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Mycelium

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Dr Adlington skimmed the paper she was preparing for submission to *Medical Advances.* Merely checking for typos at this stage. She was confident that the data spoke for themselves — no statistical spin required to prove significance, this time.

Of course it had already been scrutinised, scoured, checked and counter-checked. Everyone in the department wanted in on this one and it was going to be a long list of authors. Adlington *et* quite lengthy *al*. She had both the alphabetical and authoritative advantage this time. Not that it was about her name. No, of course not. This was for her grandmother, and each patient she had seen over the years devoured from the inside, brain matter lignified, pock-marked, burrowed and punched-out by plaque or ischaemic attack. This was for the flourishing of humanity.

She looked again at the beautiful Kaplan–Meier chart, whose filamentous threads did not merely plateau (best hoped-for outcome) or diverge into varying gradients of decline (best expected outcome); but — astonishingly, and she had never seen this in any other trial —up-tick and climb, within mere months, even to surpass baseline IQ. It was staggering. And with only a handful of major adverse reactions (immune rejection leading to death) and fewer than five percent minor side effects in the two thousand trial subjects, few could argue against the risk-benefit balance and cost-effectiveness. That this would be the greatest medical advance of the past century was beyond doubt.

There she was again, getting ahead of herself, distracted with what could be. It was hard not to envision the prizes and plaudits that must follow. Further safety data beyond the current stage 3 trial would, of course, be a matter of time.

There. A final typo. People were always misspelling her name: Addlington.

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Mayu Matsumoto was sixty-three — the age at which her mother had started forgetting. First her PIN pass, then security number. Then where she was going. Then where she was. Then

words. Her children's names. Her own. Finally, her swallow. Then she had been returned to the earth — material reclaimed, spirit released.

Mayu was even younger when she had started forgetting. Genetic *anticipation* they called it — without irony — the earlier onset of increasing severity with each generation. She could anticipate the attrition of her own mind, even before she noticed the first symptoms: the mis-spliced sentences; familiar words sinking under the surface; imposters resurfacing in their place.

She had had confirmation of her gene carrier status a few years by the time she was invited to participate in the trial. She was aware of the myco-anthropogenetics department at the Biosphere as a leader in neuroregenerative research from when her mother had donated tissue samples to an earlier study. The invitation did not come without stark warning of the risks of first human trials — although the mouse trials had been reassuring so far — and had emphasised that due to double-blinding, she would not even know whether she would receive the new therapeutic or a placebo. But what was there to lose, that she was not already expecting to lose? She owed it to others affected by this unrelenting gene; she owed it to her son.

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The administration had been effortless — a pressurised puff to the roof of her nose through a fine white silicon tube, which she had barely felt. Afterwards, she felt so little difference she felt sure she had received the placebo, of saline or some other innocuous solution. Although prepared for that possibility, she nevertheless felt twinges of disappointment, mixed with tugs of relief, amidst a prevailing sense of resignation. She carried on as usual, to await her follow-up scans and serial cognitive testing.

At her first follow-up, she reported no change in symptoms. She could not view her cognitive results, nor see the team raise optimistic eyebrows at the two-point difference in word-finding speed and improved reaction times. She glimpsed them through the window as she came out of the scanner, clustered around the monitor, trying to maintain neutral expressions. All she was told as she was ushered out was that there had been 'no deterioration', which was a relief, at least.

The changes came gradually but more noticeably after that: she found her daily puzzles easier and achieved a new Tetris level week by week. She started organising her decades-cluttered flat with new energy. She discovered an old painting set which had waited patiently,

aspirationally, to be used. First studies, then work, then caring duties for her son, then latterly for her mother, had prevented her from ever taking up the brushes; and perhaps, if she cared to admit it, a reluctance to find that, after all, she had no talent for painting.

She unscrewed the lids, pierced the silver circle of yet-unbroken tubes, and squeezed a streak of the primary colours onto the pristine palette. The paint had separated a little into oil and sludgy pigment but mixed easily back together. The colours were so vivid they almost sang to her. She sat down at the table, picked up the cheap nylon brush, and fluidly sketched out the peonies in the vase in front of her. She was quite pleased with how she captured the dimensions and textures of the blowsy petals — effortlessly, intuitively, though yet imperfectly. Acceptable, for a first attempt — she might even frame it.

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A year later and, though the results of the trial had not been announced, she was beyond doubt that, whatever she had received, it was working. Decline was no longer inevitable. She felt good about life, which had a new vibrancy. Even food tasted better (if she ate in the right places) and she could discern subtleties of flavour that she had not appreciated before. Umami and earthy notes would ground sweet florals, weaving alongside hints of citrus, which all together danced in a scintillating kaleidoscope on her mind. Some flavours she had no name for, although new words suggested themselves to her.

November came round with a spell of unseasonable warmth. Today's weather took her back to her childhood summers — before the gulf stream had shut down with its complementary current of warmer air, and temperatures had occasionally hit as high as twenty. Perhaps it was a harbinger of yet further cycles of climate change, but today she would enjoy it. The honeyed breeze carried hints of heather and moor from the Pentlands, recalling old happinesses, and it occurred to her that a walk in the hills would give her just the right vantage point for painting the light on the city on this amber day.

She settled on Allermuir, easily accessible by public transport, and set off on the path kept freshly trampled by nature-walkers. At the foot, some blossom trees were duped into an early spring. As she walked on, although the colours were autumnally muted, the crisp light glazed them to a renewed sharpness. Some red-capped mushrooms buttoned the bright bracken. As she climbed, she noticed some winged ants emerging from peppered holes in the bank, and before long both the ground and air were seething with them, their silvery wings catching in her silvery hair.

Next she noticed some flashes of white darting among the heather, which confused her — could it be a stoat, a little early with its winter coat? But as the heather thinned, she realised it was a mouse, which, now that it was out of cover, seemed unnaturally nonchalant and unafraid. It tracked along at a few metres distance, occasionally pausing to sniff, then darting onwards.

It was not a high hill and within half an hour she had reached the trig point, where she stopped to open her flask and set up her paints. She took in the panorama, the low sun highlighting the foreshortened city. To the north-west, the Forth Bridges: the rail bridge, once lapped by perpetual paintbrushes, now lapped by perpetual waves, glowed a rusted red. The elegantly engineered rigging of the road bridge stood proudly behind, like a semi-submerged tall ship, its white bones gleaming a coral orange-pink. Against the russet-brown scrub of the hill, the colours chimed in her mind as a pure piercing harmony. She picked up her squirrelltail brushes and started to paint.

Absorbed in her painting, she could yet sense activity around her. The flying ants gathered on the warm side of the trig cairn behind her back. The white mouse that had tracked her up the hill had nestled in next to her leg. Soon, a few new white mice had scurried to join them, then quietly curled up to sleep. They had not gone unnoticed by a circling buzzard, which hovered uncertainly at a distance, perhaps deterred by her presence. She felt at one with all around her — with the light, with the mice, with the buzzard, with the ants.

She stroked the mouse's head between its ears, her little finger caressing the plush tissue of fur, and beneath it, the malleable shell-fine skull. She could almost discern each silky white fibre. Running her finger over its ear, she noticed a firmer clump, almost rubbery, villous. She looked down and saw from its ear a growth, white as its fur. A tumour, perhaps — which might explain its unusual behaviour. She continued to stroke her (she felt sure it was a *her*) in sympathy, and as she did so a fine white puff dispersed into the air. Catching the light, it shimmered faintly, barely perceptible, as it hovered in a halo above the mouse's head, which had now stilled. With barely a movement of her own head, her attention expanded to perceive the same soft glow, a talc-fine haze lingering above the other creatures around her — the mice, the ants. She observed this strange phenomenon not so much with curiosity as with an absorption of its beauty; with peace. As she did so, she felt her own consciousness drift above her, released, dispersed into the evening light.

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Dr Adlington stood on the platform, which was really the floor of her office, and scanned the crowded virtual room: journalists with DictAi at the ready; global academics eager to glean details of techniques to mimic or reproduce; jostling entrepreneurs; even that controversial billionaire, curiously un-aged, although he must have already reached his fourscore and ten when she was a child. Word had clearly got out.

She felt a little clammy, especially under the sweaty band of the headset. Despite the ultralight design, it put uncomfortable pressure on her temples. She acknowledged that pre-presentation nerves — especially to such a significant audience — may have something to do with it. It also happened to be unseasonably warm.

There was a clamorous chatter, not often heard at remote — room events, which was reminiscent of the in-person conferences that she had attended in her early career and signalled the excitement and interest of the audience. Everyone muted as she took the lectern. She opened with her well-practiced script.

"Mycelium: in the nineteenth century, it solved the greatest medical problem of the day: from the petrie dishes of Alexander Fleming were built the pharmaceutical giants of that age. Life expectancy was transformed. So too, now, it has come to solve the most intractable confounder of medical progress of our age, which, in the intervening century, advances in other fields have only served to propagate.

You are all aware of the monoclonal antibody technologies that offered some early hope, but for most merely delayed the inevitable decline by a year or two, and not without cost.

Many of you will know that over the last decade we have been pioneering myco-anthropogenetic therapies, with encouraging results in laboratory and animal studies. Today, I present to you the exciting outcome of the first human trial, which promises to revolutionise healthcare, to enhance humanity…"

She paused to take in the murmur that she could see, rather than hear, ripple around the room, as the strands on the animated Kaplan-Meier graph spread across her screen, infiltrated their minds.

Scientific Statement

Mushrooms have long been known to have medicinal and psychoactive properties. There is growing research into new applications in medicine, from psilocybins for the treatment of depression in patients with terminal cancer diagnoses (Griffiths et al., 2016), to the cognitive enhancing properties of Hericium erinaceous, commonly known as Lion's Mane, as a treatment for dementia (Mori et al., 2009). In vitro studies have explored the ability of bioactive compounds from Lion's Mane to stimulate the growth of damaged peripheral nerves via nerve growth factor (Ma et al., 2010). Simultaneously, electronic technologies such as Neuralink are being developed as potential therapies for neurological disorders (Musk, 2019).

This speculative fiction weaves together these strands and asks, what if there were an organic solution that could achieve what is being attempted by brain-machine interface technology, yet more elegantly? Mycelium is the often-subterranean fungal hyphal system that allows communication between plants and trees across distances and species. What if these cell-fine, invisible, infiltrative networks could be made compatible with human tissue through chimeric gene-editing technologies, to symbiotically repair damaged neurons?

The story borrows ideas of mutualism and symbiosis, where species coexist to benefit one another to the point of co-dependence — for example ants benefiting from farming fungi — and of parasitism, for example Ophiocordyceps invading ant bodies to control behaviour and promote spore dispersal (Trinh et al., 2021).

The end of the story is left open to the imagination of the reader: Has Mayu's mind become entwined with a coordinated, fungal consciousness, along with the mice, ants, and other study participants? Or has she died, having enjoyed a few good years of life, rather than suffering decline? Or has she simply had a psychedelic experience? And will this new technology be seized on by those eager for self-enhancement, without yet having awareness of the long-term consequences?

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