, no mysterious Rapture. No single-sex colony on a distant planet, no Born-again Bronze Age matriarchs, no gender-selective genocide, no sex-linked plague. I would return *ad fontes*, to the source of all modern

folklore, whether or not labeled “sci-fi”: science itself—the marvelous in its street clothes.

Shadowing a Scientist

Ideally, science fiction writers should be scientists, tossing-off best-sellers in their spare time. Ideally, they should be working in theoretical physics or engineering; astrophysics, astronomy, and branches of computer science may also apply. This is our long-established, male-typic elite, the standard by which we judge ourselves. (The genre is conservative. Life sciences, until recently considered more suitable for women writers, are coming up fast.) Even now I feel slightly shocked when I hear that one of their number has quit to “become a full time writer.” What a fall! The rest of us are camp-followers, groupies, cargo-cultists, collectors of antique packaging.

I had been writing science fiction for more than a decade without ever going near a lab. For the Anna Senoz novel I needed to enlist a scientist, and this was alarming. I had been working with Richard Crane (now the Convenor of Creative and Dramatic Writing, at the Centre of Continuing Education, University of Sussex, UK) on community writing projects. I asked him to be my matchmaker. Could he find a molecular biologist, preferably female, who would be willing to talk to a sci-fi writer? Who might even let me come into a lab and be a fly on the wall?

My first approaches were not successful. I find an entry in my notebook, after one phone call in which I'd been given a short, sharp answer. Here's the catch. Women in science are likely to be hard pressed. *Oh dear, I've hit the busy people. This isn't going to work; why should anyone make time for me?*

Eventually, Dr Jane Davies agreed to see me.

I prefer to do my own research. I read everything I can get my hands on. I do my best to understand, or at least to capture the ambience; and then I make it up. Conformity to today's knowledge base is beside the point in sci-fi. The Higgs boson discourse will no doubt have moved on, two hundred years from now—if anybody cares at all. When I have to call in a specialist, I try to use (and not to abuse) a personal contact. I don't tend to ask questions, because I fear I'm too ignorant to think of the

right way to frame them. I tell my story, explain how the device or special effect is supposed to fit into my plot, and the specialist makes objections. This seems to work. I had no list of questions with me, no tape-recorder either, when one morning in November I set out for Sussex University, my old *alma mater* (where I had wasted three years of my parents' and my government's money, once upon a time).

At Sussex, four miles from Brighton, on the edge of the south downs, the Great Divide between arts and science is physical and dramatic. Arts is in the green valley; Science occupies a concrete hillside. I announced myself at the porter's desk in BIOLS, a building in a part of the campus I had never entered when I was an undergraduate. I approached the corridor lined with office doors expecting very little. I thought I'd state my case, go away and wait for Dr Davies's decision. I was concerned because I was going to have to talk about feminism right away, or I'd be under false pretences, and I didn't know how she would react. In my experience successful professional women are often very wary of that word. It's demeaning.

Feminism? Special pleading, whiney nonsense. Get out of here!

I saw a woman in a white coat, maybe a few years older than myself (but I'll feel childish 'til I die), with a warm smile. I stumbled through my intro, and Dr Davies showed no sign of impatience. Unprepared, and babbling I'm afraid, I began to tell her my story—

“The important thing to remember is that Anna isn't interested in sexual politics or politics of any kind. She's not *anti-feminist*, she'd say she just wants to be treated like a human being. She's ambitious, secretly and wildly ambitious. When she's an undergraduate she dreams of finding a missing link—some mechanism to bridge the gaps in evolutionary theory, giving a better model of life itself. But that's a daydream. In real life she's an idealist; she wants to do good. She decides on a career in plant biology, improving food crops (sustainably of course). Feed the world. But she gets derailed by bad luck involving a male student who probably resents her talent. She ends up in human fertility studies, and then she spots something going on, a tiny change in a sample of male sex chromosomes, which she sees at once might have a very weird explanation...if it's not an experimental artifact. She checks it out and is convinced she's

on the track of something, and I'm not sure how, but in the end this will happen *fast*, become visible and unstoppable *fast*, within a generation.

"Is it possible? I know they don't usually but do the X and the Y ever exchange bases, would it be obvious or could it appear and disappear, the way I need—? At some point she's forced to sacrifice her career to her domestic responsibilities—"

I trembled every time I had to use a technical term. *Mitochondria*, how do you pronounce that? I rambled around, explaining about taking things apart, identifying er, the basic components, as if that's what's important... I remember Dr Davies gently prompting me. "Reductionism—?"

"Uh, yes."

Reducing dramatic situations to their component parts, isolating them from the real world, is science fiction's most treasured technique, borrowed from science itself. But Anna's story had to be natural, complex, full of inextricable connections, like a novel about real life. And here I was asking a scientist to help me—

I was extremely exposed. All I could do was cling to Anna.

She keeps coming back to the thing she saw, and finding it again, and getting more and more excited. She knows it's the key to a BIG discovery, but she knows, and it turns out she's right, that the sex angle will be her downfall. It's what happens to women in science in real life. Because they have children, or a husband who doesn't like their long hours, or a superior, or a grants board, tacitly, unthinkingly, marking them down, or because they make male colleagues feel insecure (though you can never say that). It's meant to be read doubly: a young woman who wants to be a *pure* scientist and has a very idealistic notion of what that means, but she keeps being brought up against the sex angle—

I have pages of scribbled notes from this interview; it was astonishingly successful for me. There are no notes about my state of mind, but I know how I felt. I'd been trying to teach myself molecular biology, from a half-page of misunderstood notes washed up on a desert island: and was plunged into a masterclass—

Interview Notes

A transfer of material from the Y to the X, with some selective advantage?

The X and the Y don't usually exchange recombination, they're too different in shape, but there is a small area where this male donation could happen —

A benign mutation, fixed in the population for thousands of years?

A tiny change in the amount of Y (more)

Conveying resistance to our increasingly toxic environment?

What's needed is a horizontal transfer

Transposons. What about transposons?

(Transposons were my big idea—)

What do you see? When that happens? A band changes in size?

Spontaneous change causes transposable elements to mobilise.

At least 10/15% of our DNA is made up of transposable elements.

They can act like viruses. . .

She would note this change, publish a paper in "Trends in Genetics"

a scientific journalist would pick it up from a database

Very bad news if your supervisor doesn't know what's in your graduate paper. If it's published without her supervisor's name, that's a crushing blow —

I had not decided *when* my story would start when I walked into Dr Davies' office. Possibly the near future? As we mapped out Anna's career for her, as if she were setting out now (a game of snakes and ladders: that's not going to change), I made an instant decision. She starts from here —

She knows nothing about seventies feminism (although she's going to meet a ferocious, defiant young feminist). She's eighteen, proud and brave, and the Spice Girls have just released "Wannabe." She's *disgusted* by girl power —

She gets a good first degree

A science department gets a quota of grants

Your supervisor puts you on a project

For three years. It's not enough time.

The nature of lab-based science makes it impossible to survive for the fourth year. Industry sponsored studentships, for top-up grant support. Student works w. industrial partner, but no guaranteed employment.

Many supervisors use their students as technicians, you could end up without much choice of work.

In academic science you can keep going on short-term contracts. But you have to have a permanent job by 35-40. Teaching, administration, grant organization.

Publish! Publish! Publish!

Her own research is always going to have to give —

Serendipity: I was very lucky to have encountered someone who was prepared to countenance my proposal: to recognize and nurture what faint resonance it had with her professional knowledge. Perhaps even luckier to meet someone—outside science fiction or academic literary criticism—who grasped the idea of a *doubled* narrative, where the information, the sequence of events, is meant to convey at least two meanings at the same time. Or perhaps that wasn't luck. The genome is the original complex, layered, looping, interactive narrative. A gene may “mean” several different things. Depending on the location, depending on the bases upstream and down; depending on the weather in the cells...

Simplicity as a result of complexity: this is a historical document. I met Dr Davies in 1996. The human genome project had begun in 1990. The Y chromosome would not be sequenced until 2003. In 1996, horizontal transfer of DNA, in a population, between species, was verging on science fiction, to coin a phrase. I was to spend the next few years, as I wrote and rewrote this book, rearranging my fantasy science so that it could live in the chinks between real world discoveries (conditions, current affairs): my understanding of the science growing more sophisticated, and the surface of my fiction growing sleek as flesh and blood.

Some things certainly haven't changed. In 1996 there were initiatives, conferences, workshops, on the Women in Science question. The hemorrhage of female graduates, from both public and private sectors,

was being debated. “Everyone” knew about the hoops women had to jump through to get grants, the scandal revealed by blind testing of the funding application process; the dearth of women reaching high-level, role-model, influential posts. And yet, just as now, girls like Anna, talented and liberated, were supposed to be having it all. If Equal Opportunities didn’t work for them, there must be something wrong with the girls.

(My memories: Once, when I was twenty or so, a fellow undergraduate jumped on me. We were alone in a student rented house, a grimy front room with a mattress on the floor, posters of Ché and Dylan. He was one of the circle of friends, by no means a close friend of mine. What did I do? I fought him off. He came back for more, I kept on fighting. I did not scream; of course I didn’t. I went on fighting, silently, until he finally quit. But if he had persisted, I would have had to give in. I would not have called it “rape,” not unless he’d beaten me unconscious or tied me up or something; and I wouldn’t have dreamed of reporting the incident. Girls usually don’t. What would you say, in the face of his convinced denial? It’s true, I let him do it. He didn’t rape my body, he raped my mind, he forced me to accept his version... Nah, better keep quiet. Expect to be insulted; understand that you always have to be careful.)

After about an hour, I took away the ideas I’d been given, the insights into the feudal relationship between a student and (her) supervisor, and the promise that I could have a lab visit. My sense of astonished daring, my feeling that I’d entered a sanctuary, a holy place where I had never expected to tread, was no part of the interview. But it was to become part of Anna.

She spent the lunch break lurking in the crowd, unmolested. In the middle of the afternoon she presented herself in good time. Professor Reeves of Computer Science, who was running the symposium, greeted her distractedly.

“Who are you?” His grey curly hair fizzed with anxiety.

“I’m Anna Senoz, from Parentis.”

“Good, good. Now look, er, Anna, we’re running late, it’s going to be very unfair on the last group, so could you make it short. Get through your stuff in fifteen minutes, instead of twenty. Can you do that for me, love?”

“Of course.”

“Good girl! Now where the hell’s Eswin? Anyone here seen Terry Vick?”

She scanned her pages and made instant cuts. It was better this way: hustled, badgered, no time to think. It would be no worse than talking to a nearly empty hall, the way she’d imagined. There was no one here remotely interested in “Transferred Y.” This was a rehearsal, harmless as practicing in front of the mirror. Her heart beat wildly, she felt like a half-fledged bird crouched on the rim of the nest: “*Ca, mon ame, il faut partir...*” Who said that? Rene Descartes, as he lay dying. My soul, we must go. But she was not dying, she was being born. She was about to join the edifice, the organism, thousands of years, to which she had given her life and heart. To speak and be heard. She checked the OHP, made sure her acetates were in order—and saw K.M. Nirmal, sitting erect in the middle of the front row. She hardly recognized him. Her supervisor was wearing a very smart suit. She’d never seen him except in a lab coat or a shabby sports jacket. He hadn’t said a word about attending the symposium. Her head started to spin. To speak in front of Nirmal was *completely different*.

She began.

That evolution is still a mysterious process, with many unsuspected byways, and perhaps she had found an example of one of these. That her predecessors in sequencing the Y chromosome had worked like this.

That she was analyzing samples of DNA from healthy, normally fertile contemporary human males and from recovered medieval tissue.

That her technique was like this (including the tweaked modeling program). That she had repeatedly observed an exchange of the same sequence of bases, between the Y and the X chromosomes in the modern samples. That she had found no sign of this polymorphism in human male DNA from a similar

geographic location at an earlier date. (The Huit Bories samples.) Further investigation was indicated. Was there a female version of “Transferred Y,” passed on by affected males to their daughters?

Meanwhile here was a distinctive genetic variation, apparently fitness-neutral, that had established itself in a human population in a relatively short time. How this happened—if it was not disproven by further evidence—and whether there were other instances of the same mechanism, continued studies might reveal.

The previous speaker, Eswin Holmes (Bacteriostatic Effects of Food Preservation) had overrun his fifteen minutes a little. Therefore, after about thirteen minutes and a quarter, Professor Reeves started making urgent *wind it up!*, signals. Anna wound it up. She was pleased with herself for being in control enough to do that and still more or less make sense. No one was listening, anyway—except presumably Nirmal. She dared, as she delivered her final sentence, to risk a timid glance in his direction. He was staring right at Anna, his eyes blazing with naked fury. As she watched, horrorstruck, he got to his feet, pushed his way along the row, and marched out of the hall.

There were no questions.

The symposium had been on a Saturday. Nirmal kept her waiting for a week before he called her to his office. No one else had mentioned the symposium except Ron Butler (m), who made an attempt to congratulate her on breaking her duck. Anna thought the delay was a refinement of cruelty; she realized later that Nirmal had been giving himself a chance to calm down. The worst part was that Anna hadn’t an idea what she had done wrong. He’d accepted her Transferred Y outline without comment, merely telling her to carry on, and she’d been too unsure to ask to talk it over. She’d handed him a copy of her final draft and waited hopefully for his input. She’d been disappointed when he failed to make any response, but it was typical of Nirmal.

The best and worst thing about the interview itself was that everything became very clear very quickly.

“So, Miss Senoz. I gather that the work we have been doing together has been far from worthy of your undivided attention. When I suggested that you give a paper at the Young Scientists’ symposium, I think I had a right to assume that your presentation would focus on the doctoral project you are undertaking with my supervision.”

“I’m sorry,” she whispered.

“But no. Your mind is elsewhere.” He lifted a copy of Anna’s “Transferred Y” paper and slapped it down on his desk as if he hoped to break all its bones. “If it cannot be distorted into the service of your much more interesting private preoccupations, your work in this lab does not engage you at all. I trusted you implicitly! It was extremely, extremely unpleasant for me to discover, in public, that you had chosen to present a peculiar hobbyhorse of your own—”

Anna was dumbfounded. It dawned on her that Nirmal had not read her outline or her paper. Of course, he’d assumed he *had* read it. He knew everything she’d been doing on the pseudogenes. He’d assumed she would be going over that ground. He had not made time to check up on her, or it had slipped his mind, or he’d let it go because he hated one-on-one meetings. She stared at her hands, clasped in her lap to stop them shaking, and wondered, how on earth did someone as allergic to personal contact as Nirmal get to be a postgraduate adviser? It wasn’t because she was a girl, he was as distant with the male members of the team. Everybody complained about it.

That’s science for you. The better you are at what you do, the more time you’re doomed to spend doing things you’re no good at. Her terror was strangely dissipated. *No way* was she going to remind him that he’d told her she could do what she liked. *No way* was she going to point out that he’d had every

opportunity to find out and had omitted to make sure he knew what his student was going to say in her first public appearance.

“Until you are free to return to your beloved potatoes,” Nirmal was saying, with withering politeness. “I expect you to concentrate *mainly* on the tasks in hand here.”

Anna nodded: accepting her lessons. Anything you say in the lab, your supervisor is going to hear. Anything you do, it is your responsibility to make sure your supervisor knows about it. Don't take chances with the natural human vanity of your boss.

“Professor Reeves intends to publish a transcript of the colloquium. Needless to say, *this* will not feature. It will never be published. I cannot consider putting my name to it.”

She nodded again. She was no longer devastated. She knew he would not be unfair in his personal record. Neither of them would say it, but he knew he'd been neglectful.

“I'm sorry,” she said, standing up. “I got carried away. It won't happen again.”

“Good. I hope I can trust you from now on.”

She reached for the paper. Nirmal's thin hand came down upon it, the nails almond shaped and calcined, thick as seashells. He didn't speak, so she headed for the door.

“Oh, Anna—”

She quailed. What now?

“This is very good work,” said her supervisor dryly, tapping the Transferred Y paper. “Wrong-headed, even absurd, in the implications, which you wisely didn't spell out. But bold, original, well-reasoned, and well-presented. Your technical work is also very good. You have a formidable talent, young lady. But you must focus. Focus!”

“Thank you,” she muttered. “Thank you, I'm sorry, I will.”

“A formidable talent,” repeated Nirmal. “Don’t waste it!”

[Extract from Life, Chapter Two: Anna Anaconda]

(My present: I watch the extreme sports programs on late night tv, with my son. I see those young men leaping into the empty air, their preternatural confidence: as if they have an immediate, physical sense of their place in the whole of this state of all states, this state of affairs, a path they follow that will never let them fall. The truth is that they DO fall, crash and burn, smash their elbows, snap their collarbones. But they don’t care. I wonder, is that leap into space testosterone, or nurture? Is it something I could never learn, or is it something I could find in myself, an atrophied skill? What kind of human being am I?)

Shaking B. Polymerase Chain Reaction

28.1.97 Martin shows me round:

A Biology lab, too warm. Long islands of benches, clutter of equipment, screwtop jars with masking tape labels. Post docs in jeans and teeshirts. Names of the machines: a microwave oven bought from a chain store, various devices for long-term shaking of things. A squat pyramid with a rubber cone let into the top vibrates a microfuge (eppendorf) tube. The fridge freezer, the PCR machines, the gel trays linked to a row of transformers. Designed so you can put your hand in the electroporesis liquid with the current running. For sequencing the voltage may be very high, today it's not critical. The prep room where tech support staff make up mixes from enzymes and proteins bought in bulk. The fume cupboard, the camera in a closet, Eagle Eye, where people take pictures of their gels. Moments of tension, sometimes no bands appear.

Blots and Gels

Anna wanted to tell them that when she studied a protein separation gel, it was like a negative image of the starry sky. She was an astronomer, a cosmologist, a particle physicist: knowing events by their traces, through a chain of mathematical inference, never able to perceive her quarry directly. She wished she could make her friends understand the vast *distances*: which was far more important than worrying about vanity parenting or whether men or women owned the jargon. It is so far away, you can't imagine how far. We don't exist there. They don't direct us, no more than the stars direct human affairs. We are part of the same system, obeying the same laws, but we hardly begin to understand what the laws are. Maybe we're still waiting for Galileo's telescope...

[Extract from Life, Chapter One: The Spirit of the Beech Tree]

Dr Davies had advised me to listen-in on some lectures. I turned up and snuck in at the back of the theatre for Janet Collett's Eukaryotic Genetics (1996/7), "Heritability; Genetic Constraints of Selection; Recognising, Saving, and Using Genetic Resources." The lecturer was a tall woman with a graying braid, dressed in work shirt and jeans; unpreten-

tious and kindly. The students liked her, evidently; so did I. My way had been prepared for me. When I first appeared, someone came up at the end and asked, “Are you the science fiction writer?” I nervously agreed, and that was all. I copied diagrams; I made adjustments to the ideas formed by my amateur reading. I discovered how fluid, how interactive the genome was becoming, how much unsuspected complexity had been uncovered by the failure of early attempts at “genetic engineering.” It’s not that the processes aren’t predictable, they’re just far more intricate, and there are far, far more variables, combinations, feedback loops, than had been dreamed possible. I pondered on transposons, viruses, cohorts, methylation, environmental factors.

Polymerase Chain Reaction #2

The project involves a gene in *Drosophila* called Shaking B that affects nerve/muscle junctions. The object of this exercise is to try and pinpoint the working part of the code. Martin is using a different technique in this reaction—a section of DNA with an added long tail of nucleotide bases that will help him to spot his target. PCR record sheet, check boxes. Use the micropipette to make up the mixture of cutting enzyme, buffers, template, de-ionized water etc. Add a thin film of oil to prevent evaporation. The enzyme is a special one that is thermostable to 95 degrees centigrade. Shake the tubes, using the machines that shake them, and insert in the PCR machine.

Micropipettes are robust, practical looking dispensers, disposable tips, use and eject into beaker (bin) Care must be taken to let no part of the pipette beyond disposable tip touch microfuge, DNA is everywhere.

Names on masking tape, like on food in a student fridge. Post-docs are in their late twenties. Pressures on labspace, supervision hours = many undergrads do no practical work, except by-rote prepared experiments. A few will be lucky enough to do a 3rd year project.

In the late nineteen-thirties (this was before Crick and Watson, before the dramatic revelation of the structure of DNA) something highly critical happened to genetics, which until then had been a patient science of organisms and cells, where the result of a cytology experiment had to be read in the variegated color of a flower; in the shape of an insect’s wing. The technology improved and the physicists moved in, notably Max Delbrück, bringing their mechanistic, reductionist (that word again!)

world-view. For more than thirty years thereafter, DNA was the miraculous blueprint (this was what they taught me in school, in the nineteen sixties): changeless as the fixed stars—except when a random mutation, conveying an advantage at some level, propagated through a population via fitness selection. It was a beautiful model, pure and simple, and essentially tragic. Every organism, every gene, was an isolated warrior, forging alone through the ages, ruled by arbitrary fate. And it was wrong.

It was wrong, but inescapable (it remains, with grudging concessions, “received wisdom”). You believed in the physicists’ version or you didn’t work; or if you worked you were a crank, unpublishable: you were nobody. The heroes of the resistance (Lynn Margulis, Barbara McClintock) suffered quite horribly, especially McClintock. It was like being nailed as Un-American, except nobody talked about a blacklist. I was proud of them. Yet if I had been a female biology student in the fifties, the sixties, wouldn’t I have been *very* careful not to associate with anything cranky? Can’t be too careful. Wouldn’t I still be wary today? I felt my native caution welling up: if someone is called a crank, there’s usually something in it. No smoke without fire. Just because I write sci-fi, doesn’t mean I’m gullible.

But I took comfort—I take comfort—in the big mistakes of science. Sun still going round the earth, anyone? There’s no mystery as to how a revolution happens. As long as the accepted theory works and produces good results, a few mavericks can easily be ignored. When cracks begin to show, they are shored-up and painted over. All human structures protect themselves. The life of the mistake is prolonged by peer-pressure, by witch-hunts, by more or less wilful blindness: whatever the market will bear. But sooner or later, the mistake is defeated by its own success. The bigger and more pervasive the system gets, the more the contrary evidence begins to mount up, too, until a tipping point is reached. Anyone can suppress the truth. You can suppress the truth as often as you like. But there comes a point when you can’t suppress the facts, because there they are! All over the place.

The idea that gender is all important could be simply wrong. Down among the chromosomes, among the bases, the science is neutral. Every human body (right now, no fantasy intervention required) is a mosaic of male and female cells. If we were to look for sexual identity on that level, we’d be very puzzled to exercise our apartheid, our decree of either/or. The

whole idea that humanity is divided into two halves could be a chimera.⁸ One day it might vanish, like the Cold War, like the crystal spheres, like canals on Mars and jungles on Venus. People born with currently recognized X/Y pair problems would be treated only for the medical ill-effects. Parents and doctors would be less concerned to have babies with “indeterminate” genitals corrected by surgery. There’d be people who felt themselves to be men getting pregnant; people who felt themselves to be women at ease with their penises. People who just couldn’t see the problem, letting their “sexual identity” go into free fall. And then everyone would—

Be happy?

Better than that. Everyone would be the same as before, or that’s what they’d tell you. Successful revolutions vanish, nobody realizes they happened.

*Dark they were, and golden-eyed.*⁹

Random Lecture Notes

The rule is not “if you have a Y you’re male”

It’s 1X+2 sets of autochromes and you’re male

2X+ 2 sets of autochromes and you’re female.

A molecular mechanism that can distinguish one from two is sophisticated

Triggered by meiosis sorting X from Y or X from not-X

Y in flies, not necessary for male identity, is necessary for spermatogenesis

Environmental cues can also be used to determine sex, e.g., reptilians (temperature); sea worms — an embryo develops as male if near another embryo that’s developing as female.

Genetic determinism = the genotype drives all subsequent behaviors = wants to ascribe all behaviors to one part of a process

Vast fruit fly chromosomes looking like the Alphabet necklace in “Just So Stories”

1966 refined specific enzyme assays in plants = wild type alleles were hugely variant! = we are extraordinarily variable, not only between genes but inside genes, in the coding systems of proteins

1944 Oswald Avery, Colin Macleod, Maclyn McCarty, identified DNA as the “transforming principle”; but cautiously hedged their conclusions. It was in the middle of the war but Avery isn’t a legend, nobody’s heard of him, because he wasn’t the alpha male type. Discuss.

You have to be ruthless and driven to get to top, in science as elsewhere, but a woman with full domestic support immediately becomes a man — a man who makes time for his personal life, his family, in the chinks allowed by lab science.

¶ Feeling for the Organism¹⁰

In our first interview, Dr Davies advised me to read Evelyn Fox Keller’s biography of Barbara McClintock, *A Feeling for the Organism*. All I knew about Barbara McClintock at that time was that she’d discovered “transposons” in maize—the jumping genes I’d read about and pounced on as a possible mechanism for my “Transferred Y” idea—; and won a Nobel Prize. It took me a while to get hold of the book. When I finally read it, chills went down my spine. The parallels between the story of this dead woman scientist of genius and my Anna were startling.

Barbara McClintock was born in 1902 and got her PhD from Cornell when she was twenty-five. There were no careers for women in scientific research in those days. She spent her life on the margins, amassing awards and honors, collecting fellowships that financed her research: never appointed to a post to match her reputation or her achievements. Her gender was “always there, always intruding” (Fox Keller 76). Male colleagues acknowledged that she was brilliant; they were in awe of her “surpassingly beautiful investigations” (Fox Keller *xviii*), but considered her “difficult,” if not slightly deranged, when she protested at being passed over for jobs.

She became increasingly isolated after the advent of Molecular Biology, and her discovery of “transposition,” announced in 1950, was dismissed as invention. Her results did not fit into the model of the gene as

a fixed, unchanging unit of heredity. It would be more than twenty-five years before “transposons” were recognized in bacteria and the connection with her work was made. She was awarded the Nobel Prize in 1983. The implications of her work are still expanding, still causing controversy: perhaps, who knows, she’ll be remembered in the end as the woman who discovered a better model of life itself.

Most biographical summaries, articles you’ll read on the web, gloss over the “delay” in recognizing her discovery. Actually, you see, McClintock *was* difficult, and more than a little strange. She saw things nobody else could see; she had ideas nobody else could conceive. It was no wonder people found her hard to understand—it was her own fault, really. So was Richard Feynman a little strange, by all accounts. So was Albert Einstein hard to understand. Don’t get me started on Isaac Newton. Being difficult and hard to understand didn’t do *their* careers any harm. They had permission to be extraordinary. And here lies an issue for women in science that I had not suspected and that had no part of my original plan.

“Keep a cobbler’s job,” Einstein once said. But isolation from the mainstream has a high price, especially in lab science. By the time Barbara McClintock announced her “transposition” discovery, her vision was so differently trained, she was so preternaturally expert in the field of one that she had created, that other scientists literally *could not* see what she was seeing through the microscope. Even modern Molecular Biology is a “black art” (the organism fights back!). Samples behave differently in different culture mixes, visual acuity and deft hands make the difference between success and failure. Talented experimenters can produce perfectly genuine results that nobody can replicate... I’d walked into Dr Davies’s office with an idea for a story about a woman scientist. I hadn’t intended for Anna to be a “genius.” But maybe it’s the discovery that makes the genius, and not the other way round: a compelling insight that gets hold of a trained mind, and will not let go, and forces that mind to grow, to become the equal of the thing it glimpsed... Because of Barbara McClintock and Lynn Margulis, too (and others, the roll call stretches back), the issue of fame had to become a part of my novel.

But at least Anna was no longer alone. She was part of the ongoing drama in her field: life science riven by passionate loyalties, cold-blooded feuds, vicious disputes. She was a samurai serving her lord, then

she became the handmaid of a visionary recluse; eventually she was the team-leader of a furious, sleepless race to be first past the post, with the proof that everyone in the game was madly chasing—

Coda

At the end of January, 1997, I had my last session in the BIOLS building. I sat in on a team meeting, in Dr Davies's office, keeping quiet, taking notes.

Business

JD: hopes the building work won't be too disruptive. The radiation area will go, needs a new home at the back of the lab, must have a separate room, nice surfaces—

Martin: says he needs to upgrade Word on the PowerMac. Can't defrag the hard drive any more. Is anybody in charge of the computers?

Work

Trying to make antibodies to Shaking B. There's a commercial firm in Belgium that will make them for us. Martin and Lucy have been designing peptides for the anti-serum. When David Beckham (not the footballer) came here he was talking about a wonderful new way to couple antibodies. Keyhole Limpet hemocyanin.

Unfortunately he still hasn't sent us the references—

Tanya is still doing hybridization, been doing Southern Blots, got v. high background and can't wash it off—

Do you have enough leech DNA to make another blot?

If you're doing some, give the carcass to Tanya

It's impossible to grind up that elastic skin—

This is how it sounds, looks, this is how things are done that have never been done before. The Shak-B gene, neurogenesis, gap junctions, CNS, wonder if I'll ever find out what happened... Wonder if *any* of

these notes will turn up in my book, in any form? I was thinking about an expert system who was almost, arguably a person (call the Turing police!), and a storming guardian angel who would keep pestering Anna to get radical. I was preparing to take away with me, folded down small, the slightly rank smell of the big warm lab, the calm atmosphere in here, and a feeling for the vast complexity, the intricacy and individuality of the very small. Creatures of another world, speaking to us in their own language. How far away, how far—

I was supposed to go back for an internship, maybe in April '97, but I didn't. Perhaps I was too busy. I was on the Committee for Amnesty International UK's Women's Action Network, I was helping to set up a "feminist" website (short-lived!) for my local internet provider. There was always something. I have a last note: not referenced or attached, "you're going to have great difficulty getting this published." True enough. In 2003, when the latest rewrite was wandering the Western Seaboard of the USA, passed from hand to hand, my friend Timmi Duchamp contacted me and asked if she could publish it, for her new venture, The Aqueduct Press. *Life* won the Philip K Dick award for 2004. In 2006, I was invited to speak on a panel on Women in Science, at a literary convention, where I had to field some entertaining questions. I don't *know* much about the secondary school science curriculum. I did my best.

I watch my son's friends. How unaffectedly physical the boys are with each other, how easily they relate to the girls; now the segregated years are over. But still the young girls dress up in spike heels, fragile blouses, and tight little skirts. Maybe it's meant for dominance display (Spice Girl style), but I think of the Chinese proverb, *binding one's feet to prevent one's own progress*. More than likely there'll be another Women's Movement along soon. Right now there's a war on, that's the main story, and permanent warfare isn't good for women's rights. Or men's rights, really.

The story I told in *Life* is true. I wonder when it will be out of date.

Eppur si muove.

With grateful thanks to Dr Jane Davies, Dr Janet Collett, and the Shak B team, 1996/7.

Notes

1. The sf feminism of the seventies and eighties could trace its lineage in the USA through crusading women writers and editors of previous decades, to the Utopian New Woman fictions of the early twentieth century (Charlotte Perkins Gilman, *Herland*). But knowledge of this genealogy came after the fact for most of us.
2. Jeanne Gomoll, in her “open letter to Joanna Russ” describes the situation, and the swift reversion to the status quo that followed. It can be found online (<http://www.geocities.com/athens/8720/letter.htm>).
3. “Only one science fiction book in hundreds manages to convince the reader that it ever could have happened anywhere, and at least that few are worth reading at all. In *Walk to the End of the World*, Charnas has created a future that is at once believable and fascinating.”
—William S. Burroughs
4. “Que les accidents de féerie scientifique et les mouvements de fraternité sociale soient chéris comme restitution progressive de la franchise première...” Arthur Rimbaud, *Illuminations*
5. “When It Changed,” Joanna Russ, 1972. First published in *Again, Dangerous Visions*, edited by Harlan Ellison; subsequently much anthologized; text online at: http://www.scifi.com/scifiction/classics/classics_archive/russ/russ1.html.
6. I’ve written about this experience, find it here: <http://homepage.ntlworld.com/gwynethann/OSLO.htm>.
7. *The Differences Between the Sexes*, eds. R.V. Short and E. Balaban, Cambridge University Press, 1994; reviewed here: <http://tracearchive.ntu.ac.uk/frame/freebase/free2/gjones.html>.

8. This is not my story; it's a story told as a science paper, with great verisimilitude, by a writer called Raphael Carter: "Congenital Agenesis of Gender Ideation," *Starlight 2*, edited by Patrick Nielsen Hayden, Tor Books, 1998.
9. "Dark They Were, and Golden-Eyed," Ray Bradbury, *Thrilling Wonder Stories*, August 1949. Bradbury's poetic vision of cultural change, mysterious and absolute, resonants beyond his times.
10. Evelyn Fox Keller. *A Feeling for the Organism*. New York: Henry Holt & Company, 1983, 1.