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Flora

by David Rose

I CAME ACROSS her first in Kew Gardens. I watched her scrambling over the rocks of the rockery, and wondered how long it would be before a warden (are they called wardens? Not guards, surely) remonstrated with her.

Strangely, none did.

A little later, she was in the Alpine House, peering at a saxifrage on the Arctic bench, notebook and pencil in hand. I contrived to peep over her shoulder. She was sketching it, not merely noting its name in the manner of most botanical tourists. The sketch was most accomplished, in my humble opinion.

Later still, she was back on the rockery, sitting on a slab, her feet in the stream, plimsolls by her side, sketching a contorted pine. This time, after a few minutes, she *was* cautioned by one of the staff. She tossed her hair, picked up plimsolls and rucksack and walked away barefoot across the grass.

I completed my seasonal tour of the woodland beds, then went to the Orangery for a little sustenance.

I have never believed in fate, although I have several times been tempted. But there, in my carriage on the train home, she was. Feet – *sans* plimsolls – on the opposite seat, a hibiscus blossom, picked, I surmised, in the Tropical House, braided into her hair.

She was blissfully unaware of my disapproval.

I was preoccupied in the weeks after my visit to Kew. I had discovered a fungal infection on a Japanese maple which – the nub of my concern – is host to a rare codonopsis, one I had (I'm boasting here) grown from seed brought back from China.

I spent anxious days swabbing the bark with soft-soap and water, checking morning and evening for any fresh irruption.

Yet even as I swabbed and scrubbed, I had to admit to a sneaking regard for the fungal growth – not only its persistence, but its own strange beauty, the subtlety of its opalescent colours, the intricacy of its structure. Are we right, I wondered, to divide nature as we do?

Nonetheless it had to go, in deference to the codonopsis. Anxious to implement some prophylactic measure, and as my modest library had exhausted its usefulness, I went to the local reference library.

Needless to remark, there she was, still barefoot, her hair, draped over one shoulder, curtaining the book over which she was hunched.

I went on to the next bay, Pests and Diseases. I removed several books en bloc for perusal and noticed that, through the resulting gap, I could observe her at her desk. Her posture was one of total concentration. Her stationary arm, deeply tanned, pointed toward me. The elbow was rough, dry, white against the tan – from propping up bars, perhaps. But that, on reflection, was prejudice, for which I mentally rapped my knuckles.

In fact, on further reflection, I realised that what I had caught in myself was closer to tenderness, almost pity, for that nonchalantly uncared-for patch of skin.

I took my pile of books over to the furthest desk and arranged them into a little wall. They turned out to be limited in scope. My best option was to consult the bibliographies and

order the most promising titles commercially. I whittled down the list to an economically feasible number and came away. I think she was still there; appeared, in fact, not to have moved.

Such is the demand for quasi-academic textbooks that it was some weeks from my initial enquiry before I was able to collect them. I went straight round after receiving the bookshop's postcard (I rarely answer the telephone).

She was – I had almost expected it – there, in the Botanical recess. As I waited for the assistant to locate, price and wrap my books, she came to the counter. She was holding a copy of Wilson's *Flora Pyrenaica* from the second hand section, but judging from the binding, it was the 1907 edition.

Hesitantly, I said, "You do realise there is a later edition, superior to that? Your edition is incomplete; it suffered a partial appendectomy in the printing. Do they not have a copy of the 1912 edition secreted somewhere? Let me ask for you."

She finally looked up.

She said, "This is okay. I only need the illustrations. And it's cheap."

I said, "You're on a budget? Student, then? Where are you studying?"

She gestured vaguely. "Up at the College. Holloway."

"Botany? I understood they had closed the Botany Department. They have sold off the botanical gardens, I know."

"Oh, it's rumoured."

"In what does your course consist?"

"A little of everything."

"A foundation course?"

"I suppose so. But I want to concentrate on botanical illustration."

I thought of the fungus, and the little patch of dry skin.

I said, "The departmental library – doesn't it have the Wilson in any edition?"

"I don't think they have the library now. Perhaps it was sold with the gardens."

I said, "That's scandalous. But look, I have a modest library at home. You would be most welcome to use it. It would save your book grant. I take it you have a book grant?"

I gave her my card. It was slightly dog-eared from my wallet. I rarely have cause to give them out. But she didn't seem to notice, just tucked it into her book.

We had settled into a spell of fine weather, so I was spending more time in the garden. I even had time, between tasks, to admire the results of my work, to enjoy the garden as a visitor might. The maple was showing no sign of further infection, and the codonopsis insinuated through it was budding nicely.

As I raked the gravel of the dry pond in the Japanese section, the sun was setting, the light sifted through the black bamboo, shadowing the stupa. The breeze stirred the wind-chimes.

I crossed to the bench in the Mediterranean section to catch the last of the sun before beginning my watering regime. My footfall in the gravel released the scent of lavender and cistus, and suddenly I felt absurdly happy. Also, a sense of privilege, I would have to call it, that I was able to enjoy all this. I felt obligated to share it all – that my work was in vain if it were all for myself.

I looked across into the sunset, watching the bronze heron as it sank into the dark.

Next morning it was raining.

I answered a knock at the door around midday. She stood, one foot on the step, the other still on the path. Her hair was

gathered into a single braid which hung round her neck and over one breast.

I waved her in.

She said, "I'm so sorry to intrude. I just wondered ... Do you happen to have *Orchidaceae of the Amazon Basin*?"

I noticed then that she had a faint accent which, despite my years of travel, I couldn't place.

I said, "As it happens, I have."

I led her into the sitting room-cum-library. As I unlocked the glass of the bookcase, I could see her peering in.

"You have *The Clematis in Western Culture*?"

"Yes. First edition, as it happens, with the hand-coloured frontispiece."

"And *Plant Hunting in Nepal*. Where did they come from?"

"Oh, one collects, you know, over the years."

I don't normally use the formal construction, but there are times when one finds it appropriate. I handed her the orchid book. She went to put it into her bag.

"Ah," I said, "as you may have gathered, this copy is quite rare. I can't really allow ... You understand?"

She coloured charmingly.

"You are welcome to use my desk. Stay as long as you wish."

She sat at the desk and unpacked sketchbooks and a pencil case embroidered with beetles. I left her to it. To mitigate any abruptness in my tone, I took her in a tray of coffee and chocolate digestives. She was immersed in her copying.

Around five, she put her head round the door to say she was going. I showed her out and insisted she return. To show I meant it, and in token of my trust, I showed her the spare key to the bookcase.

I said, "This will be hanging in the hall by the clock. I want you to use it. Books need airing, after all."

I watched from the window as she walked up the street, and as she was met at the corner by a friend – a man, I realised, with a short pony tail, so short as to be almost a pig tail. In my years abroad I had encountered such fashions, years before they were commonplace here. Likewise the anklet above his sandal. They embraced in the street, in the manner of the young.

Despite my broad-mindedness, I did think to check the library. The book was neatly closed on the desk, the chair exactly in its place.

She returned the next morning. We both smiled as she took down the key. I had left a tray of milk and biscuits on the desk, in case.

The sitting room-library was originally dining- and sitting-rooms until I had them knocked through. The serving hatch was now unused, but I hadn't bothered to have it bricked up. Open, as it now was, I caught a glimpse of her arm, sleeved, moving at her work.

After she had gone, I could tell from the disturbance of the books what she had been copying. She had gone on to the genus *Convolvulus*.

I said, before she settled down for work the following morning, "Why not work from life? I have a *Convolvulus mauritanicus* in flower on the Alpine bed."

She followed me out.

I had a camp stool waiting, but she turned it down and squatted cross-legged on the grass with her sketchbook on her knee.

She came back mid-morning for her snack. I had realised that milk and biscuits were hardly suitable, and laid out Martini,

buttered crackers and a dish of olives. As I brought it in, she began to enthuse over the garden.

She said, "I hope you didn't mind me poking about, but it's all so lovely, like a miniature Kew."

I said, "Not at all, I'm delighted to share it. Come and go as you please. Bring your boyfriend sometimes."

"Oh, he's not my boyfriend."

"Just a chum? Bring him anyway. I will arrange to leave the gate unbolted between ten a.m. and eleven p.m." She blushed and bent to her books.

He turned out to be considerably older on closer view, or as close as my kitchen window allowed. Still, they made a nice couple as they foraged in the garden.

A week later, she handed me a package as she unpacked her bag. I unwrapped it carefully as she watched. It was a painting of the *Convolvulus mauritanicus*, in ink and watercolour, in an antique frame.

I said, "Thank you so much, it's charming. Your own?"

I couldn't read the signature, and besides, I didn't know her name.

She said, "Yes, but framing it was Jerome's idea."

I said, "Thank him for me. It's just right; how clever of him."

She reached for the key of the bookcase. Evidently she had exhausted, temporarily I hoped, the profusion of my garden.

"The desk," she said, "you've moved it."

"Only a foot or so. I thought it would give you more leg room." I left the tray on the side table.

Now with the serving hatch open, I could see her entire. The scuffs on both elbows, the down on her neck, the verte-

brae above her top. But someone loved her and I was glad of that.

The fine weather persisted and often, after her work in the library, I would catch glimpses of her, sometimes them, sitting on the benches or strolling in the sun. I had dug out my old bird-watching Zeisses and could see them comfortably from the bedroom window. She would bend and stroke the foliage against her cheek while he stooped to check the name-plates. Fortunately I was confident of their accuracy, since it had crossed my mind that he may have been her tutor. Such things are not unknown. Certainly he seemed protective.

There was an incident one afternoon. I was in the kitchen, binoculars not to hand, when I heard a little scream, or maybe a moderate cry. All I could make out was him stamping, almost viciously, on something on the grass. I was at a loss to work out what it could have been. A slug which had somehow evaded my beer traps? But slugs are no more than an irritation to a botanist, while I as a gardener would be dismayed at one.

I searched that evening for some squashed remains but found none, only the outline of something lozenge-shaped and sharp stamped into the lawn.

That, I realised later, was the last time I saw him.

She, after a few days, was back as before, working quietly in the library, her arms more tanned but still scuffed at the elbows. Her concentration was even stronger and she was taking from the bookcase more and more titles, but always returning them to the shelves as she finished with them. I guessed she was completing a project, up against a deadline. Such was the pressure on her time that she didn't even consume the contents of her tray, except for the Martini.

This continued for several days. I thought it better not to break the rhythm of her work, and she came and went un-greeted.

Then she stopped coming. A week had elapsed, then a fortnight, then I knew she wouldn't be back. Her project, I assumed, was finished, or she had exhausted my library.

I confessed to a slight hurt that she hadn't said goodbye. I had the framed *Convolvulus*, of course, but I felt that a word of thanks or goodbye wouldn't have been amiss.

The library felt heavily empty when I finally went in. The desk was tidy, the chair straight, the books back in order in the bookcase – or almost. One – *The Clematis in Western Culture* – was out of alphabetical sequence.

I took it out. Between the pages at the top, like a miniscule bookmark, was a hair. I pulled it out, held it to the light. It curled and wiggled with static, clung to my cuff.

I sat at my desk with the book, fingering the embossing and the scuffed buckram edges of the boards. I began to lose myself in the index, in the neutrality of the Latin.

As I laid the book down flat, it began to open to the middle, the illustrations flapping past like a lantern slide show. Suddenly I had to catch a page and turn back. The *Clematis integrifolia* didn't look right. It shouldn't have tendrils – it's herbaceous.

I looked closely. The tendrils had been added to the engraved plate in pencil. They were almost obscene in the outline they limned.

I hastily took down other books I had noticed her using. In *Terrestrial Orchids of the World*, I found a *Cypripedium reginae* with its bladder flower grossly distended, a *Paphopedilum* whose freckles had been added to and a waxed moustache imposed. In Sutton's *Primulaceae* – the original monochrome

edition – a *Primula flaccida* had extra stems, willingly arched, and a *Primula hirsuta* a clump of frond-like hair drawn in at the base.

I couldn't open any more.

I piled them on the desk and fell into the chair.

The books were stacked with the bottom edges facing me. All of them had a letter inscribed in red – a W on the Sutton, N on *Orchidaceae of the Amazon Basin*, L on *The Clematis in Western Culture*. I was now as much curious as distraught.

I took down almost the entire middle shelf, rearranged the books into correct order, bottom edge facing me on the desk. They now spelled with gaps where the books had been replaced out of sequence – ON LY WIN TER IS TRU

I sat looking at them for a long time. The shock of desecration had subsided. I felt only a wearying sadness.

I returned the books to the bookcase, locked the glass doors and tossed the key away. It landed somewhere under the desk. After some thought, I retrieved it and hung it, with the spare, by the clock in the hall. ♦

What is the Ultimate Difference Between a Man and a Woman?

by *Ariel Levy*

WHEN PEOPLE IN South Africa say “Limpopo,” they mean the middle of nowhere. They are referring to the northernmost province of the country, along the border with Botswana, Zimbabwe, and Mozambique, where few people have cars or running water or opportunities for greatness. The members of the Moletjie Athletics Club, who live throughout the area in villages of small brick houses and mud-and-dung huts, have high hopes nonetheless.

One day in late September, twenty teen-age athletes gathered for practice on a dirt road in front of Rametlwana Lower Primary School, after walking half an hour through yellow cornfields from their homes, to meet their coach, Jeremiah Mokaba. The school’s track is not graded, and donkeys and goats kept walking across it to graze on the new grass that was sprouting as the South African winter gave way to spring. “During the rainy season, we can’t train,” said Mokaba, a short man wearing a brown corduroy jacket with a golden Zion Christian Church pin on the lapel. “We have nowhere to go inside.”

For cross-country, Mokaba and his co-coach, Phineas Sako, train their runners in the miles of bush that spread out behind

the track, toward the mountains in the distance. The land is webbed with brambles, and the thorns are a serious problem for the athletes, who train barefoot. “They run on loose stones, scraping them, making a wound, making a scar,” Sako, a tall, bald man with rheumy eyes and a big gap between his two front teeth, said. “We can’t stop and say we don’t have running shoes, because we don’t have money. The parents don’t have money. So what must we do? We just go on.”

The athletes and their coaches apologized for not having a clubhouse in which to serve tea. They didn’t like talking out in the wind and the dust. There was music playing down the road at a brick-front bar, and chickens squawking in people’s front yards, where they are kept in enclosures made out of tree branches. “The most disadvantaged rural area,” Sako said, laughing a little and stretching his arms out wide. “That is where you are.”

The fastest runner in the club now is a seventeen-year-old named Andrew who recently became the district champion in the fifteen-hundred-metre event. The average monthly income for black Africans in Limpopo – more than ninety-seven per cent of the local population – is less than a thousand rand per month, roughly a hundred and thirty-five dollars. (For white residents, who make up two per cent of the population, it is more than four times that amount.) “I think I will go to the Olympics,” Andrew said, with conviction.

Joyce, a tiny girl in a pink sweater who is eighteen but looked much younger, was similarly optimistic. “I want to be the world champion,” she said, her voice so soft it was almost a whisper. “I will be the world champion. I want to participate in athletics and have a scholarship. Caster is making me proud. She won. She put our club on the map.”

Caster Semenya, the current world champion in the eight hundred metres, was a member of the Moletjie Athletics Club until a year ago. She was born in Ga-Masehlong, a village about fifteen miles from the track, and she was, Coach Sako said, “a natural.” Even before Semenya left Limpopo for college, in Pretoria, she had won a gold medal in her event at the 2008 Commonwealth Youth Games, in Pune, India, with a time of 2:04, eleven seconds behind the senior world record set by the Czech runner Jarmila Kratochvílová in 1983. “I used to tell Caster that she must try her level best,” Sako said. “By performing the best, maybe good guys with big stomachs full of money will see her and then help her with schooling and the likes. That is the motivation.” He added, “And she always tried her level best.” Semenya won another gold medal in July, in Mauritius, at the African Junior Athletics Championships, lowering her time by a remarkable seven and a half seconds, to come in at 1:56.72. This beat the South African record for that event, held by Zola Budd, and qualified Semenya for her first senior competition, the 2009 World Championships, in Berlin.

Semenya won the eight-hundred-metre title by nearly two and a half seconds, finishing in 1:55.45. After the first lap of the race, she cruised past her competitors like a machine. She has a powerful stride and remarkable efficiency of movement: in footage of the World Championships, you can see the other runners thrashing behind her, but her trunk stays still, even as she is pumping her muscle-bound arms up and down. Her win looks effortless, inevitable. “Even when we were training, I used to pair her with the males,” Sako told me. “I feel like she was too powerful for ladies.” It was a stunning victory for Semenya, for the Moletjie Athletics Club, and for South Africa.

After the race, Semenya told reporters, “Oh, man, I don’t know what to say. It’s pretty good to win a gold medal and bring it home.” (Her voice is surprising. As Semenya’s father, Jacob, has put it, “If you speak to her on the telephone, you might mistake her for a man.”) She continued, “I didn’t know I could win that race, but for the first time in my life the experience, the World Championships . . .” She broke into a grin. “I couldn’t believe it, man.”

Since the day Semenya broke Zola Budd’s record, people in South Africa had been talking about her. Semenya does not look like most female athletes. People questioned whether she was really a woman. Some even e-mailed the International Association of Athletics Federations, the worldwide governing body for track and field, with their doubts. Before Semenya was awarded her gold medal in Berlin, on August 20th, a reporter asked about a story that had been circulating at the Championships, that Semenya’s sex was unclear and that she had been required to undergo gender-verification testing before the race. The I.A.A.F. confirmed the rumor, arguably in violation of its confidentiality policies. (“The choice is that you lie, which we don’t like to do,” Nick Davies, the communications director, told the New York Times.) The story ripped around the world. Several of Semenya’s competitors in the race were incensed that she had been allowed to participate. “These kind of people should not run with us,” Elisa Cusma, of Italy, who came in sixth, said. “For me, she is not a woman. She is a man.”

“Just look at her,” Mariya Savinova, of Russia, who finished fifth, said.

Semenya is breathtakingly butch. Her torso is like the chest plate on a suit of armor. She has a strong jawline, and a build

that slides straight from her ribs to her hips. “What I knew is that wherever we go, whenever she made her first appearance, people were somehow gossiping, saying, ‘No, no, she is not a girl,’ ” Phineas Sako said, rubbing the gray stubble on his chin. “ ‘It looks like a boy’ – that’s the right words – they used to say, ‘It looks like a boy.’ Some even asked me as a coach, and I would confirm: it’s a girl. At times, she’d get upset. But, eventually, she was just used to such things.” Semenya became accustomed to visiting the bathroom with a member of a competing team so that they could look at her private parts and then get on with the race. “They are doubting me,” she would explain to her coaches, as she headed off the field toward the lavatory.

South Africa has eleven official languages. The majority of people in Limpopo speak the Pedi language, and many also speak English and Afrikaans, which schoolchildren were required to learn under apartheid. Sako’s English was fluent but rough, and he frequently referred to Semenya as “he.” “Caster was very free when he is in the male company,” Sako said. “I remember one day I asked her, ‘Why are you always in the company of men?’ He said, ‘No, man, I don’t have something to say to girls, they talk nonsense. They are always out of order.’ ”

On September 11th, Australia’s Daily Telegraph, a tabloid owned by Rupert Murdoch, reported that Semenya’s test results had been leaked, and that they showed that Semenya, though she was brought up as a girl and had external female genitalia, did not have ovaries or a uterus. Semenya was born with undescended testes, the report said, which provided her with three times the amount of testosterone present in an average female – and so a potential advantage over competitors.

“I know what Caster has got,” her aunt Johanna Lamola told the Times. “I’ve changed her nappies.” Semenya’s father said, “I don’t even know how they do this gender testing. I don’t know what a chromosome is. This is all very painful for us – we live by simple rules.” Semenya did not cheat. She has not been evasive. It is very common for elite female athletes, who exert themselves to their physical limits as a matter of course, not to menstruate. There’s no reason that Semenya or her coaches would have been alarmed if she were amenorrheic. “Maybe it’s because we come from a disadvantaged area,” Jeremiah Mokaba said. “They couldn’t believe in us.”

The I.A.A.F. has yet to inform Semenya whether she can continue running in international female competitions. I asked Sako what he thought would happen. “Caster,” he said firmly, “will remain Caster.”

Sports have played an important role in modern South African history. A crucial part of the African National Congress’s strategy to end apartheid during “the struggle,” as everyone calls it, was to secure international condemnation of South Africa’s government through boycotts and the banning of South African athletes from all international competitions. Conversely, during the 1995 rugby World Cup Nelson Mandela managed to unite the entire country behind the Springboks, the South African team, which had been a hated symbol of Afrikaner white supremacism. It was pivotal to his success in avoiding civil war and in establishing a new sense of national solidarity. Sports are “more powerful than governments in breaking down racial barriers,” Mandela said. “Sport has the power to change the world. It has the power to inspire, the power to unite people that little else has.” Sometimes it can unite people against other people. The South African Minister

of Sport and Recreation, Makhenkesi Stofile, has warned, “If the I.A.A.F. expels or excludes Semenya from competition or withdraws the medal, I think it would be the Third World War.”

In August, when Semenya returned from Germany, thousands of cheering supporters waited to welcome her at O. R. Tambo Airport, outside Johannesburg. President Jacob Zuma met with her to offer his congratulations, as did Nelson Mandela.

Phat Joe, one of the most famous radio d.j.s in the country, was fired by Kaya FM for suggesting on his show that Semenya might have testicles. Lolly Jackson, the owner of a chain of strip clubs called Teazers, put up an enormous billboard in a suburb of Johannesburg picturing a naked woman lying flat on her back above the words “No Need for Gender Testing!” Jackson subsequently claimed that the billboard had nothing to do with Semenya, but he sent her lawyers, at the firm of Dewey & LeBoeuf, a check for twenty thousand rand.

“I think it is the responsibility of South Africa to rally behind this child and tell the rest of the world she remains the hero she is and no one will take that away from her,” Winnie Madikizela-Mandela, an ex-wife of Mandela’s and a recently elected Member of Parliament, was quoted as saying in the London Telegraph. “There is nothing wrong with being a hermaphrodite. It is God’s creation. She is God’s child.” By contrast, the African National Congress Youth League, a division of the African National Congress, issued a statement saying that it “will never accept the categorization of Caster Semenya as a hermaphrodite, because in South Africa and the entire world of sanity, such does not exist.”

The African National Congress is part of the Tripartite Alliance, with the South African Communist Party and the Congress of South African Trade Unions. This year’s meeting of the Congress happened to coincide with Heritage Day, and many of the hundreds of delegates who assembled at a conference center outside Johannesburg were in traditional tribal dress. Winnie Madikizela-Mandela wore a Xhosa turban and cape. A representative from the police and prison workers’ union, wearing nothing but a loincloth made from springbok pelts and a Swazi necklace of red pompoms, mingled with fellow union members at the back of an enormous auditorium, where delegates were debating the items of the day: whether to support the legalization of prostitution in time for the soccer World Cup, which South Africa will host in 2010, and whether to pass a resolution in support of Caster Semenya.

The sessions are meant to evoke the African tradition of villagers gathering to share opinions on local matters. Everyone gets to speak, though men speak much more than women. The prostitution question was examined from every angle: some were concerned about “the downgrading of our women by capitalism”; others felt that every source of income was desperately needed and that sex workers, like everybody else, deserved the protection of a union. After several hours, the delegates decided that what was needed was more discussion.

The South African Minister of Women, Children, and Persons with Disabilities, Noluthando Mayende-Sibiya, went to the lectern dressed in red Xhosa regalia to speak about “the issue of our young star, Caster Semenya.” Everyone applauded. “She is our own,” Mayende-Sibiya said. “She comes from the working class.” The crowd blew horns in support, and some people ululated. “You cannot be silent! The human rights of

Caster have been violated,” she concluded. The resolution passed with unusual alacrity.

South Africans have been appalled by the idea of a person who thinks she is one thing suddenly being told that she is something else. The classification and reclassification of human beings has a haunted history in this country. Starting with the Population Registration Act of 1950, teams of white people were engaged as census-takers. They usually had no training, but they had the power to decide a person’s race, and race determined where and with whom you could live, whether you could get a decent education, whether you had political representation, whether you were even free to walk in certain areas at certain hours. The categories were fickle. In 1985, according to the census, more than a thousand people somehow changed race: nineteen whites turned Colored (as South Africans call people of mixed heritage); seven hundred and two Coloreds turned white, fifty Indians turned Colored, eleven Colored turned Chinese, and so on. (No blacks turned white, or vice versa.)

Taxonomy is an acutely sensitive subject, and its history is probably one of the reasons that South Africans – particularly black South Africans – have rallied behind their runner with such fervor. The government has decreed that Semenya can continue running with women in her own country, regardless of what the I.A.A.F. decides.

South Africans have compared the worldwide fascination with Semenya’s gender to the dubious fame of another South African woman whose body captivated Europeans: Saartjie Baartman, the Hottentot Venus. Baartman, an orphan born on the rural Eastern Cape, was the servant of Dutch farmers near Cape Town. In 1810, they sent her to Europe to be exhibited in

front of painters, naturalists, and oglers, who were fascinated by her unusually large buttocks and had heard rumors of her long labia. She supposedly became a prostitute and an alcoholic, and she died in France in her mid-twenties. Until 1974, her skeleton and preserved genitals were displayed at the Musée de l’Homme, in Paris. Many South Africans feel that white foreigners are yet again scrutinizing a black female body as though it did not contain a human being.

Mayende-Sibiya has asked that the United Nations get involved in Semenya’s case, and I asked her what she thought it could do. “I would like to see it getting more information from the I.A.A.F.,” she said over lunch at the Congress. “We wrote to the I.A.A.F. to ask a number of questions, including what precedents informed the action that it took on Caster. Why pick up on her? What were the reasons? The I.A.A.F. has not responded, and that to me raises questions on how it conducts business.” Mayende-Sibiya is a big, warm woman, a grandmother and a former nurse, who hugs everyone she meets. She sighed. “There is a lot that has gone wrong in this process.”

The I.A.A.F. has behaved erratically on the issue. On November 19th, the South African Ministry of Sport and Recreation announced that the I.A.A.F. had said that Semenya could keep her medal, but the I.A.A.F. refused to confirm this. Its president, Lamine Diack, was scheduled to visit South Africa several weeks ago to talk to Semenya and to representatives of the government, but he cancelled his trip at the last minute. In late October, I got in touch with the I.A.A.F., with questions about Semenya, and received a form-letter reply (dated September 11th) that it would not comment on the case until after its council meeting, at the end of Nov-

ember. Then, a few hours later, Nick Davies, the director of communications, wrote back by e-mail:

Two things triggered the investigation. Firstly, the incredible improvement in this athlete's performance... and more bluntly, the fact that SOUTH AFRICAN sport Web sites were alleging that she was a hermaphrodite athlete. One such blog (from sport24.co.za) stated, "Caster Semenya is an interesting revelation because the 18 year old was born a hermaphrodite and, through a series of tests, has been classified as female." With this blatant allegation, and bearing in mind the almost supernatural improvement, the I.A.A.F. believed that it was sensible to make sure, with help of A.S.A., that the athlete was negative in terms of doping test results, and also that there was no gender ambiguity which may have allowed her to have the benefits of male hormone levels, whilst competing against other women.

A.S.A. is the abbreviation for Athletics South Africa, the national governing body in charge of track and field. The group's president, Leonard Chuene, who was also on the board of the I.A.A.F., and had been in Berlin for the Championships, told reporters when he returned, "We are not going to allow Europeans to define and describe our children." South Africa would have no part in tests conducted by "some stupid university somewhere," Chuene, who also happens to be from Limpopo, said. "The only scientists I believe in are the parents of this child." He claimed to be shocked by the way that the I.A.A.F. had treated Semenya, and he resigned from the board in protest before he left Berlin. (A week later, Chuene wrote the I.A.A.F. a letter saying that his resignation had been hasty, and asked to be reinstated.)

In fact, Chuene was not only aware of the Berlin tests; he had authorized them, and, at the urging of the I.A.A.F., he had also had Semenya tested before she left Pretoria. On August 3rd, the I.A.A.F.'s anti-doping administrator, Dr. Gabriel Dollé, had sent an e-mail to Harold Adams, A.S.A.'s team doctor, citing the Web-site posting that Nick Davies mentioned to me, which alleged that Semenya is a "hermaphrodite . . . classified as female." Dollé asked Adams if sex verification had been conducted – or ought to be. (Debora Patta, the host of a South African investigative program called "3rd Degree," obtained the e-mail exchange and forwarded it to me.) Adams then sent the following e-mail to Leonard Chuene and A.S.A.'s general manager, Molatelo Malehopo:

After thinking about the current confidential matter I would suggest we make the following decisions.

1. We get a gynae opinion and take it to Berlin.
2. We do nothing and I will handle these issues if they come up in Berlin. Please think and get back to me A.S.A.P.

Malehopo replied the same day, agreeing to the exam. Semenya was taken to the Medforum Medi-Clinic, in Pretoria, for tests by a gynecologist.

"They did not even consult us as parents," Semenya's mother, Dorcus, told the Star, a South African daily. "They acted like thieves. They did whatever they wanted to do with our child without informing us."

On August 8th, Adams and Semenya flew to Germany to join the rest of the South African team and the A.S.A. staff at the training camp. Adams, who is also one of President Zuma's personal physicians, told Chuene that the Pretoria test results were "not good." He recommended that they withdraw

Semenya from the competition, rather than subject her to further testing.

“The reason for my advice was that the tests might prove too traumatic for Ms. Semenya to handle, especially without the necessary support of family and friends around her,” Harold Adams wrote in a subsequent report to Parliament. “The other reason was that being tested at the World Championships would not give her enough time to consult extensively and perhaps arrive at a decision to refuse the testing.”

Leonard Chuene did not take Adams’s advice. Instead, Semenya ran in a qualifying heat on August 16th and then in the semifinals, the next day. After her success in the semifinals, a television reporter outside the stadium blurted out, “With that comes rumors. I heard one that you were born a man?” The video is very hard to watch. As the reporter speaks, Semenya’s breathing quickens, and she appears to be on the verge of panic. Then she looks at the ground and says, “I have no idea about that thing. . . . I don’t give a damn about it,” and walks away from the cameras. August 18th was supposed to be a rest day before the finals. Semenya spent it undergoing a second round of tests. The next day, after two weeks of confusion and scrutiny, Semenya won the gold medal.

In September, the Johannesburg weekly *Mail & Guardian* exposed Chuene’s dishonesty about authorizing the tests in Pretoria and Berlin. Chuene contends that he was simply following I.A.A.F. procedure, and that his deceit was a well-intentioned attempt to maintain confidentiality. After the story broke, he held a press conference to apologize for lying to the nation, but the apology was not unconditional. “Tell me someone,” he said, “who has not lied to protect a child.”

Semenya is back at the University of Pretoria now, training with her coach, Michael Seme. I asked Seme how he thought she was doing. “Sometimes you can look at somebody thinking he is O.K.,” Seme said. “But you find out in his heart, maybe it is complaining. I can’t see what’s happening in her heart.”

At a meeting of the British Gynaecological Society on April 25, 1888, Dr. Fancourt Barnes declared that he had “in the next room a living specimen of a hermaphrodite.” The person was nineteen years old, and had always believed that she was female. Barnes thought otherwise. He cited “1) the appearance of the head, 2) the timbre of the voice, 3) the non-development of the breasts,” and “the utter absence of anything like a uterus or ovaries,” as evidence of the subject’s insufficient femininity.

Other members of the society who examined the patient disagreed. Dr. James Aveling asserted that “the face was feminine, the throat was decidedly that of a woman.” Dr. Charles Henry Felix Routh argued that Barnes’s diagnosis was “guess work,” and claimed that “the mere fact” that this patient might not have a uterus was “no argument against its being a woman.” (Routh was not entirely convinced that the patient lacked a uterus and suggested that unless Barnes tried to “pass his entire hand into her rectum” they could not be sure.) Dr. Heywood Smith finally “suggested that the Society should divide on the question of sex,” and so it did. Before the doctors sent their patient home with her mother, they took a photograph. In the foreground, a “medical man” holds the “living specimen” ’s genitals with his thumb and forefinger for the camera, between her spread legs. In the background is the blurred image of the subject’s head, not quite obscured by the blanket that covers her torso. The subject’s face is grainy, but it is set in an unmistakable expression of powerless panic.

The society's inability to reach consensus was due, in part, to its failure to locate either testicles or ovaries in the patient. Until 1915, that was the generally accepted determining factor for sex. In "Hermaphrodites and the Medical Invention of Sex," Alice Domurat Dreger calls the period from 1870 to 1915 "the Age of Gonads."

The way doctors, scientists, and sports officials have determined sex has changed radically over the years. Before 1968, the International Olympic Committee verified the sex of female athletes by looking between their legs. Athletes complained about these humiliating inspections – which weren't always conclusive – and, for the 1968 Olympics, in Mexico City, the I.O.C. decided to implement chromosomal testing. (There were rumors that some men from Eastern Bloc nations had plans to masquerade as women.) These assessments proved problematic, too.

In normal human development, when a zygote has XY, or male, chromosomes, the SRY – sex-determining region Y – gene on the Y chromosome "instructs" the zygote's protogonads to develop as testes, rather than as ovaries. The testes then produce testosterone, which issues a second set of developmental instructions: for a scrotal sac to develop and for the testes to descend into it, for a penis to grow, and so on. But the process can get derailed. A person can be born with one ovary and one testicle. The SRY gene can end up on an X chromosome. A person with a penis who thinks he is male can one day find out that he has a uterus and ovaries. "Then, there is chromosomal variability that is invisible," Anne Fausto-Sterling, the author of "Sexing the Body," told me. "You could go your whole life and never know."

All sorts of things can happen, and do. An embryo that is chromosomally male but suffers from an enzyme deficiency that partially prevents it from "reading" testosterone can develop into a baby who appears female. Then, at puberty, the person's testes will produce a rush of hormones and this time the body won't need the enzyme (called 5-alpha-reductase) to successfully read the testosterone. The little girl will start to become hairier and more muscular. Her voice may deepen, and her testes may descend into what she thought were her labia. Her clitoris will grow into something like a penis. Is she still a girl? Was she ever?

If a chromosomally male embryo has androgen-insensitivity syndrome, or A.I.S., the cells' receptors for testosterone, an androgen, are deaf to the testosterone's instructions, and will thus develop the default external sexual characteristics of a female. An individual with androgen-insensitivity syndrome has XY chromosomes, a vagina, and undescended testes, but her body develops without the ability to respond to the testosterone it produces. In fact, people with complete A.I.S. are less able to process testosterone than average women. Consequently, they tend to have exceptionally "smooth-skinned bodies with rounded hips and breasts and long limbs," Dreger writes in "Hermaphrodites."

People with incomplete A.I.S., on the other hand, could end up looking and sounding like Caster Semenya. Their bodies hear some of the instructions that the testosterone inside them is issuing. But that does not necessarily mean that they would have an athletic advantage.

For example, the Spanish hurdler Maria Patiño, who had A.I.S., went to the World University Games in Kobe, Japan, in 1985, and forgot to bring a letter from her doctor verifying that

she was female. Until 1999, gender verification was compulsory for all female athletes. Officials scraped some cells from the inside of her cheek for chromatin testing. If visual inspection had still been the standard, Patiño's gender never would have been questioned. Her genitals, and the rest of her, looked female, but according to the test she was male. The story got out, and she was stripped of her past titles. Her boyfriend left her. Her scholarship was revoked, and she was evicted from the national athletic residence.

In 1991, the International Association of Athletics Federations abandoned this method as unreliable, and, nine years later, so did the International Olympic Committee. Patiño was requalified in 1988, when she was able to prove that her body could not make use of its testosterone, and that she had developed as a woman. "I knew I was a woman," Patiño said, "in the eyes of medicine, God, and most of all in my own eyes."

The approach that the I.A.A.F. appears to be taking in its review of Semenya's test results from Berlin is not unlike the British Gynaecological Society's muddled attempt to determine the sex of its living specimen. The I.A.A.F.'s gender policy states that an athlete "can be asked to attend a medical evaluation before a panel comprising gynecologist, endocrinologist, psychologist, internal medicine specialist, expert on gender/transgender issues." It has not come up with a single litmus test for sex; its goal, like that of the I.O.C. in such situations, is to reach consensus. The federation does not define the criteria that its group of experts must use to reach their determination, however. "It seems to be working with a kind of 'I know it when I see it' policy," Dreger, a professor of clinical medical humanities and bioethics at Northwestern

University's Feinberg School of Medicine, told me. The policy does not indicate who should be tested and on what grounds. An athlete will be examined if "there is any 'suspicion' or if there is a 'challenge' " to her sex. Evidently, a blog post qualifies as a challenge.

In conjunction with other sports bodies, the I.A.A.F. will hold a special conference, in January, 2010, to review the policy. On November 18th, it sent out a press release stating that there would be "no discussion of Caster Semenya's case" at the November council meeting, despite its earlier promise to resolve the issue there.

Unfortunately for I.A.A.F. officials, they are faced with a question that no one has ever been able to answer: what is the ultimate difference between a man and a woman? "This is not a solvable problem," Alice Dreger said. "People always press me: 'Isn't there one marker we can use?' No. We couldn't then and we can't now, and science is making it more difficult and not less, because it ends up showing us how much blending there is and how many nuances, and it becomes impossible to point to one thing, or even a set of things, and say that's what it means to be male."

In 2000, Anne Fausto-Sterling, a professor of biology at Brown University, conducted what remains the study of record on the frequency of intersexuality, and concluded that 1.7 per cent of the population develops in a way that deviates from the standard definition of male or female. (Some scholars have argued that Fausto-Sterling's categories are too broad, because they include individuals who show no noticeable expression of their chromosomal irregularity.) Based on this figure, intersexuality is much more common than Down syndrome or

albinism, though it can be harder to keep track of: every baby born in the United States is registered as “male” or “female.”

The word “hermaphrodite” is as outdated and offensive to the people it once described as the word “mulatto.” In one Greek myth, Hermes, the son of Zeus, and Aphrodite, the goddess of love, have a child endowed with all the attributes of both of them. “Hermaphrodite” implies a double-sexed creature, fully male and fully female, which is a physical impossibility for human beings. (You can be half and half, but you can’t be all and all.)

In the nineteen-nineties, a movement spearheaded by an activist who used to call herself Cheryl Chase, and now goes by the name Bo Laurent, insisted that what was needed was a new identity. Chase founded the Intersex Society of North America (now defunct) to draw attention to the frequently tragic consequences of doctors’ performing irreversible surgery on newborns to enforce a sex – one that the baby might just as easily as not grow up to reject. The society advocated assigning intersex children a gender at birth but leaving their bodies intact, so that upon adulthood they could make their own choices about whether they wished to undergo surgical modification.

Then something unexpected happened. “The intersex identity started getting inhabited by people who weren’t really intersex,” Dreger said. “The people who accumulated around the intersex identity tended to be queer and out and comfortable with this identity outside the gender binary.” They felt that refraining from interfering with infants’ ambiguous genitalia was the first step on a desirable path to dissolving gender altogether. To them, this idea was “as politically inspiring as it is utterly disconnected from the actual experience

of intersex people or the heart-wrenching decisions their parents have to make when an intersex child is born,” as Vernon A. Rosario, a professor of psychiatry at U.C.L.A., put it in a recent issue of *The Gay and Lesbian Review*.

Semenya, whether she wants to be or not, has become a hero to many people who “don’t fit the sex and gender boxes,” as Jarvis, from Winnipeg, posted on the Web site casterrunsforme.com. A person named Megan Ewart wrote, “I’ll bet you’ve got a lot more transgendered allies than just me that are feeling your pain.”

Now there is an even newer term of art for people born with ambiguously sexed bodies who do not wish to be connected with the “L.G.B.T.Q.I.” – lesbian, gay, bisexual, transgender, queer, intersex – camp: “disorders of sex development,” or D.S.D. By naming the condition a medical “disorder,” advocates of the D.S.D. label hope to make the people it describes seem less aberrant. “Oddly enough, it does normalize it in a certain way,” Fausto-Sterling said. “It’s putting it on the same plane as other anomalous development – like congenital anomalies of the heart.” Advocates of the D.S.D. label are not seeking to create a third sex. Rather, they want disorders of sex development to be treated like any other physical abnormality: something for doctors to monitor but not to operate on, unless the patient is in physical discomfort or danger.

In science and medicine, categories are imperative, but they are also inflected by social concerns. “Mammals,” for example, were so named by Linnaeus, in the eighteenth century, because their females produce milk to suckle their young. Was it irrelevant that scientists like Linnaeus sought to encourage mothers to breast-feed their own children, and to do away with

the “unnatural” custom of wet-nursing? “There are philosophers of science who argue that when scientists make categories in the natural world – shapes, species – they are simply making a list of things that exist: natural kinds,” Fausto-Sterling said. “It’s scientist as discoverer. The phrase that people use is ‘cutting nature at its joint.’ There are other people, myself included, who think that, almost always, what we’re doing in biology is creating categories that work pretty well for certain things that we want to do with them. But there is no joint.”

If sex is not precisely definable, how else might sports be organized? Theoretically, athletes could be categorized by size, as they are in wrestling and boxing. But then women would usually lose to men. Or athletes could be categorized by skill level. Almost always, this would mean that the strongest elite female athletes would compete against the weakest elite male athletes, which would be pretty demoralizing all the way around.

Another option would be to divide athletes biochemically. Testosterone is, for an athlete, truly important stuff. Developmentally, testosterone spurs linear bone growth in adolescents. Fully grown people use testosterone in doping because it helps create muscle mass and increases red-blood-cell production, which, in turn, increases cellular oxygen-carrying capacity. The more oxygen an athlete has in her cells, the more efficiently her muscles operate and the longer it takes for her body to start producing lactic acid, the substance that causes cramps and pain. Testosterone makes a faster, better athlete, and enables a body to recover more quickly from exhaustion. Hypothetically, according to Eric Vilain, a professor of human genetics and pediatrics at U.C.L.A., those with a

certain level of functional testosterone (testosterone that the body can actually make use of) could be in one group, and those below it could be in another. Although the first group would be almost all male and the second group would be almost all female, the division would be determined not by gender but by actual physical advantages that gender supposedly, yet unreliably, supplies.

But, setting aside the issue of gender, there is still no such thing as a level playing field in sports. Different bodies have physical attributes, even abnormalities, that may provide a distinct advantage in one sport or another. The N.B.A., for instance, has had several players with acromegaly – the overproduction of growth hormone. Michael Phelps, who has won fourteen Olympic gold medals, has unusually long arms and is said to have double-jointed elbows, knees, and ankles. Is Caster Semenya’s alleged extra testosterone really so different?

There is much more at stake in organizing sports by gender than just making things fair. If we were to admit that at some level we don’t know the difference between men and women, we might start to wonder about the way we’ve organized our entire world. Who gets to use what bathroom? Who is allowed to get married? (Currently, the United States government recognizes the marriage of a woman to a female-to-male transsexual who has had a double mastectomy and takes testosterone tablets but still has a vagina, but not to a woman who hasn’t done those things.) We depend on gender to make sense of sexuality, society, and ourselves. We do not wish to see it dissolve.

What the I.A.A.F. concludes about Caster Semenya could have ramifications for sports in general and for South Africa in particular. This is true not only because it is Semenya’s place of

origin. South Africa has an unusually high level of intersex births. Nobody knows why.

During apartheid, for every white town there was a black township. Only the white towns appeared on maps, though the townships were nearly always more populous. John Carlin, in his account of the 1995 rugby World Cup, "Playing the Enemy: Nelson Mandela and the Game That Made a Nation," describes townships as "the black shadows of the towns." Khayelitsha is the black shadow of Cape Town. According to the most recent census, half a million people live there, but in reality the number is probably much higher. Many of their parents and grandparents settled in the Cape Flats, outside of Cape Town, after the Group Areas Acts of the nineteen-fifties made it illegal for them to live in the city. "Khayelitsha" is Xhosa for "New Home." Shacks made of corrugated tin, cardboard, and scrap wood, many without electricity or running water, sprawl for miles along mostly unmarked dirt roads, punctuated by beauty parlors and fruit stands in structures no bigger than British telephone booths.

By Khayelitsha standards, Funeka Soldaat's small home, with its solid brick walls and tiled floor, is very fine. Soldaat is an L.G.B.Q.T.I. activist. Both she and a cousin – whom Soldaat, following local custom, referred to as her sister – were born with anomalous genitalia, and both underwent "corrective" partial clitoridectomies when they were young, which they now regret. This is the standard "treatment" for babies born with a clitoris longer than one centimetre but smaller than 2.5 centimetres, at which point it becomes a medically acceptable penis. The scar tissue that forms after such a procedure can impede sensation for the rest of a person's life.

"My sister, she look just like Caster," Soldaat said, smiling. "She don't have the breasts. She never get a period. Everybody thinks she's a guy, just like Caster. We call them, in Xhosa, italasi. It is not a new thing – everybody has a word for it." That there is a name for intersex does not mean it is a condition that is ever spoken about. "One thing that is so difficult for African people: there's no way that you can discuss about something that's happened below the belt," Soldaat said. "All the time you don't know what's happening in your body, and there's nobody that try to explain to you. Then it becomes a problem. If my mom would know that I'm intersex and there's nothing wrong about it, then there was nothing going to make me panic."

Particularly in remote areas, where babies tend to be born in the presence of a mother, a grandmother, and maybe a midwife, it is easy to keep a baby's genitalia a secret. People want to insulate their children from the shame of being different, so they simply pretend that they are not. "Limpopo and Eastern Cape are the high incidence of intersex people," Soldaat said. "And when you grow up in the rural areas it's a mess, because people don't even go to doctors." The determination of gender is made very simply. "It depends what they do when they go to the loo," Soldaat said. "That's what makes their children to be women. If they go to the loo and they sit, that's it."

On her coffee table, Soldaat had a photocopy of the South African magazine *You*, which featured a photo spread showing Caster Semenya dressed in high heels and a short skirt, her hair fluffed out and her face made up. Her expression was painfully uncomfortable, and the pictures were garish.

“My sister was crying when she saw this whole thing on paper,” Soldaat said, flipping through the pages. “It’s a disaster. She look like a drag queen! I can just imagine her at night when she’s alone, looking at these pictures.”

Soldaat tossed the papers on the floor. “When we are really, really poor sometimes, and we really, really want to protect ourselves, people take an advantage,” she said. “That’s why it was easy for people to force her to do this, for A.S.A. to do this.” Athletics South Africa received a payment from You in exchange for Semenya’s appearance in its pages. “To say that she enjoyed doing this, that’s a lie! There is no way. There is no way!”

Soldaat has a shaved head and was wearing big jeans and a baseball cap with the words “Mama Cash,” the name of a Dutch women’s-rights organization, on it. She is a lesbian, and she said that she suspected Semenya is, too.

“Everyone! Everyone who is like this likes women,” Soldaat said, laughing. “Everyone!” (“Caster has never cared about men other than as friends,” her father told a reporter. “Her sisters were always after boys in the way that I, too, was always after girls when I was younger. But Caster has never been interested in any of that.”) If Soldaat is right, then Semenya’s life may well get more difficult. Soldaat was going to court later that day to listen to the proceedings against several men accused of raping and murdering a lesbian in Khayelitsha. “They are raping lesbians to correct them,” she said. “In order they can be a proper woman.”

Soldaat said that Semenya should run with women. “It will never be like intersex women have their own Olympic Games – that’s ridiculous!” she said. Soldaat has a big, raucous laugh, and the idea of that imaginary competition absolutely killed her.

Soldaat was a runner herself when she was young. “If she can’t run in the Olympics, Caster has to continue running with other girls in South Africa. Because, really, that’s what she wants, that’s what she is, that’s what keeps her alive: that’s running.”

The only thing more slippery than the science in the Semenya case is the agendas of the men who have involved themselves in it. There is a bounty of political gain for whoever spins the story most successfully.

Julius Malema, the president of the A.N.C. Youth League, has said that he does not believe in the existence of intersex people, and has tried to frame the concept as a suspect and unwelcome import from abroad. “Hermaphrodite, what is that?” Malema asked at a press conference in October. “Somebody tell me, what is ‘hermaphrodite’ in Pedi? There’s no such thing. So don’t impose your hermaphrodite concepts on us.” (The word is tarasi, according to a professor of South African languages at Yale.) The Youth League issued a press release decrying a “racist attack on Semenya” orchestrated by the media in “Australia, which is the most lucrative destination for South Africa’s racists and fascists who refused to live under a black democratic government.”

Julius Malema is not known for being levelheaded. He won the presidency of the Youth League in a highly contested election in 2008. Just a few months later, while Jacob Zuma was fending off charges of racketeering and fraud (the charges have since been dropped), Malema became notorious for vowing, “We are prepared to die for Zuma. Not only that, we are prepared to take up arms and kill for Zuma.” (Zuma also beat a rape charge, in 2006.) Zuma has called Malema “a leader in the making,” worthy of “inheriting the A.N.C.” one day. Malema has demonstrated an ability to mobilize people and an almost

reckless willingness to use charges of racism to do so. He has been Leonard Chuene's most steadfast defender.

Chuene has, since the revelation of his deceit, become almost as controversial a figure in South Africa as Caster Semenya. Countless editorials have accused Chuene of sacrificing her in his quest for a gold medal and have demanded his ouster. In Dr. Harold Adams's report to Parliament, he calls Chuene's decision "short-sighted and grossly irresponsible." Though Chuene received a vote of confidence from Athletics South Africa's board after his admission, the A.N.C. asked him to apologize; its rival party, the Democratic Alliance, demanded his resignation, and the Deputy Minister of Sport called him a liar. Minister Mayende-Sibiya told me that Chuene's behavior was "totally unacceptable."

Julius Malema has continued to paint any criticism of Chuene as racist. In early October, one of A.S.A.'s biggest sponsors, Nedbank, announced that it would withdraw its support pending a change in A.S.A.'s leadership. Malema retaliated by calling for a boycott of the bank. "We will teach them a lesson about the power of the masses," Malema said. "They may have money, but we can defeat them because we have the masses."

On three occasions, Leonard Chuene's personal assistant made an appointment for me to interview "the president," as she calls her boss. She always called or e-mailed at the last minute to cancel. We had several calls scheduled, but Chuene never picked up his phone at the appointed time. Then, one day, I got on an airplane going to Polokwane, a small northern city. Sitting in an empty row, in a navy blazer and pressed jeans, was Leonard Chuene.

Chuene wanted to know how I recognized him. Only minutes before, I had been looking at his photograph in a newspaper, alongside a story about Nedbank's withdrawal of funds from A.S.A. and A.S.A.'s failing finances. "I have become more famous than Caster," he said, and chuckled. Chuene has a shiny bald head and a little gut. He was once a serious runner and has completed more than a hundred marathons, he told me. He said he had no choice but to get Semenya tested. "You cannot just argue like a fool and say no. This is not the law of the jungle!" He speaks very quickly. He explained why he had not heeded Adams's advice to withdraw Semenya from the race.

"I don't have the results in my hand!" he said. "How did you expect me to take an informed decision?"

Indeed, Adams had had word from the Pretoria clinic but no actual documentation of the test results. "Where is the evidence?" Chuene said. "Now I come back home and they will say, 'When this black child from the rural be No. 1, why do you deprive her?'"

Chuene shrugged. "They say I lied. That's what they are saying. I said no. There is confidentiality! I.A.A.F. is in trouble for breaching that. Who was going to be Leonard to say that?" The engines started roaring as the small plane took off. "It was 22-Catch situation!" Chuene shouted over the noise. "If I will do this, it's 'Why did you withdraw her?' If I did not, 'Why did you allow her to run?' Whatever way you look at it, I'm judged. I'm judged!"

There were around twenty people on the plane. We were airborne, and the engines quieted. Chuene did not. "The stupid leader is the one who says, 'I'm not sure; I don't know.' I had to take a decision! She must run. If Chuene didn't allow her, it

meant she was going to stay in South Africa. This thing has given her more opportunity! Everybody knows her. The world is out there to say, 'Your problems are our problems.' Imagine if I had not let her win!" As we touched down in Polokwane, he said, "If there is to be help, it is because of the opportunity created by Leonard Chuene."

Recently, Semenya told the Guardian, "It's not so easy. The university is O.K. but there is not many other places I can go. People want to stare at me now. They want to touch me. I'm supposed to be famous." She added, "I don't think I like it so much."

The law firm Dewey & LeBoeuf announced in September that it was taking on Caster Semenya as a client. It is still sorting through what happened and deciding whom to sue. One afternoon, I drove with Benedict Phiri, an associate in the firm's Johannesburg office, across the Blood River from Polokwane to Ga-Masehlong to meet Semenya's mother. Ga-Masehlong is a small village dotted with jacaranda trees; goats graze on the garbage and the grass on the roadsides. The houses have tin roofs, and people put rocks on top of them to keep them from blowing away. There are satellite dishes in several yards, but most people have dug their own wells and collect firewood from the bush for cooking. Everyone knows everyone else in Ga-Masehlong, and it was easy to get directions to the house of the champion.

At the Semenya home, there was a flyer tacked to the front door promoting a lecture that Julius Malema was giving at the local elementary school. Phiri knocked. We heard shuffling and then the sound of locks turning and bolts sliding. Phiri called out that he was Caster's lawyer, but nobody came to the door.

A few minutes later, a pretty girl wearing an orange fleece jacket walked into the yard and introduced herself as Maphela. She said she was fourteen. "Do you want my story?" she asked in English. "I am Caster's sister! But I am not like her. I am different from Caster." I asked her what she meant, and Maphela replied emphatically, "I am not that way."

Maphela looked toward the window where her mother, Dorcus, was hiding her face behind the curtain and motioning vigorously for her daughter to stop speaking with us. We asked Maphela if she would tell her mother that Phiri was Caster's lawyer. Maphela ran off toward the back door.

We sat on the stoop of a cooking hut in the Semenyas' front yard, and waited with the chickens and the goats. An elderly neighbor named Ike came into the yard. "Caster has done a wonderful thing," he said. "This has brought to mind when the Philistines were persecuting the Israelites." Ike told us that he just wanted to check on the family and see how their visit from Julius Malema the previous evening had gone. This made Phiri nervous.

After a few minutes, Maphela returned. She told us that her mother would not meet with Phiri, because she did not agree that Caster should have a lawyer.

As we drove away through the bush, Phiri called his boss in Johannesburg, a white former rugby player named Greg Nott. I could hear Nott yelling through the phone. "We knew this would happen all along," Phiri said, trying to calm him. "Julius Malema is Chuene's ally, and Julius is giving Caster money."

On the occasion of the A.N.C. Youth League's sixty-fifth anniversary, in October, Julius Malema presented Caster Semenya with a hundred and twenty thousand rand (about sixteen thousand dollars) at a gala dinner in Johannesburg. "I

can even see it,” Phiri said on the phone. “They probably told the mom, ‘People will come and say they’re her lawyer. Don’t believe it.’ ” Phiri was afraid that Malema would step in and persuade the family to side with Chuene, who comes from the same region, and whose interests might not be served by lawyers poking around. One of the first things that Dewey & LeBoeuf did when the firm took the case was to ask both A.S.A. and the I.A.A.F. to provide documentation of the tests and any other pertinent paperwork; neither organization has fully complied.

The firm is representing Semenya pro bono, so good publicity will be its only reward. “And that,” Phiri said, “could blow up in our faces.”

Nobody wants Chuene out of office more than an old friend and colleague named Wilfred Daniels, who started at A.S.A. with him, sixteen years ago. “From day one we connected, in the struggle days, you know?” Daniels said. “We were like, we belong together.” Both Daniels, fifty-eight, and Chuene, fifty-seven, grew up as promising athletes who could never compete internationally because of apartheid. They understood each other then, but not anymore.

Daniels – whom everyone calls Wilfie – is the unofficial mayor of Stellenbosch, a leafy college town in the wine country. He likes to hold court at the Jan Cats restaurant, in front of the elegant Stellenbosch Hotel. As he sat at his street-front table on a sunny afternoon in a green Izod jacket and track pants, drinking a bottle of Chenin blanc, every other person who passed by stopped to pay his respects, or at least waved at him driving by. Daniels was a famous athlete in his youth, and he is even more famous now. In early September, he resigned from A.S.A. in protest over its handling of Caster Semenya, and had

since been in the papers constantly. “We allowed it,” he said. “If we as management were on our game, we would’ve objected. We accompanied her to the slaughter. And that is my dilemma.”

Daniels was not directly involved in the testing or the coverup. During the first training session in Berlin, “while she was warming up and stretching, putting on her spikes, she told me they had done tests on her. I said, ‘What tests?’ ” Semenya told him that she didn’t know what they were for, but she described what had happened. “They put her feet in straps and ‘they work down there,’ she said. They told her it was dope tests.” Semenya had undergone routine doping tests many times before. She knew that this was something very different.

“If you and me who come from the big cities, if we find it repulsive, I mean, what about a rural girl,” Daniels said. “She doesn’t know what’s happening around her. She’s seven, eight months in the city now, in Pretoria, a new life altogether, and nobody takes the time to explain to her?” He shook his head in disgust. “It was unprovoked talk, and she’s not somebody who talks, normally. And she spoke to me as a Colored guy, as a man, about intimate, female things. That to me was like a cry for help.”

The sins of A.S.A., as Daniels sees it, are, first, not giving Semenya adequate information about the Pretoria tests – including her right to refuse them – and, second, not pulling her out of the competition in Berlin.

“It’s the day before the championships,” Daniels said. “Eighteen years old, your first World Championships, the greatest race of your life. You can’t focus, because you have to go for gender testing. And you come back and you have to watch on TV: they are explaining the possibilities. I found her

in her room, sitting in front of the TV like this,” Daniels put his hand up to his face to show how close she was to the screen. “And they’re talking about her and she’s trying to understand what they’re saying. Because nobody has spoken to her, to tell her, Look, this is what these tests might mean. I felt so ashamed.”

Daniels has worked in various capacities at A.S.A. over the years, first in management, then as a coach, and, most recently, as A.S.A.’s coördinator with the High Performance Centre, the program at the University of Pretoria where Semenya is now. Daniels does not agree with the I.A.A.F.’s assessment that Semenya’s seven-and-a-half-second improvement was “supernatural.” She went from training on the dirt roads of Limpopo to a world-class facility. She is also an extraordinarily hard worker. “Understand: Maria Mutola is her hero,” Daniels said. “So she had wonderful goals and ideals for herself; she was really trying to emulate her hero one day.” Maria Mutola is a runner from Mozambique whose event, like Semenya’s, was the eight hundred metres. Mutola also happened to have a strikingly masculine appearance.

Daniels believes that the best that can happen for Semenya at this point is to have a career like his. He has travelled the world and met many of his heroes. He has a cellar with more than two thousand bottles of red wine. He eats his grilled springbok at Jan Cats and clearly enjoys being a local eminence. But it is probably not the life he would have led if apartheid hadn’t prevented him from competing internationally; and it is not the life that was in front of Caster Semenya before she went to Germany. “I understand that her running days are over,” Daniels said.

There’s another scenario, in which Semenya’s story could become one of against-all-odds victory. The I.A.A.F. could apologize and decree Semenya female. Kobus van der Walt, the director of sport at the High Performance Centre, pointed out that though Semenya has beaten the South African record for her event, she hasn’t come anywhere near Kratochvílová’s world record, which means that there are plenty of women with a chance of besting Semenya. Conceivably, one day we will see Caster Semenya at the Olympics with a medal hanging from her neck. She could be the poster child for triumphant transgression.

But that is not what Daniels thinks will happen. “Now her life is over,” he said. “Not only as an athlete but as a human being. Even if the I.A.A.F. says there’s nothing wrong with her, people will always look at her twice. There should be hell to pay for those responsible.” He pounded his fist on the table. “I’ve got a daughter. If that was my daughter, what would I have done as a father? Somebody might have been dead by now.”

On November 5th, Chuene and the entire board of A.S.A. were suspended by the South African Sports Confederation and Olympic Committee, pending an investigation into how they handled Caster Semenya.

One afternoon at the High Performance Centre, I sat up in the bleachers, killing time before a meeting with Kobus Van der Walt. I was surrounded by a spread of neatly partitioned fields, like a Brueghel painting: there are twenty-four cricket nets, six rugby fields, twenty-two outdoor tennis courts, nine soccer fields, seven squash courts, and a track surrounded by a three-thousand-seat stadium, all kept in impeccable condition. Runners in little packs zoomed around the fields and into the

distance. Spring sunlight flicked along the blue of the swimming pool.

A figure in a black sweatshirt with the hood up walked along the path about thirty yards in front of me. There was something about this person's build and movements that drew my attention. I got up and followed along the path, until I caught up to the person where he or she was stopped behind the cafeteria, talking to a waiter and a cook, both of whom were much shorter than she was. It was Caster Semenya.

She wore sandals and track pants and kept her hood up. When she shook my hand, I noticed that she had long nails. She didn't look like an eighteen-year-old girl, or an eighteen-year-old boy. She looked like something else, something magnificent.

I told her I had come from New York City to write about her, and she asked me why.

"Because you're the champion," I said.

She snorted and said, "You make me laugh."

I asked her if she would talk to me, not about the tests or Chuene but about her evolution as an athlete, her progression from Limpopo to the world stage. She shook her head vigorously. "No," she said. "I can't talk to you. I can't talk to anyone. I can't say to anyone how I feel or what's in my mind."

I said I thought that must suck.

"No," she said, very firmly. Her voice was strong and low. "That doesn't suck. It sucks when I was running and they were writing those things. That sucked. That is when it sucks. Now I just have to walk away. That's all I can do." She smiled a small, bemused smile. "Walk away from all of this, maybe forever. Now I just walk away." Then she took a few steps backward, turned around, and did. ♦

Airport Security

by David Knepper and Steven Bierfeldt

From a June 23, 2009, incident report by David Knepper, a policeman at Columbus Airport, in Columbus, Ohio. A CTX is a machine that screens for items that have the same density as explosives.

I WAS CALLED to investigate an unattended package at the South Departures CTX. Upon my arrival, I observed a small backpack sitting on the floor in front of the doors that lead to the CTX machine. My K-9 searched the bag and did not show any signs that it detected explosives. TSA officer Dustin Epperson opened the bag and determined that it was a diaper bag. Dustin also informed me that he had a small can that was from India that set off the alarm in the CTX. It had been resealed with some type of solder. Dustin stated that he X-rayed the can and that it appeared to have some kind of solid in it, but not powdered milk, which was printed on the can.

The owner of the can was contacted, escorted off a Southwest plane, and brought to the location. Jyotsna Varma stated that the can was from her mother and had pickles in it. I asked her why the can was resealed. Varma stated that her mother reuses cans to save money. I asked her why her mother did not put things like this in jars like most people do. Varma did not know.

Sgt. Bekemeier arrived on the scene and made the decision to notify the bomb squad. The Columbus Fire Department Bomb Squad arrived on the scene, as did members of the Joint Terrorism Task Force and the FBI. The can was placed into the bomb-containment vessel and transported to the safe site. The Fire Department blew the can open and determined that the contents appeared to be pickled mangoes.

From a March 29, 2009, audio recording made by Steven Bierfeldt, twenty-five-year-old treasurer of Ron Paul's Campaign for Liberty, on his iPhone while he was detained by Transportation Security Administration agents at Lambert-St. Louis International Airport. After Bierfeldt, who was carrying Campaign for Liberty paraphernalia in his travel bag, passed a box containing \$4,700 in cash through a security checkpoint's X-ray machine, agents interrogated him for nearly half an hour before he could board his flight. In June, the ACLU filed a complaint charging that Bierfeldt's detention constituted an unreasonable search and seizure. The ACLU dropped its lawsuit after the TSA revised its policies to make clear that agents cannot engage in general law enforcement and that traveling with large amounts of cash is not illegal.

AGENT 1: How much money do you have in here?

STEVEN BIERFELDT: I don't know exactly.

AGENT 1: What do you do for a living?

BIERFELDT: Is that relevant, sir?

AGENT 1: Yes, it is.

BIERFELDT: Am I legally required to tell you that?

AGENT 1: I'm just trying to ask some questions so I can get you on your plane. But you want to play smartass, and I'm not going to play your fucking game.

AGENT 2: Here's the situation. Whenever you come through a security checkpoint, we have a right to ask you about anything you have. And since you have a large sum of money, he's required to ask you some questions. Now if you have a problem answering those questions, you need to talk to me. We're here to protect you from the FBI. Where is the money coming from? Is there any reason you're not answering questions?

BIERFELDT: I'm not refusing to answer.

AGENT 2: Is it a secret or something?

BIERFELDT: I don't know the exact amount.

AGENT 2: Well, why do you have this money? That's the major question.

BIERFELDT: And I'm asking if I'm legally required to answer that question.

AGENT 2: So you refuse to answer the question?

BIERFELDT: No, sir, I'm not refusing.

AGENT 2: Well, you're not answering.

BIERFELDT: I'm simply asking my rights under the law. I don't understand the law, sir, and I'm asking you as a law enforcement officer for guidance.

AGENT 2: I can't guide you in answering the reason why you have that money. I don't know you. I'm not your translator, or your caretaker, or anything like that.

BIERFELDT: Sure, and I'm saying I don't understand the law, sir.

AGENT 2: It's not a question of the law! It's a simple question and answer.

BIERFELDT: Well, am I being detained because of the law, sir?

AGENT 2: Because you have a large sum of money and you can't answer why you have it.

BIERFELDT: I can answer. I'm asking if I'm required by law to answer.

AGENT 2: I don't – you don't know the law?

BIERFELDT: Do you know the law, sir?

AGENT 2: Yeah, I do.

BIERFELDT: Am I legally required to answer that question?

AGENT 2: I can't answer that for you.

BIERFELDT: But you know the law, so I'm asking for your guidance.

AGENT 1: I will tell you one thing, no matter what they decide to do with you, unless I'm satisfied, I don't have to let you go through my checkpoint.

AGENT 3: You want to talk to the DEA about it?

BIERFELDT: If they can tell me if I'm required by law to answer the question, I'll answer. I'm just looking for a simple yes or no.

AGENT 3: I want to know why you have \$4,700 on you. That's suspicious. If you have nothing to hide, you can just tell us what it's for. You're going to have to have proof of why you have that much money anyway, for the DEA. It's your money?

BIERFELDT: Does the money belong to me? No, sir.

AGENT 3: What, you stole it? Well, we gotta find this out. We're going to take you to the station and find out if you stole it. What's Campaign for Liberty?

BIERFELDT: Campaign for Liberty is a political organization founded by Ron Paul.

AGENT 3: You work for that?

BIERFELDT: Yes, sir.

AGENT 3: What are you in St. Louis for?

BIERFELDT: Am I required by law to answer the question?

AGENT 3: You can't answer a simple question of why you're in St. Louis? You don't have to understand the law to just answer the question.

BIERFELDT: Well, I'd prefer to understand the law.

AGENT 3: Are you from this planet?

AGENT 2: You're acting like a child, man, like you're five.

AGENT 3: We're just going to take you to the station, and the DEA can figure it out.

BIERFELDT: Am I being taken, or am I free to go?

AGENT 3: Whatever you want to call it, we're going to the police station. I don't want to get into semantics here.

AGENT 2: Now do we have to put you in handcuffs?

BIERFELDT: No, sir. That's fine. I don't understand the law. I'm happy to go.

AGENT 2: Well, we're going to help you understand if you don't.

[Agents lead Bierfeldt through the airport concourse, but they are stopped by a plainclothes agent, Agent 4, who leads them back to the interrogation room and rifles through Bierfeldt's bag.]

AGENT 4: So you worked for Ron Paul, and these are campaign contributions?

BIERFELDT: Yes, sir, the money is for Campaign for Liberty.

AGENT 4: Okay, that's all you had to tell us.

BIERFELDT: I was asking if I was required to answer the question. You could just have given me a yes, and I would have answered the question.

AGENT 4: You're free to go.

AGENT 1: Well, I'm not all that ready just to let him out of the concourse, sir.

AGENT 4: Well, that's up to you. I don't see anything. These are campaign contributions.

AGENT 1: Let him go.

[Bierfeldt leaves.]

BIERFELDT: [Speaking to a friend] That, sir, is a damn good recording right there. They were asking me, Who do I work for? Why are you here? And my response is: Sir, am I required by law to answer that question? They were going to take me to the DEA, FBI office. And I was like, Okay, let's go. And I called their bluff. We're going to tell the judge that one. He's going to love that story. ♦

What's Your Problem?

My boyfriend has figured out how to avoid luggage fees on airlines: he wears most of the clothes he needs for a trip onto the plane. He wears three shirts, three pairs of socks, and – here's the problem – three pairs of underwear beneath his pants, which are very tight at this point. He flies often, and says he saves a lot of money by doing this. Is he nuts?

S. C.

Dear S. C.,

No, he is not nuts. His sense of frugality, and fashion, is to be commended. I am fiercely opposed to the hidden (and not-so-hidden) fees imposed on the flying public by desperate and rapacious airlines, so anyone who battles against them deserves praise. His behavior does raise one troubling question: How does he transport his underwear on the flight home? Is he wearing three pairs of dirty shorts at the same time? If so, then you ought to have a heartfelt discussion with him. Should his plane crash, you would not want to risk embarrassment (on top of the death or dismemberment of your boyfriend) when rescue personnel discover his dirty underwear in triplicate.

I'm about to be married. I've never worn jewelry, and I'd prefer not to wear a wedding band. But my wife-to-be insists that we both display evidence of our marriage on our fingers. Is there any argument you can think of as to why I should be exempt from this rule? Don't you think the requirement that all men must wear a wedding band is a creation of the wedding-ring industry?

C. C.

Dear C. C.,

The answer to your second question is yes, but so what? You will wear the wedding band. There is no chance that you will not. I'm married to my first wife, but I'm on my third wedding band. I lost the first one on our honeymoon (this is considered a good omen in certain cultures, though not in ours), and I lost the second one at a Jimmy Hoffa rally in Las Vegas (don't ask). My advice is to get a ring that is exceptionally tight-fitting. You can explain to your fiancée that you'd like it to be extra tight because you want to be reminded constantly of your devotion to her. If she's not bright, she may believe you.

My cousin was recently indicted for a financial crime. If he's convicted, he could go to jail for a year or more. He believes he should look his best at the trial, and so he wants to wear his best suits. I argue that considering the tenor of the times, juries will be harder on men they think are super-rich, so he should dress more casually. Not sloppily, but in a way that allows the jury to relate to him. What do you think?

G. C.

Dear G. C.,

I think you should dress him like a waitress. People are innately sympathetic to waitresses, especially in times of economic hardship. If he resists, you might want to dress him in beige. According to John Molloy, a "clothing consultant," you might be able to "diminish his look of authority by having him wear a pale-beige suit, a pale shirt (not light-blue), and a pale tie. This combination suggests to a jury that this is not really a man of authority and raises the question of how he could have abused what he obviously didn't have."

What happens to my e-mail accounts when I die?

T. C.

Dear T. C.,

If you suspect that you're going to die soon, I suggest that you print out important correspondence, or share your password with a loved one. If you have a Yahoo e-mail account, no one will be allowed access to it, so your contacts will have to be notified of your death some other way; the company will permanently delete your e-mails when it receives a death certificate. Gmail is a bit more generous. Your legal representative will be allowed access to your account when proof of death is provided. AOL also transfers the e-mail account to your designated representative upon receipt of a death certificate. The new user will have the option of sending out a death notice, or simply deleting the account. Individual companies have different policies, of course. ♦

Side by...

Geo-engineering

by *Graeme Wood*

IF WE WERE transported forward in time, to an Earth ravaged by catastrophic climate change, we might see long, delicate strands of fire hose stretching into the sky, like spaghetti, attached to zeppelins hovering 65,000 feet in the air. Factories on the ground would pump 10 kilos of sulfur dioxide up through those hoses every second. And at the top, the hoses would cough a sulfurous pall into the sky. At sunset on some parts of the planet, these puffs of aerosolized pollutant would glow a dramatic red, like the skies in *Blade Runner*. During the day, they would shield the planet from the sun's full force, keeping temperatures cool – as long as the puffing never ceased.

Technology that could redden the skies and chill the planet is available right now. Within a few years we could cool the Earth to temperatures not regularly seen since James Watt's steam engine belched its first smoky plume in the late 18th century. And we could do it cheaply: \$100 billion could reverse anthropogenic climate change entirely, and some experts suspect that a hundredth of that sum could suffice. To stop global warming the old-fashioned way, by cutting carbon emissions, would cost on the order of \$1 trillion yearly. If this

...by side

Geokozmetika

fordította *Tárnok Attila*

HA MÓDUNKBAN ÁLLNA az éghajlati változásoktól sújtott katasztrofális jövőbe utazni, a Földről kiinduló és az ég felé tartó, bosszú, hajlékony, tűzoltócsövekre hasonlító kinövésekkel találkozánk, amelyek spagettiként kigyóznak felfelé, és húszezer méter magasságban himbálózó léghajókba kapaszkodnak. Földi gyárak minden egyes csövön másodpercenként 10 kilogramm kéndioxidot pumpálnának a léghajókba, kénfelhővel terítve be az eget. Napnyugtakor a Föld némely pontjáról a spray-szerűen kibocsátott anyagtól megfestett ég vihar előtti vörösben játszana, nagyjából ahogy azt a Szárnyas fejedelmek című film sugallja. A nap folyamán azonban a kénfelhők megkímélnék égitestünket a Nap sugárzásától, és hűvös hőmérsékletet biztosítanak, amennyiben a gyárak egy pillanatra sem állnak le a kéndioxid-termeléssel.

Földünk bioszférájának ilyen vörös felhők által történő szabályozására a technológia jelenleg már hozzáférhető. Néhány éven belül bioszféránk hűtése olyan méreteket ölthet, amilyen hőmérséklettel a 18. század óta – amikor James Watt gőzgépe először öklendezett füstöt a levegőbe – nem találkoztunk. Mindezt olcsón megtehetnénk: 100 milliárd dollár elegendő lenne ahhoz, hogy az ember okozta éghajlati változásokat a visszájára fordítsuk, sőt egyes becslések szerint ennek a századrésze is elégséges lehet. A globális felmelegedés sikeres megfékezése a hagyományos stratégia segítségével, a széndioxid-kibocsátás korlátozásával, évi ezer

idea sounds unlikely, consider that President Obama's science adviser, John Holdren, said in April that he thought the administration would consider it, "if we get desperate enough." And if it sounds dystopian or futuristic, consider that *Blade Runner* was set in 2019, not long after Obama would complete a second term.

Humans have been aggressively transforming the planet for more than 200 years. The Nobel Prize-winning atmospheric scientist Paul Crutzen – one of the first cheerleaders for investigating the gas-the-planet strategy – recently argued that geologists should refer to the past two centuries as the "anthropocene" period. In that time, humans have reshaped about half of the Earth's surface. We have dictated what plants grow and where. We've pocked and deformed the Earth's crust with mines and wells, and we've commandeered a huge fraction of its freshwater supply for our own purposes. What is new is the idea that we might want to deform the Earth intentionally, as a way to engineer the planet either back into its pre-industrial state, or into some improved third state. Large-scale projects that aim to accomplish this go by the name "geo-engineering," and they constitute some of the most innovative and dangerous ideas being considered today to combat climate change. Some scientists see geo-engineering as a last-ditch option to prevent us from cooking the planet to death. Others fear that it could have unforeseen – and possibly catastrophic – consequences. What many agree on, however, is that the technology necessary to reshape the climate is so powerful, and so easily implemented, that the world must decide how to govern its use before the wrong nation – or even the wrong individual – starts to change the climate all on its own.

If geo-engineers have a natural enemy, it is the sun. Their

milliárd dollárba kerülne. Hogy ennek a lehetősége mennyire adott, arra legyen elég Obama elnök tudományos tanácsadója, John Oldren szavait idézniünk: a kormány foglalkozik a gondolattal „vészhelyzet esetére” – mondta 2009 áprilisában. És ha mindez anti-utópisztikusan hangzik, ne feledjük, hogy a Szárnyas fejtánc 2019-ben játszódik, röviddel azután, hogy Obama kitölti esetleges második elnöki mandátumát.

Az elmúlt kétszáz évben az emberiség drasztikusan felforgatta a Föld életét. A Nobel-díjas atmoszféra-kutató, Paul Crutzen egyike azoknak, akik elsőként szorgalmazták az imént leírt stratégiát problémáink megoldására. Megítélése szerint geológusaink az elmúlt kétszáz évet, amelyben az emberiség nagyjából a Föld felszínének a felét formálta át, az 'antropocén' kor kezdeteként kéne értelmezzék. Az ember szabja meg, milyen növény hol teremjen. Bányákkal és kutakkal sértettük fel és deformáltuk a földfelszínt. Az édesvíz-készlet tekintélyes hányadát saját céljainkra hasznosítottuk. Újszerű elképzelés az, hogy szándékosan alakítsuk át a Földet; állítsuk vissza az iparosodás előtti állapotokat vagy hozzunk létre egy ideális új (harmadik) állapotot. E változásokat célul kitűző nagyszabású projekteket a 'geokozmetika' összefoglaló nével illelhetjük. Az éghajlati változásokat szabályozó projektek a legújseriesbb, ugyanakkor a legveszélyesebb elképzeléseknek adnak otthont. Egyes tudósok az utolsó mentsvárként kezelik a geokozmetikát égitestünk halálra forrósításának megakadályozására, míg mások attól tartanak, hogy az ilyen jellegű lépések előre nem látható és valószínűleg katasztrofális következményekhez vezetnek. Abban azonban sokan egyetértenek, hogy az éghajlati változások újrarendelése olyan horderejű, ám ugyanakkor annyira egyszerűen kivitelezhető beavatkozás, hogy félő, egyetlen állam vagy akár egyetlen személy hozzáférhet a saját szakállára azelőtt, mielőtt globális konszenzus születne.

Ha van egyáltalán akadálya a geomérnöki elképzeléseknek, akkor az éppenséggel a Nap. Első lépésként meg kéne próbálnunk korlátozni a sugárzást. Egy skót mérnök, Stephen Salter azzal az elgondolással

first impulse is to try to block it out. Stephen Salter, a Scottish engineer, has mocked up a strategy that would cool the planet by painting the skies above the oceans white. Salter's designs – based on an idea developed by John Latham at the National Center for Atmospheric Research – call for a permanent fleet of up to 1,500 ships dragging propellers that churn up seawater and spray it high enough for the wind to carry it into the clouds. The spray would add moisture to the clouds and make them whiter and fluffier, and therefore better at bouncing sunlight back harmlessly into space. Salter, who has investigated the technical feasibility of this idea minutely (down to the question of whether ship owners would mind affixing spray nozzles to their hulls with magnets), estimates the cost to build the first 300 ships – enough to turn back the climatological clock to James Watt's era – to be \$600 million, plus another \$100 million per year to keep the project going.

Roger Angel, an astronomy and optics professor at the University of Arizona, would block the sun by building a giant visor in space. He proposes constructing 20 electromagnetic guns, each more than a mile long and positioned at high altitudes, that would shoot Frisbee-size ceramic disks. Each gun would launch 800,000 disks every five minutes – day and night, weekends and holidays – for 10 years. The guns would aim at the gravitational midpoint between the Earth and the sun, so that the disks would hang in space, providing a huge array of sunshades that would block and scatter sunlight and put the Earth in a permanent state of annular eclipse. Angel's scheme relies on launch technology that doesn't yet exist (no one has ever wanted to shoot Frisbees at the sun before), and would cost several trillion dollars. "I know it sounds like mad science," he says. "But unfortunately we have a mad planet."

állt elő, hogy ha az óceánok fölött fehérré festjük az eget, az a Föld hőmérsékletének kívánt csökkenését fogja eredményezni. Az ötlet John Lathamtól, a Nemzeti Atmoszférakutató Központ tudósától származik. Salter tervei szerint egy ezeröttszáz hajóból álló flotta folyamatosan azon dolgozna, hogy a tenger vizét propellerekkel a légterbe spriccelje és a szél erejében bízva felhőket hozzon létre. A víz növelné a felhők nedvességtartalmát és tömegét, s ezáltal visszaverné a Nap sugárzását. A skót mérnök a megvalósítás olyan technikai részleteit is kidolgozta, mint például a spray csöveinek mágnessel a hajótesthez történő rögzítése. Számításai szerint az első 300 hajó megépítése, amely elegendő lenne ahhoz, hogy légterünket a James Watt korabeli állapotokra állítsuk vissza, 600 millió dollárba kerülne, és a projekt évi 100 millió dollárból működtethető.

Roger Angel, az Arizonai Egyetem Csillagászati és Optikai Tanszékének professzora egy óriási napellenző segítségével korlátozná a Nap túlzott sugárzását. Javaslatá alapján húsz darab, egy mérföld hosszúságú, elektromágneses ágyút kéne a légterbe telepíteni nagy magasságban. Minden egyes ágyú öt percenként 800 ezer darab, friszbí méretű kerámialemezt löne ki, tíz éven át, megállás nélkül éjjel-nappal. Az ágyúk a Föld és a Nap közötti gravitációs középpontra irányulnának, ami által a lemezek a súlytalanság állapotában lebegnének a légterben. A lemezek együttesen egy óriási napernyőt alkotnak, amely szűrné és távol tartaná a Nap káros sugárzását és a Föld számára permanens napfogyatkozást biztosítana. Angel megoldása olyan technológián alapul, amely még nem létezik – még soha senki nem akart friszbít kilőni a Nap elé –, és dollármilliárdokat emésztene fel. „Tisztában vagyok vele, hogy örültségnek hangzik, amit mondok – szabadkozok –, de sajnos egy örült égitesten élünk.”

A Nap hőhatásának csökkentésére tett javaslatok közül a kénefelhő (a Szárnyas fejvadászt idéző elgondolás) tűnik a legkevésbé örült megoldásnak, ugyanakkor azt a kompromisszumot is jól példázza,

Of all the ideas circulating for blocking solar heat, however, sulfur-aerosol injection – the *Blade Runner* scenario – may actually be the least mad. And it provides an illustrative example of the trade-offs that all geo-engineering projects of its scale must confront. The approach is already known to work. When Mount Tambora erupted in Indonesia in 1815 and spewed sulfur dioxide into the stratosphere, farmers in New England recorded a summer so chilly that their fields frosted over in July. The Mount Pinatubo eruption in the Philippines in 1991 cooled global temperatures by about half a degree Celsius for the next few years. A sulfur-aerosol project could produce a Pinatubo of sulfur dioxide every four years.

The aerosol plan is also cheap – so cheap that it completely overturns conventional analysis of how to mitigate climate change. Thomas C. Schelling, who won the 2005 Nobel Prize in economics, has pointed out how difficult it is to get vast international agreements – such as the Kyoto Protocol – to stick. But a geo-engineering strategy like sulfur aerosol “changes everything,” he says. Suddenly, instead of a situation where any one country can foil efforts to curb global warming, any one country can curb global warming all on its own. Pumping sulfur into the atmosphere is a lot easier than trying to orchestrate the actions of 200 countries – or, for that matter, 7 billion individuals – each of whom has strong incentives to cheat.

But, as with nearly every geo-engineering plan, there are substantial drawbacks to the gas-the-planet strategy. Opponents say it might produce acid rain and decimate plant and fish life. Perhaps more disturbing, it's likely to trigger radical shifts in the climate that would hit the globe unevenly. “Plausibly, 6 billion people would benefit and 1 billion would

amelyel a hasonló nagyságrendű projektek szembe találják magukat. Az elgondolás bizonyíthatóan működőképes. Amikor az indonéziai Mount Tambora vulkán 1805-ben kitört és kén-dioxidot lövellt a sztratoszférába, az Egyesült Államok-beli New England farmergazdálkodói feljegyezték, hogy fagy borította el a földjeiket júliusban. A Fülöp-szigeteki Mount Pinatubo vulkán 1991-es kitörése 0,5 °C-kal hűtötte le Földünk hőmérsékletét a kitörést követő néhány évben. A kénfelhő-projekt négy évente a Pinatubo vulkán hatásával azonos eredményt produkálna.

A kénfelhő légterbe történő bocsátása mindemellett olcsó is: olyan olcsó, hogy minden korábbi, az éghajlati változásokat elősegítő hagyományos elemzést felülír. A 2005. évi közgazdasági Nobel-díjas, Thomas C. Schelling rámutatott, mennyire összetett folyamat tető alá hozni az olyan globális nemzetközi egyezményeket, mint amilyen a Kyotói Egyezmény. Azonban – teszi hozzá – a kénfelhőt létrehozó geomérnöki stratégia „minden korábbi elképzelést megváltoztat”. Hirtelenjében annak veszélye helyett, hogy bármely ország megbéníthatja a globális felmelegedés megakadályozására tett erőfeszítéseket, a veszély abban áll, hogy az új elképzelés alapján bármely ország egyedül is képessé válhat ilyen erőfeszítések kivitelezésére. Az atmoszférába történő kénkibocsátás sokkal egyszerűbb feladat, mint 200 ország (sőt: 7 milliárd egyén, akik mindannyian erős késztetést érezhetnek a csalásra) tevékenységének összehangolása.

Am, ahogy szinte bármely más geomérnöki elképzelés kapcsán, a kénfelhős megoldás kapcsán is hátulütők merülnek fel. Ellenzői szerint savas esőt okozhat, amely megtizedelheti a növény-, és hal-állományt. Ami még aggasztóbb, a radikális éghajlati változások nem azonos arányban hatnának a Föld egész területén. „Valószínűsíthető, hogy hatmilliárd ember számára hasznos, egymillárd számára pedig károkat eredményezne a kivitelezés” – jelenti ki Martin Bunzl, az amerikai Rutgers Egyetem klímatiszta szakértője. A negatív módon

be hurt,” says Martin Bunzl, a Rutgers climate-change policy expert. The billion negatively affected would include many in Africa, who would, perversely, live in a climate even hotter and drier than before. In India, rainfall levels might severely decline; the monsoons rely on temperature differences between the Asian landmass and the ocean, and sulfur aerosols could diminish those differences substantially.

Worst of all is what Raymond Pierrehumbert, a geophysicist at the University of Chicago, calls the “Sword of Damocles” scenario. In Greek legend, Dionysius II, the ruler of Syracuse, used a single hair to suspend a sword over Damocles’ head, ostensibly to show him how precarious the life of a powerful ruler can be. According to Pierrehumbert, sulfur aerosols would cool the planet, but we’d risk calamity the moment we stopped pumping: the aerosols would rain down and years’ worth of accumulated carbon would make temperatures surge. Everything would be fine, in other words, until the hair snapped, and then the world would experience the full force of postponed warming in just a couple of catastrophic years. Pierrehumbert imagines another possibility in which sun-blocking technology works but has unforeseen consequences, such as rapid ozone destruction. If a future generation discovered that a geo-engineering program had such a disastrous side effect, it couldn’t easily shut things down. He notes that sulfur-aerosol injection, like many geo-engineering ideas, would be easy to implement. But if it failed, he says, it would fail horribly. “It’s scary because it actually could be done,” he says. “And it’s like taking aspirin for cancer.”

In 1977, the physicist Freeman Dyson published the first of a series of articles about how plants affect the planet’s carbon-

érintett egymilliárdos tömeget részben Afrika lakossága alkotná, akik – abszurd módon – a jelenleginél forróbb és szárazabb hőmérsékleti viszonyokkal lennének kénytelenek együtt élni. Mivel a kénfelhők csökkenének az indiai szubkontinens és az óceán közötti hőmérsékleti különbséget, amely hőmérsékletkülönbség a monszun esőke kiváltó oka, a csapadék mennyisége Indiában drasztikusan visszaeshet.

A legrosszabb eshetőség a Chicagói Egyetem geofizikusa, Raymond Pierrehumbert által Damoklész kardjának nevezett utóhatás. Szirakúza uralkodója, II. Dionüszosz egyetlen hajszállal kardot lógatott Damoklész feje fölé, hogy rávilágítson számára, mennyire törekény lehet még a hatalmas uralkodók élete is. Pierrehumbert szerint a kénfelhők csakugyan csökkentenék égitestünk hőmérsékletét, de amint szüneteltetnénk a kén kibocsátást, az esőkekel visszaérkező, az évek során felhalmozódott szén [sic] a Föld hőmérsékletét iszonyatosan megnövelné. Más szavakkal, minden csodálatosan működne, amíg a hajszál el nem szakad, ám azután néhány katasztrófális éven belül a világ a késleltetett felmelegedés minden átkát megtapasztalná. Pierrehumbert meglátása szerint a Nap sugárzásának korlátozása működhet ugyan, de számos, előre nem látható következményekkel jár, mint például az ózonréteg hirtelen károsodása. Hiába ismeri fel a jövő generációja, micsoda végtelen mellékhatásokat hordoz magában a geomérnöki program, nem egykönnyen lesz képes a folyamatot leállítani. A kénfelhőt létrehozó geomérnöki elképzelés, ahogy számos hasonló elgondolás, rendkívül könnyen kivitelezhető, de ha a működésben zavar támad, az eredmény katasztrófális. „A dolog azért ijesztő, mert megvalósítható – teszi hozzá Pierrehumbert –, de az egész olyan, mintha aspirint szednénk rákos megbetegedés esetén.”

Freeman Dyson, fizikus 1977-ben kezdett közölni egy cikksorozatot, amelyben a növények a Föld szén-dioxid koncentrációjára gyakorolt hatását elemzi. Nyaranta a növények a bioszféra szén-dioxid tartalmának mintegy egytizedét nyelik el. Ősszel azonban, amikor a növekedé-

dioxide concentrations. Every summer, plants absorb about a tenth of the carbon dioxide in the atmosphere. In the fall, when they stop growing or shed their leaves, they release most of it back into the air. Dyson proposed creating forests of “carbon-eating trees,” engineered to suck carbon more ravenously from the air, and to keep it tied up in thick roots that would decay into topsoil, trapping the carbon. He now estimates that by annually increasing topsoil by just a tenth of an inch over land that supports vegetation, we could offset all human carbon emissions.

Dyson’s early geo-engineering vision addressed a central, and still daunting, problem: neither sulfur-aerosol injection nor an armada of cloud whiteners nor an array of space-shades would do much to reduce carbon-dioxide levels. As long as carbon emissions remain constant, the atmosphere will fill with more and more greenhouse gases. Blocking the sun does nothing to stop the buildup. It is not even like fighting obesity with liposuction: it’s like fighting obesity with a corset, and a diet of lard and doughnuts. Should the corset ever come off, the flab would burst out as if the corset had never been there at all. For this reason, nearly every climate scientist who spoke with me unhesitatingly advocated cutting carbon emissions over geo-engineering.

But past international efforts to reduce emissions offer little cause for optimism, and time may be quickly running out. That’s why a few scientists are following Dyson’s lead and attacking global warming at its source. David Keith, an energy-technology expert at the University of Calgary, hopes to capture carbon from the air. He proposes erecting vented building-size structures that contain grids coated with a chemical solution. As air flows through the vents, the solution

siük leáll, és elhullatják leveleiket, a szén-dioxid legnagyobb részét a levegőbe visszabocsátják. Dyson azt javasolta, hogy telepítsünk a szén-dioxidot mohón elnyelő fák alkotta erdőket, és nemesítéssel érjük el, hogy vastag gyökérzetükkel ezek a fák a szén-dioxidot a földben kössék le, majd elkorhadásuk után a földfelszín alatt tartásuk. Becslése alapján a föld növényeket fenntartó termőréteg-vastagságának 2,5 milliméterrel történő évenkénti növelése ellensúlyozhatja a teljes emberi eredetű szén-dioxid kibocsátást.

Dyson egykori geomérnöki víziója egy központi és máig ijesztő problémát jelez: a szén-dioxid szint csökkentése irányában semmit sem használnak a kénfelbőké, az óceán vizéből létrehozott fehér felbőké tömege vagy az óriási napellenzők. Ha a szén-dioxid kibocsátás szintje állandó marad, a bioszféra egyre több üvegház-gázzal telítődik. A halmozódó gázokat a Nap sugárzásának korlátozása nem befolyásolja. Hasonlatlanul élve, még annyi eredményt sem érünk el, mint a kövér hölgy, aki zsírregetéssel próbál fogyni. Legfeljebb annyit, amennyit a fűző használata palástol, de a hölgy közben zsíros édességekben leli örömét. Ha egyszer a fűző lekerül, a zsírpárnák úgy türemkednek elő, mintha ruhadarab soha nem fedte volna őket. E logika mentén, szinte az összes klimatológus, akivel találkoztam, habozás nélkül előnyben részesíti a szén-dioxid kibocsátás csökkentését bármely geomérnöki megoldással szemben.

Am a múltbeli nemzetközi erőfeszítések a kibocsátás csökkentésére kevés optimizmusra adnak okot, és féltő, hogy kifutunk az időből. Ezt felismerve néhány tudós Dyson útmutatását követi, és a globális felmelegedés problémáját a gyökereknél próbálja megragadni. A Calgary-i Egyetem energia-technológia szakértője, David Keith a szén-dioxidot a légtérben szeretné hatástalanítani. Elképzelése szerint tömbhöz méretű, vegyi oldattal bevont rácszerkezeteknek otthont adó tornyokat kéne építeniünk; az ezeken keresztül áramló levegőben az oldat megkötne a szén-dioxid molekulákat. Az ipari hűtőtornyokra emlékeztető építményekben zajló kibocsátás-szabályozási folyamat olcsón, központi bázis-

would bind to the carbon-dioxide molecules and trap them. Capturing carbon in these structures, which might resemble industrial cooling towers, would allow us to manage emissions cheaply from central sites, rather than from the dispersed places from which they were emitted, such as cars, planes, and home furnaces. The grids would have to be scrubbed chemically to separate the carbon. If chemists could engineer ways to wash the carbon out that didn't require too much energy, Keith imagines that these structures could effectively make our carbon-spewing conveniences carbon-neutral.

The question then becomes where to put all that carbon once it's captured. Keith has investigated one elegant solution: put it back underground, where much of it originated as oil. The technology for stashing carbon beneath the earth already exists, and is routinely exploited by oil-well drillers. When oil wells stop producing in large quantities, drillers inject carbon dioxide into the ground to push out the last drops. If they inject it into the right kind of geological structure, and deep enough below the surface, it stays there.

We might also store carbon dioxide in the oceans. Already, on the oceans' surface, clouds of blooming plankton ingest amounts of carbon dioxide comparable to those taken in by trees. Climos, a geo-engineering start-up based in San Francisco, is trying to cultivate ever-bigger plankton blooms that would suck in huge supplies of carbon. When the plankton died, the carbon would end up on the sea floor. Climos began with the observation that plankton bloom in the ocean only when they have adequate supplies of iron. In the 1980s, the oceanographer John Martin hypothesized that large amounts of oceanic iron may have produced giant plankton blooms in the past, and therefore chilled the atmosphere by removing

sokról üzemeltethető, szemben azszal az elgondolással, amely a kibocsátás különböző forrás-helyszínein, a gépjárművekben, repülőgépeken vagy az épületek klímaberendezéseinél kísérli megoldani a problémát. A rácsszerkezetekben felhalmozódott szén-dioxidot vegyi úton lehetne leválasztani. Ha a vegyszereknek sikerül olyan eljárásokat kidolgozniuk, amelyek ezt a feladatot kevés energia felhasználásával képesek megoldani, Keith szerint a tornyok hatékonyan semlegesíthetik az ember szén-dioxid kibocsátását.

A kérdés a továbbiakban az marad, hol tároljuk az ily módon megkötött szén-dioxidot. Keith kutatásai elegánsnak tűnő megoldáshoz vezetnek: visszatemetethetnénk a föld alá, ahonnan nagy részét olaj formájában eleve nyertük. A technológia már létezik, az olajfúró-tornyok rutinfeladati közé tartozik: amikor egy olajkútból nem várható már számottevő hozam, a fúrótornyok szén-dioxidot juttatnak a földbe, ami az olaj utolsó maradékát a felszínre kényszeríti. Ha megfelelő földtani szerkezetbe történt az injektálás, és a földfelszíntől elegendő mélységben, az anyag nem tör újra a felszín fölé.

A szén-dioxid tárolására az óceánok is alkalmasak. Az óceán felszínén planktontömegek felhői olyan mennyiségű szén-dioxidot nyelnek magukba, ami csak a fák elnyeléséhez hasonlítható. Egy 'Climos' elnevezésű, San Francisco-i geomérnöki kezdeményezés óriási méretű planktonpopuláció létrehozásán dolgozik, amely az eddigieknél nagyobb mennyiségű szén-dioxid elnyelésére lenne képes. A planktonok élettartamuk befejeztével a hordozott szén-dioxiddal együtt a tengerfenékre süllyednek. A Climos kutatóinak megfigyelése szerint a planktonok csak az óceán megfelelő mennyiségű vastartalma esetén szaporodnak. Az 1980-as években az óceánkutató, John Martin azt is feltételezte, hogy a múltban a tengerek vastartalma vezetett a planktonpopuláció növekedéséhez, ami a szén-dioxid elnyelésével csökkentette a bioszféra hőmérsékletét. Javaslatá alapján, ha az óceánok felszínén finom vasport hintonénk szét, rövidesen a planktonpopuláció drámai növekedésével számolha-

carbon dioxide. Spread powdered iron over the surface of the ocean, and in very little time a massive bloom of plankton will grow, he predicted. “Give me half a tanker of iron,” Martin said, “and I’ll give you the next Ice Age.” If Martin’s ideas are sound, Climos could in effect become the world’s gardener by seeding Antarctic waters with iron and creating vast, rapidly growing offshore forests to replace the ones that no longer exist on land. But this solution, too, could have terrible downsides. Alan Robock, an environmental scientist at Rutgers, notes that when the dead algae degrades, it could emit methane – a greenhouse gas 20 times stronger than carbon dioxide.

Just a decade ago, every one of these schemes was considered outlandish. Some still seem that way. But what sounded crankish only 10 years ago is now becoming mainstream thinking. Although using geo-engineering to combat climate change was first considered (and dismissed) by President Johnson’s administration, sustained political interest began on the business-friendly right, which remains excited about any solution that doesn’t get in the way of the oil companies. The American Enterprise Institute, a conservative think tank historically inimical to emission-reduction measures, has sponsored panels on the sulfur-aerosol plan.

By now, even staunch environmentalists and eminent scientists with long records of climate-change concern are discussing geo-engineering openly. Paul Crutzen, who earned his Nobel Prize by figuring out how human activity punched a hole in the ozone layer, has for years urged research on sulfur-aerosol solutions, bringing vast credibility to geo-engineering as a result.

With that growing acceptance, however, come some grave

tunk. „Álljon rendelkezésemre egy fél hajórakomány vas, és előidézek egy új jégkorszakot” – jelentette ki. Ha Martin elképzelései megalapozottak, a Climos-kezdeményezés a világ kertésze lehet. Az Antarktis vizzeinek vastartalmát növelve távoli erdők sarjadnának ott, ahol már régen kipusztultak. Ám ez az elgondolás is borzasztó veszélyeket rejt. A Rutgers Egyetem környezetkutatója, Alan Robock arra a tényre hívja fel a figyelmet, hogy amikor az algák oszlásnak indulnak, metánt bocsáthatnak ki, ami hússzor erősebb üvegház-gáz, mint a szén-dioxid.

Alig tíz éve a felsorolt elképzelések mindegyikét képtelenségként kezelték, némelyik még ma is annak látszik. De sok minden, ami tíz éve különködésnek számított, mára elfogadott magatartás lett. Jóllehet az éghajlatváltozások szabályozását elősegítő geomérnöki tervek először a demokrata Lyndon Johnson elnöksége idején merültek fel és lettek elvetve, határozott politikai figyelem a vállalkozóbarát jobboldal részéről volt tapasztalható, amely oldal minden megoldásra nyitott, amely nem sérti az olajvállalatok érdekeit. Konzervatív szakértők egy csoportja, akik ugyan a kibocsátás szabályozását korábban ellenezték, a kénfelhős elképzelést megalapozó projekteket anyagi támogatásban részesítettek.

Manapság elkötelezett környezetvédők és az éghajlati változások kutatásában érdekelt tudósok a geomérnöki megoldások gyakorlati vetületeiről cserélnek eszmét. Paul Crutzen, aki az ózonréteg emberi tevékenység okozta sérüléseit vizsgáló kutatásaiért kapott Nobel-díjat, és aki sokat tett a geomérnöki elgondolások hitelességének népszerűsítése érdekében, évek óta szorgalmazza a kénfelhős elképzelés kifejlesztését.

A korábban örültségnek tündt elképzelések elfogadása ugyanakkor veszélyeket hordoz magában. Ha a köztudat a geokozmetikát az éghajlatváltozások problémáira megfelelő megoldásként kezeli, a kormányok hajlamosak lesznek lazítani a szén-dioxid kibocsátás korlátozását előíró rendelkezéseken, amely kibocsátás a globális felmelegedés kiváltó oka volt eredetileg. Ha meggyőződésünké válik, hogy egy esetle-

dangers. If geo-engineering is publicly considered a “solution” to climate change, governments may reduce their efforts to restrict the carbon emissions that caused global warming in the first place. If you promise that in a future emergency you can chill the Earth in a matter of months, cutting emissions today will seem far less urgent. “Geo-engineering needs some government funding, but the most disastrous thing that could happen would be for Barack Obama to stand up tomorrow and announce the creation of a geo-engineering task force with hundreds of millions in funds,” says David Keith.

Ken Caldeira, of the Carnegie Institution for Science, thinks we ought to test the technology gradually. He suggests that we imagine the suite of geo-engineering projects like a knob that we can turn. “You can turn it gently or violently. The more gently it gets turned, the less disruptive the changes will be. Environmentally, the least risky thing to do is to slowly scale up small field experiments,” he says. “But politically that’s the riskiest thing to do.”

Such small-scale experimentation, however, could be the first step on a very slippery slope. Raymond Pierrehumbert likens geo-engineering to building strategic nuclear weapons. “It’s like the dilemma faced by scientists in the Manhattan Project, who had to decide whether that work was necessary or reprehensible,” he says. “Geo-engineering makes the problem of ballistic-missile defense look easy. It has to work the first time, and just right. People quite rightly see it as a scary thing.”

The scariest thing about geo-engineering, as it happens, is also the thing that makes it such a game-changer in the global-warming debate: it’s incredibly cheap. Many scientists, in fact, prefer not to mention just how cheap it is. Nearly everyone I spoke to agreed that the worst-case scenario would be the rise

ges jövőbeni vészhelyzet esetén hónapokon belül lehetséges a Föld hőmérsékletének csökkentése, a jelenlegi kibocsátás korlátozása sokkal kevésbé tűnhet égető kérdésnek. „A geomérnöki fejlesztés szerepet kell kapjon az állami költségvetésben – jelenti ki David Keith –, de katasztrófális lenne, ha Barack Obama holnap bejelentené, hogy a cél érdekében néhány százmillió dollár el lett különítve.”

Ken Caldeira, a Carnegie Tudományos Intézet kutatója szerint a lehetséges technológiai eljárásokat fokozatosan kéne tesztelniünk. Indítványozza, hogy az elképzelések együttesét kezeljük úgy, mint egy állítócsavart. „Elfordíthatjuk gyengéden vagy hirtelen nagy erővel. Minél gyengédebben kezeljük, annál kevésbé lesz durva a változás, amit előidéz. A környezet szempontjából a legkevésbé kockázatos, ha a kisebb terep kísérleteket lassanként szélesítjük ki – szögezi le –, ám politikai szempontból éppen ez a legkockázatosabb.”

Mindazonáltal a kisebb nagyságrendű kísérletek lehetnek az első lépések, amelyeket egy nagyon csúszós, meredek úton megteszünk. Raymond Pierrehumbert a geomérnöki tevékenységet a stratégiai nukleáris fegyverkezéshez hasonlítja. „Olyan probléma ez, amilyennel a Manhattan Project tudósai találták magukat szembe – mondja. – El kellett dönteniük, hogy munkájuk megéri-e a fáradságot vagy szűkségtelen. A ballisztikus rakétaelhárító-rendszerek problémája a geokozmetika mellett eltörpül. A geomérnöki megoldásnak elsöre működni kell, és hibátlanul. Teljesen érthető, hogy sokan az elképzeléseket rémisztőnek találják.”

A geokozmetika legijesztőbb vetülete éppen az a jellege, ami alapján üttökártya a globális felmelegedésről folytatott egyeztetésekben: hibetetlenül olcsó. Sok tudós egyenesen tartózkodik attól, hogy meghatározza, mennyire olcsó. Abban szinte mindenki egyetért, hogy a lehető legrámaibb fejlemény az lehet, amit David Victor, a Stanford Egyetem jogi professzora a ‘Greenfinger’ effektusként említ: egy megszállottan környezettudatos, gazdag örült a James Bond-filmekből ismert Auric Goldfinger

of what David Victor, a Stanford law professor, calls a “Greenfinger” – a rich madman, as obsessed with the environment as James Bond’s nemesis Auric Goldfinger was with gold. There are now 38 people in the world with \$10 billion or more in private assets, according to the latest Forbes list; theoretically, one of these people could reverse climate change all alone. “I don’t think we really want to empower the Richard Bransons of the world to try solutions like this,” says Jay Michaelson, an environmental-law expert, who predicted many of these debates 10 years ago.

Even if Richard Branson behaves, a single rogue nation could have the resources to change the climate. Most of Bangladesh’s population lives in low-elevation coastal zones that would wash away if sea levels rose. For a fraction of its GDP, Bangladesh could refreeze the ice caps using sulfur aerosols (though, in a typical trade-off, this might affect its monsoons). If refreezing them would save the lives of millions of Bangladeshis, who could blame their government for acting? Such a scenario is unlikely; most countries would hesitate to violate international law and become a pariah. But it illustrates the political and regulatory complications that large-scale climate-changing schemes would trigger.

Michaelson – along with many others – has called for public research on some possible legal responses to geo-engineering. “It would be a classic situation where the problem should be handled in an official capacity,” he says. In practice, that would likely mean industrialized governments’ regulating geo-engineering directly, in a way that lets them monopolize the technology and prevent others from deploying it, through diplomatic and military means, or perhaps by just bribing Bangladesh not to puff out its own aerosols. Such a system

szerepét öltetheti. A Forbes magazin legutóbbi felmérése szerint jelenleg 38 ember él a világon, akinek személyes vagyona eléri a 10 milliárd dollárt. Elméletileg közülük bárki egyedül képes lehet az éghajlati változások visszafordítására. „Nem hiszem, hogy bátoritanunk kéne Richard Bransont és társait, hogy efféle lépésekhez folyamodjon” – mondja a környezeti jog szakértője, Jay Michaelson, aki az utóbbi időben felmerült kétségeket már tíz évvel ezelőtt megjósolta.

Még ha Richard Branson tartózkodik is a beavatkozástól, bármely rosszindulatú nemzet elegendő forrással rendelkezik a klímátikus változások szabályozására. Banglades lakosságának túlnyomó többsége olyan mélyföldön él, amelyet a tengerszint emelkedése elmoshat. Az ország éves nemzeti össztermékének a töredéke elegendő lenne ahhoz, hogy a jéghegyek csúcsa a kénfelhőknek köszönhetően ismét befagyjon, ámbar Banglades ilyen irányú lépése valószínűsíthető kárára is válna, hisz a beavatkozás a monszunt sem hagyná változatlanul. És ki kérhetné számon ezt a lépést a bangladesi kormánytól, ha ezzel a lakosság millióinak életét menti meg. Az ilyen lépések azonban valószínűtlenek; a legtöbb ország tartózkodik attól, hogy nemzetközi jogi előírásokat áthágjon, és ezáltal kitaszított státuszba kerüljön, de a példa jól illusztrálja azokat a politikai és szabályozási nehézségeket, amelyeket az éghajlatváltozás problémája előidéz.

Michaelson – sokakkal egyetemben – a geokozmetika lehetséges jogi vetületeinek közpénzekből finanszírozott kutatását szorgalmazza. „Abban a tipikus helyzetben találjuk magunkat, amikor egy problémát csak hivatalos minőségben lehet kezelni” – állítja. Gyakorlatilag ez annyit jelent, hogy az iparilag fejlett társadalmak kormányai közvetlenül szabályoznák a geomérnöki tevékenységet oly módon, hogy a technológia monopolizálásával, diplomáciai és katonai úton elzáránának másokat az alkalmazás lehetőségétől, vagy esetleg egyszerűen anyagi juttatásban részesítenék Bangladeset, nehogy kénfelhőket akarjon létrehozni. Egy ilyen rendszer nagyban hasonlítana ahhoz a szerephez, ahogy jelenleg a

might resemble the way the International Atomic Energy Agency now regulates nuclear technology.

And since geo-engineering – like nuclear weapons – would most likely be deployed during a moment of duress, legal experts like Victor have urged establishing preliminary regulations well in advance. “Suppose the U.S. or Brazil decided it needed some combination of emissions-cutting and geo-engineering in a sudden catastrophe,” Victor says. “How would the rest of us respond? There’s been no serious research on the topic. It has to be done right now, and not in a crisis situation.” An outright ban on geo-engineering could lead other countries to try out dangerous ideas on their own, just as a ban on cloning in the United States has sent research to Korea and Singapore; it would constrain all but the least responsible countries.

Victor doesn’t believe geo-engineering will solve anything by itself, but he expects that ultimately we will have a cocktail of solutions. Perhaps we could start with a few puffs of sulfur in the atmosphere to buy time, then forests of plankton in the ocean, and then genetically engineered carbon-hungry trees. What isn’t an option, Victor says, is refusing to fund more research, in the hope that geo-engineering won’t be needed.

Thomas Schelling, who won his Nobel Prize for using game theory to explain nuclear strategy and the behavior of states in arms races, shares Victor’s frustration about the way geo-engineering has been ignored. Multinational agreements to cut emissions amount to a game of chicken that tends to end unhappily in Schelling’s models. The ideal outcome would be a technology that changes the game. “We just have to consider that we may need this kind of project, and might need it in a hurry,” he says. “If the president has to go by boat from the

Nemzetközi Atomenergia Ügynökség a nukleáris technológiát szabályozza.

És mivel a geomérnöki elgondolásokat éppúgy, mint a nukleáris fegyvereket, valószínűleg kényszer hatására alkalmazzánk, David Victor és más szakértők mielőbbi előzetes jogi szabályozást sürgetnek. „Tegyük fel, hogy az Egyesült Államok vagy Brazília a kibocsátáskorlátozás és a geomérnöki megoldások bizonyos kombinációját kénytelen alkalmazni egy estleges katasztrófa esetén – körvonalazzuk Victor a problémát. – Miként fog erre a világ többi része reagálni? Ennek az eshetőségnek nincs komoly, kutatott háttere, márpedig a kutatást most kell elvégeznünk, nem akkor, amikor a krízis kirobban.” A geomérnöki megoldások határozott betiltása ahhoz vezethet, hogy egyes országok veszélyes kísérleteket hajtsanak végre. Ez történt, amikor a klónozást betiltották az Egyesült Államokban: a kutatás áttette a székhelyét Koreába és Szingapúrba. A tiltás épp a legfelelőtlenebb országokat nem korlátozza.

Victor nem hisz abban, hogy pusztán geokozmetikai tervekkel eljuthatunk a megoldáshoz; szerinte a megoldások összetettek. Az atmoszferikus kénfelhőkkel időt nyerhetünk kezdetben, aztán az óceánok plankton-felhői, majd a szén-dioxid elnyelő fák nemesítése vezethet célra. Victor szerint annyi azonban bizonyos, hogy a további kutatások költségét – egyedül a geokozmetika eredményeiben bízva – nem úszhatjuk meg.

A nukleáris stratégiákat és a fegyverkezési verseny során az államok által tanúsított viselkedést modellező játékelmélet kidolgozásáért Nobel-díjban részesített Thomas Schelling osztja Victor véleményét: a geomérnöki kutatások nem részesülnek a jelentőségüket megillető figyelemben. A károsanyag-kibocsátás visszaszorítására hozott nemzetközi egyezmények Schelling elméletében a szomorú véget érő ‘csirkék’ játékmódel mintáját követik. Olyan technológiában kéne gondolkodnunk, amely nem e modellen belül mozog. „Azt kell szem előtt tartanunk, hogy

White House to the Capitol, we should be ready scientifically – but also diplomatically – to do something about it.”

We should keep such images in mind. And they should remind us that, one way or another, a prolonged love affair with carbon dioxide will end disastrously. A pessimist might judge geo-engineering so risky that the cure would be worse than the disease. But a sober optimist might see it as the biggest and most terrifying insurance policy humanity might buy – one that pays out so meagerly, and in such foul currency, that we’d better ensure we never need it. In other words, we should keep investigating geo-engineering solutions, but make quite clear to the public that most of them are so dreadful that they should scare the living daylight out of even a Greenfinger. In this way, the colossal dangers inherent in geo-engineering could become its chief advantage. A premonition of a future that looks like *Blade Runner*, with skies dominated by a ruddy smog that’s our only defense against mass flooding and famine, with sunshades in space and a frothy bloom of plankton wreathing the Antarctic, could finally horrify the public into greener living. Perhaps a Prius doesn’t sound so bad, when a zeppelin is the alternative. ♦

a geomérnöki projektekre égető szükség van – szügezi le. – Arra az esetre, ha az Elnök a Fehér Házból a Capitoliumba csak hajóval érkezik, nemcsak technikailag, de a diplomácia szempontjából is kész megoldásokkal kell szolgálnunk.”

Az ilyen szemléletmód emlékeztethet mindannyiunkat, hogy a széndioxidhoz fűződő hosszú barátságunk előbb vagy utóbb végzetes következményekkel jár. A pesszimista megítélés szerint a geokozmetika olyan kockázatokat hordoz magában, amelyek súlyosabb tüneteket okoznak majd, mint maga a betegség volt. Am józanabb, optimista nézőpontból nem más ez, mint a legnagyobb szabású, de ugyanakkor legjessztőbb biztosítás, amelyre az emberiség befizethet: egy olyan biztosítás, amely fukaron és hamis valutában téríti meg a kárt. Legjobb, ha abban reménykedünk, soha nem lesz kártérítésre szükségünk. A geomérnöki kutatások nem szünetelhetnek tehát, de fel kell hívnunk a Föld népességének figyelmét arra, hogy a lehetséges megoldások legtöbbször felbecsülhetetlen kockázatokkal jár, és ezek a kockázatok a legelvakultabb környezetvédő szupermágnást is vissza kell rettentsék. Ily módon a geokozmetikában rejlő hatalmas veszélyforrás lehet az elképzelések legfőbb előnye. A Szárnyas fejvadász megrajzolta jövőkép, a tömeges áradások és éhezés elleni védekezés gyanánt az eget beborító vörös szmogfelhő, a gigantikus napernyők és a planktonok habzó populációja az Antarktisz vizeiben: ezek a borzasztó látomások talán észhez térítik az embert, és jobban vigyáz majd a környezetre. Talán nem is olyan rossz választás az üzemanyag-takarékos, japán autó, ha az alternatíva a kénfelhőket pumpáló léghajó. ♦