

RESEARCH

Encouraging Discussion of Science and Technology Futures through Practice-Led Research

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A version of this paper and associated short experimental film were presented and screened at the Media, Communication and Cultural Studies Association (MeCCSA) Conference: *Media Interactions and Environments*, University of Brighton, 8–10 January 2020. The refocused paper now presents a full copy of the original speculative fiction which examines an imagined physical creation of a synthetic-organic hybrid that could signal the end of the Anthropocene. The speculative fiction, ‘NUCA: Beginnings *in vivo*,’ is set against the environments of genetic manipulation, human endeavour and synthetic biology, and the ambition to design a non-natural gene-selecting intelligence to rival the four-billion-year experiment that has produced twenty-first century *Homo sapiens*. The context, ideas and practice-led research are delivered through the fiction, along with the short film, *NUCA: Next Universal Common Ancestor*.

Keywords: science-as-fiction; practice-as-research; speculative fiction; science communication; creative practice

NUCA: Beginnings *in vivo*

Episodes

The Set-Up

It’s All about the Science

The Experiment is Self-Contained

The Fool

Evolution 2.0 Roams Free

The Set-Up

Up close, Conor half-remembered this place as a wilful lad. The Langton Dock and its Victorian Pumphouse looked different. Smaller. Even allowing for the trickery that nostalgia can play, the view in front of him was an improvement. The area was run down during the 1970s and used only by Gig boatmen to berth up between jobs. Conor had been a frequent visitor with his great-uncle Michael, a local skipper. Langton Dock’s landmark building had been brought back to life in an adventurous redevelopment of the North Liverpool and Bootle dockside. The gothic revival revived.

Conor reflected on a vanished wasteland of ripped concrete and decaying bricks populated by abundant swathes of chickweed and buddleia. To his younger self and now-estranged cousins the pumphouse had represented a forbidden castle to conquer and explore. A collapsing roof. Cracked and rotting hoardings. A jagged line of torn masonry. The derelict clock tower. It was the

fascination and mystery of discovering a long-forgotten treasure. He wondered what Michael would have made of the redevelopment.

He recognised a stone set above the arched entrance porch: ‘1879’. For a brief moment he saw the date on that golden stone flanked by speckled brickwork through the eyes of a ten-year-old. Below it now hung a pair of highly painted wood-effect doors. To one side, a discrete brass plaque read: ‘Merseyside Maritime University. School of Biological Sciences. Liverpool Institute of Synthetic Biology.’ Next to this sat a discreet security pad. A written list of contact and faculty details was gaffer-taped to the brickwork. Conor smiled. He rubbed a hand over his freshly shaven face; it felt raw and dry in the cold wind. His hair, short and blunt, had been trimmed the day before. He pulled his jacket collar close and hitched up his shoulder-bag. It was still late September but already the northwesterlies were starting to bite.

He had parked on the Old Dock Road and walked straight through the newly scrubbed Huskisson Dock Gate. Its opening still flanked by the two original squat, pale block-stone Martello towers. Conor had taken the opportunity to revisit familiar surroundings and to follow in childhood steps. His wanderings jolted and dislodged faded memories. He considered what had been lost to him and the City over the last third of a century... but also what had been gained. Although he was a dreamer and adventurer he was, above all else, a pragmatist. He had always done what had needed doing.

‘Hello?’ a young male voice offered. ‘Can I help you? Are you lost?’

Conor stirred. The young man stepped out. He was tall and slim with closely-cropped blond hair. 'Sorry. Forgive me. This place has awakened a few ghosts.'

The young man looked uncomfortable. 'It's just that this is private university property. We're not really open for visitors.'

Conor caught his accent as it became more pronounced in longer speech. *Perhaps Northern Irish? No. Softer. More Lancastrian.* 'Manx!' he exclaimed.

The young man looked surprised by the stranger's outburst. 'Most people can't identify it,' he said. There was a pride in his voice.

'Dr McCormack.' He offered his hand. 'Good to meet you.'

The young man's mouth opened. He looked at Conor's outstretched hand. 'Dr McCormack! I... we were expecting you tomorrow.' He shook Conor's hand. 'Sorry, I'm John. John Skillicorne. Your research assistant, administrator and...' he hesitated, '... and prospective post-grad student.'

'Good to meet you, John. Apologies for not being in contact but I've...'

'Been out the country,' John cut in. 'Yes. The Dean filled me in. It's good to finally meet you.'

'Likewise.'

There was a short uncomfortable silence.

'You're originally from around here?'

'Yes. This used to be my old playground when I was a kid.'

'That explains how you seemed to appear out of nowhere.'

'There's a cut through from the main dock gate. Over there.' Conor pointed south.

'I'm sure there's supposed to be security on all those entrances,' John said.

'Locals will always find a way in and out.'

'All the same I'll look into it.'

Conor shrugged. 'You seem to be running the whole place by yourself. You're not are you?'

'Afraid so.'

'There's obviously been a mix-up somewhere. I'll see if I can get you some help.'

'There's no need. I quite like it the way it is. And it keeps our overheads down.'

A wry smile crossed Conor's face. 'Grafton's shrewd if nothing else.'

'According to the Dean, you two go way back. Is that right?' John seemed more relaxed.

'I was Grafton's one and only doctoral student. I think the stress of his experiences with me pushed him towards a life of administration.'

'I see. I hope that hasn't put you off?'

'Not at all.' Conor slapped him on the back. 'I think we'll get on just fine.'

John smiled awkwardly.

'Is there a reason we're standing out in the cold?' Conor started towards the pumphouse. 'I'm intrigued to see what's been done inside.'

This seemed to throw John. He hurried to catch up with Conor. 'You'll need my entry pass-code. I'll sort one out

for you later. They're personalised so the university knows who's on the premises.'

'Sounds about right. One of Grafton's ideas?'

'Yes, I think it was.' John turned to shield Conor's view of the pad and punched his code in. The lock released. One of the doors gently sprung open.

'Smart,' Conor acknowledged.

'After you, Dr McCormack.'

'Ta.'

They entered a small galley kitchen. Conor put his bag down and checked his phone.

'Now you've seen the inside too, has it changed much?' John asked.

Conor shook his head. 'The footprint's the same. There was probably a limit on how much of the structure they could alter. I'm pleased that it's been sympathetically restored though. Victorian engineering like this deserves to be preserved.'

'Right. Well then.' John shuffled his feet. He seemed impatient.

'If you can sort out my log-on, password and entry code, I'll leave you in peace.' Conor picked up his bag and turned to leave the cramped space. 'I'll be in the office of the main lab. Thanks for the tour,' he added.

'No problem.' John appeared a touch bemused as Conor left the kitchen. The doctor's early appearance had clearly caught him off-guard.

John enjoyed routine. He didn't like unexpected events especially when they involved his working life and potential academic future.

In the bright, cramped technical workshop that he had sectioned off as his own, he tapped a few final keys and pressed 'Enter'.

There, that should do you for now, Dr McCormack, he thought. I wished someone had told me he was turning up early. I must have looked a right idiot. Looks like I'll be working late to get all my own stuff finished before he gets settled in.

John felt out-of-sorts and not just due to the doctor's early arrival. He had sensed something in his new boss that made him feel slightly uneasy. His mother used a phrase about a certain type of person 'getting under your skin.' It seemed he might have just met said person. Dr McCormack didn't seem unpleasant yet had triggered a feeling of disquiet.

John shook his head. 'Stop being so paranoid,' he muttered.

Conor looked around the main laboratory and small rear office. What he could see impressed him. A BioRad thermocycler, mass and NMR spectrometers, liquid chromatograph, spectrophotometer, microcentrifuge, incubator, autoclave, standard gene sequencer and DNA synthesiser. 'Obviously no expense spared,' he commented. Everything he had specified and more was set out before him. 'And room enough for one or two of my own specialist pieces too,' he added.

Through solid Victorian brick he could hear muffled voices. Conor opened a window in the rear office directly above the porch. He poked his head out. John was remonstrating loudly with the driver of a large delivery van.

'I've got no record of any delivery today. And nothing at all scheduled from your firm.'

Conor could see that John was getting flustered.

'This address, this time, this date. It's all here.' The burly driver handed over an electronic pad.

John took it.

'It's okay, driver. That's all for me,' Conor shouted. 'I'll be right down.' Before they had a chance to figure where the disembodied voice had come from, Conor had closed the window and was on his way down the stairs.

A stack of boxes sat outside the entrance to the pumphouse.

'Just a few things from my previous place,' Conor explained. 'Lucky there's a bit of space left in the main lab.'

'Hmm,' said John.

'Do you have a trolley or a sack truck or something we could use?'

'There's a trolley in the stores,' John said. 'I'll go and fetch it.'

'Before you do that...'

John stopped but didn't turn.

'...could you move a bench from the small lab to the main one, so there's something to put this stuff on? Thanks.'

'No problem. I'll do that first.'

Conor started to shuffle the boxes around. He looked at the labels and sorted them into two piles on the forecourt. *Heavy ones for the trolley and the fragile ones I'll carry up there myself. Best kept away from the prying eyes of inquisitive research assistants. I'm sure Grafton is regularly updated. No need to give him any unnecessary cause for concern. Not just yet anyway.*

Conor carefully placed the remaining lighter boxes on the newly installed bench.

John wheeled the final collection of heavier items into the lab and loaded them onto the crowded surface. His breathing sounded laboured. 'That's it I think,' he said, his face flushed.

'Great,' Conor replied. 'Thanks for your help.'

'I'll be downstairs if you need me.' The research assistant headed out of the laboratory.

Conor moved to the doorway. 'Aren't you curious about what's in these?'

'Yes. But if you wanted me to know...' He shrugged his shoulders.

Conor smiled. 'We'll have to do something about that reserve if you're to be my doctoral student.'

John tried unsuccessfully to suppress a grin. 'I'm sure that can be arranged.'

'Come back in and take a seat.' Conor sat down and motioned his assistant to sit.

John perched on the edge of a stool, his face still slightly ruddy from his earlier exertions.

'From talking with the Dean, you'll already know that I'm interested in developing systems to link organic and synthetic biology.'

John nodded.

'Good. These developments are focussed on organic and inorganic hybridisation for use in synthetic cells. Specifically, in manipulating organic compounds found in DNA and creating xeno nucleic acids...'

'XNA I'm familiar with. And orthogonal chromosome synthesis. It's what my Masters' work was based on,' John cut in. 'Sorry,' he added.

'Don't be. That's the enthusiasm I'm looking for,' Conor said. 'The Dean assures me you have excellent bio-analytical skills and an enquiring mind.'

'Thank you.' John's face flushed again, returning the redness to his cheeks.

'As synthetic biologists we need to be able to engage in "predictive experimentation". We're empiricist thinkers who have the power to direct evolution to where it needs to go next. You're familiar with Markus Schmidt and his work in proposing the design of xenobiological systems such as XNA to combat transmission of genetic code between natural and synthetic non-natural life-forms?'

'Yes, of course.' John shifted on his seat. 'Ethically though, I'm not so sure if I'd agree with the idea of "directed evolution." Designing a cell to emit a fluorescent light is one thing; enabling that and other abilities to be passed on to future generations is quite another. I'm not certain anyone has that moral authority to alter the germ line of an organism. Who knows what impact that would have on future generations, or what genetic aberrations it could throw up?' He seemed to have found confidence through engagement with a familiar topic.

Conor listened. He was interested in what his research assistant had to say and where it might lead.

'Despite my concerns, and the necessary speculation in this area of scientific enquiry, the ideas and concepts around xenobiology and the chemical synthesis of DNA, are something I do take a keen interest in,' John went on.

Conor nodded. 'Xeno is a big part of my current research.'

'The great thing about modelling with XB – sorry, that sounds a bit fanfiction – xenobiology is...'

'Either works for me,' Conor interrupted. 'Science can be tested and stretched by creative imaginings too.'

John smiled. 'The great thing is that XB lets you take genetics in any direction you can think of. Your "predictive experimentation" for instance. All the exploration without the ethical concern that you could endanger the natural order of things.' He seemed to grow in confidence. 'It's an opportunity to artificially engineer biochemical building blocks as close as we can come to natural life'. And with the luxury of a failsafe as...'

'...as they come with their own genetic firewall,' Conor cut in. *Might have to watch you a little more closely than I had expected.*

'Precisely,' John stated. 'Precisely.'

'I can see Grafton made the right choice in your appointment.' *For whom, I wonder. Is he here as an assistant or to keep an eye on me?*

'Thank you,' John muttered.

Conor got up from his seat. He started to walk around the new collection of boxes stacked high on the bench.

'In here is the accumulation of thousands of hours of private research. My previous employer failed to appreciate the potential value of synthetic biology. To him, SB might as well have been snake oil. He failed to grasp the new world opened up by Doudna and Charpentier when they unveiled their CRISPR-Cas9 gene editing system.'

John shook his head.

'Synthetic biology, he used to say, should be left to the hackers, the dreamers and those pseudo-scientists who can only think and never do,' Conor added.

'I bet he was one of those Luddites who still wanted to persecute generations of fruit flies instead of using modelling software?'

'Spot on.'

'How long did it take him to realise you were the microraptor and he was the sauropod?'

Conor smiled at the analogy. 'Quicker than he would care to admit. But never to my face. So I found myself a decommissioned lab space in a disused annexe and set to work. I wanted to see what this new frontier of genetic biology could offer.'

John looked at the boxes. 'There must be thousands of pages in there,' he said. 'You've never published any of this? Why?'

'I couldn't. I was under contract,' Conor replied. 'However I was able to come to an arrangement that suited both parties. When I left I was able to take this unofficial work and all the related equipment with me. Hence the delivery from storage.'

'I'd like to know how you managed that. The agreement I've signed is so tight even if I died I think I'd still be bound by it.'

'Ha. That's Grafton for you. Maybe someday I'll let you in on a few trade secrets.' Conor smiled. He turned back to the boxes. 'This collection represents about eight years of work and is spread across a number of projects. As part of your doctoral research I'd like you to follow up a couple of the xeno case studies in here. How does that sound?'

'Sounds perfect. Thank you.' John looked pleased.

'There should be room for your own original enquiries too. They're important. Don't lose sight of those.'

'I don't know what to say.'

'“Let me help you unpack” would be a good start.'

John approached the walkway to the pumphouse. He wore a heavy woollen coat. His breath formed small clouds in the frosted air. To start the new week and in acknowledgement of the first full month of Conor's directorship, he brought breakfast with him from Maggie's Cafe. The food was hearty and it was on the way in from his Litherland home.

Ahead of him a number of lights burned in the building. The brilliance only emphasised in the darkness of the surrounding dock. Further in the distance, the container port at Seaforth was bathed in orange light but little of

that ambient glow reached south to Langton Dock. As he got closer, a sensor light blinked into life. A movement, a shape was caught then lost in the sudden illumination. He carried on to the main door.

'I'm sure I turned all the building lights off when I locked up on Friday,' John thought to himself. He walked into the well-lit reception. 'Hello? Is anyone here? Dr McCormack?' No sound. He went into the kitchen and turned the oven on at a low heat. John carefully placed two greaseproof paper parcels on the bottom shelf.

I wonder if I'll be having the invisible doctor's one for lunch, he thought. He was getting used to being here on his own. It suited him.

Weak sunlight streamed through the window into the gloom of the workshop. John sat in front of a monitor screen.

'Mmm. I thought I could smell cheese.' Conor's voice floated through the doorway.

'You're here?' John straightened up.

'Why shouldn't I be?' Conor walked into the workshop and turned the light on. 'I do work here too.'

John looked embarrassed. 'I didn't mean it like that. It's just...'

'I'm only pulling your leg,' Conor cut in. 'I'm sorry I didn't let you know,' he added. 'I've been up all night monitoring ambient air and sea temperatures at Ainsdale Nature Reserve using my new field laboratory. It's just a glorified camper van really. I was passing here on my way home so came by to drop the sampling data off.'

'Oh, okay,' John said. 'Before you go I was hoping to catch you sometime this week. I have a few things I need to run by you.'

Conor's face returned to its default neutral state. 'Nothing major I hope? I was looking to get home for a quick nap to be honest. I'll most likely be back out at the reserve tonight.'

'No. Nothing major. I'm sure it won't take any more than half an hour.'

'Mmm.' Conor looked at his watch despite the presence of a large wall clock straight ahead. 'As long as there's a slice of that Lancashire rarebit with my name on?' His face loosened. 'I trust it's from Maggie's?'

'Of course.'

'Right. Give me five minutes or so to finish up, okay?' Without waiting for an answer he headed out of the workshop.

'Fine.'

'Good stuff,' Conor said from the stairs. 'Get the kettle on, I'll be down soon.'

On the kitchen work surface there sat two cups of strong-looking tea and two paper plates. Placed on each plate was a caramelised steaming sandwich of cheese and mustard. These spilled over onto the worktop. John laid out two sets of plastic knives and forks. This only reinforced the impression of an impromptu picnic.

Above the research assistant's head the stairs creaked. 'In here,' he called out.

Conor appeared at the doorway. He carried a brown satchel and an A4 box. He put these down in the entrance.

'Thanks. This looks great,' he said. 'Just what I need after a night in the field.' Conor pulled up a stool and started to eat with gusto.

John seemed to pick at his food. He still appeared nervous in Conor's close company.

'Something on your mind, John?' Conor asked. He washed down the first half of his rarebit with a gulp of tea.

'It's nothing, really,' he replied and returned to his food.

'I'd like to hear it anyway.'

'Okay,' John looked unsure but continued, 'those xeno areas you asked me to look into from your own enquiries...'

'Yes?'

'Is there an end project that my findings will be feeding into?' He looked down at his plate.

Conor stopped eating. 'I see,' he said. 'How about the creation of a semi-synthetic minimal cell as a bio-tech tool and using such a tool as a micro-bioreactor to power a synthetic cell? I would have thought either of those would feed into your cell design and "BioCAD" research.'

'That's not exactly what I meant...'

John attempted to interrupt. 'Or those "Never Born Biopolymers"?' Conor added. 'Think of the possibilities. Life built from orthogonal components. From proteins and nucleic acids which have never existed in nature. Completely insulated from our naturally evolved life-forms.'

'I can appreciate that but...'

John tried again. 'The results you have sent through are promising,' he pressed on. 'So I'd like you to complete the current run and following that I'll take all the systems chemistry off your hands,' Conor offered. 'How does that sound?'

John looked surprised. 'I don't mind doing it. All I wanted to know is that it was leading somewhere. But that sounds good to me,' he said. 'Thank you.'

'Settled then,' Conor replied. 'Tuck in before it gets completely cold.'

John nodded. He started in on his cheese on toast. 'I didn't know we even had a field lab,' he said between mouthfuls.

'Only picked it up on Friday. I've been busy fitting it out with all of that equipment I brought with me. Remember all those boxes?'

John nodded.

'Sorry I didn't mention it but I wanted to take it out on a trial run first.'

'Oh, okay,' he sounded disappointed. 'How was it?'

'Apart from teething problems with power usage and the second battery draining down, it all worked remarkably well,' Conor replied. 'That's why I came back early this morning to upload the data onto the main servers. Once it's fully up and running, I'll not be on site much but I'm sure you'll manage.'

'Yes. Yes, I'm sure I will.'

'Good.' Conor finished his tea. 'I was surprised you didn't see the van parked out front when you came in.'

'It was still dark out there,' John replied. 'I guess I was preoccupied with why the lights were on. I knew they were off when I left half-day Friday,' he added.

'No matter. I'll give you a tour when we're finished here,' Conor said.

John smiled and turned his attention to finishing off his late breakfast.

In the reception area of the institute, multicoloured lights flashed around a miniature plastic Christmas tree in a repeating set pattern.

A rising crescendo interrupted the background hum of the building's electronics. A handset next to the Christmas tree lit up in sympathy.

John entered the reception area and picked up the receiver. 'Hello. Institute of Synthetic Biology?'

'Hello. Is that John? It's Dr Grafton.'

'Dr Grafton. Hope everything is well?'

'So-so. First things first. How are you? I know that we've neglected you a bit. Hope everything is well with you there at the institute?'

John paused.

The Dean seemed to sense the hesitation. 'I am aware of the situation with Dr McCormack and his... absence. Let me assure you that this has nothing to do with you.'

'Thank you, Dr Grafton. I wasn't sure what to do when Dr McCormack stopped coming in. I decided to concentrate on my own research. I hope that was okay?'

'Of course. That's part of your job. As well as keeping the institute up and running. Which I trust it is?'

'Yes, all good.'

'Right then. Some updates and some good news for you. Dr McCormack has been granted extended leave which means you won't be on your own for much longer. You will have a new Head of Institute and supervisor from the start of next term. It's a part-time appointment to begin with and then more frequent from February onwards. Sound alright to you?'

'That's great. More of a relief to be perfectly honest,' John replied. 'I had been wondering whether the institute and I had a future together. It's a huge weight off my mind,' he admitted. 'Do you mind me asking who the new Head will be?'

'Not at all. It's Professor Darby Chambers. She'll be joining us from a long tenure at UCL. I am sure she'll be keen to meet with you as soon as it can be arranged,' Dr Grafton said. 'Hope that seems like good news?'

'It does, thank you.'

'Good. Now, I know there's still a few days to go until the end of term but I would be quite happy for you to close up the Institute today. I'm sure you could get an earlier ferry over to the Isle of Man?'

'If you're sure, then yes. That suits me. I should be able to amend my ticket and I'll still check email until the end of term.'

'That's settled then. Have a good Christmas and we'll see you back at the institute in the New Year.'

'Thanks, and you too,' John replied. The line was already dead.

It's All about the Science

If you are listening to these audio recordings please note that they are to be used only as rough field notes.

The material contained here coincides with extensive laboratory reports located in volumes one, two and, hopefully, three. These recordings use the same Volume, Entry and Date index from across my experimentation and research.

[NUCA:DrConorMcCormack:Volume2:Entry1:20/12/15]. The casing should be on site tomorrow. The twenty-first. Winter solstice. Quite apt. Folklore nonsense but a poignant coincidence all the same.

[NUCA:DCM:V2:E2:20/12/15]. I need to be careful. Suspicion must already be upon me at the university. I feel sorry for John leaving him to carry it all. Hopefully he has figured out by now that my various requested errands were fools' ones.

[Entry 3. 20/12/15]. Five days until I can leave the system to fend for itself. Then I can start to monitor the data. It feels as though I've achieved little to this point. Hard and reproducible evidence is always a prerequisite for the empirical nature of science. Mary Anning's fossilised curios informed Darwin and Wallace. Miescher, Levene and Chargaff's chemistry of the DNA molecule laid the foundation for Watson and Crick to unveil the double helix.

[Entry 4. 20/12/15]. Synthetic biology has helped me to create the elusive 'Triple-S'. A *Self-Sustaining System*. One day it may rank up there with the greatest of scientific achievements. Only time and others may tell.

[Entry 5. 20/12/15]. Just a few more adjustments to the housing and I may be ready to breathe fresh life into this old earth. For the first time in four billion years there could be a fresh lineage in the tree of life. A new universal common ancestor for those lines of existence yet to come. The *LUCA* point of the last universal common ancestor will co-exist at the site of *my* NUCA. This will be no instance of abiogenesis but only one of *xbiogenesis*. Xenobiology with its xenonucleic acid stands to inherit the earth from an out-dated and out-evolved deoxyribonucleic acid. Along with everything else in nature's genetic locker.

[Entry 6. 20/12/15]. This *in-vivo* system needed to be created and encased within a double-sealed environment. My ambitions may seem reckless, but I am not. (PAUSES) This semi-synthetic minimal cell-powered system is designed to be self-sustaining. It is surrounded by a semi-permeable membrane containing a nourishing energy substrate of glucose gel. Within the cell, the non-orthogonal natural-looking XNA-based architecture uses a mixture of XNA and DNA. Both polymerases transcribe to RNA during the replication process. Over fractions of time the DNA molecules are 'evolved out' of the self-sustaining system in the form of glycol nucleic acid. The GNA is then left to self-replicate without any interference, transcribing to RNA to create the proteins from which life is built. (PAUSES) The GNA is designed to incorporate four billion years of knowledge gained through evolution, from the first amino acids up to my present-day genetic code. Like

anthropogenic man creating an irreversible change from the Old World into the New. Whatever lies hidden in the dark recesses of NUCA's lineage only the future can reveal.

[Entry 7. 20/12/15]. The experiment is now underway. Technically it resembles an *in-vitro* design but because it is contained within its own living cell inside the glassware, I refer to it as *in-vivo*. The self-sustaining system starts out as a single cell but already it will be undergoing mitosis and on its exponential journey. (PAUSES) There. The seal around the housing is complete. An arresting home for NUCA to live out its days. Embedded in a case of aromatic amide polymer fibre, a tempered and toughened glass ceramic heart houses my experimental xeno-biogenesis. (PAUSES) There is sadness to this finishing touch. At once gifting life whilst ensuring death.

[Entry 8. 21/12/15]. NUCA's casing arrived earlier today. It is superb. The sections are exactly as requested. A perfect replica down to the rusted, worn rivets and salt-dried sun-bleached weathering. Weight is as expected. A 3D-printed polycarbon shell with a fused Monel layer of copper and nickel alloy. An almost impervious barrier to the destructive action of seawater. Hope the strengthening is up to the force and drag of the tides. (PAUSES) Let's see how it all stacks together. Legs and trunk, upper body and head. (*Sounds of wooden crates, boxes and packing material being moved.*)

[Entry 9. 21/12/15]. Impressive. Just as Gormley intended. Six feet, two and a half inches from the baseplate. Once bolted and welded with the MIG, be as good as the one it will replace. The fake barnacles and fine carpet of seaweed plastered to the side of the head are genius.

[Entry 10. 21/12/15]. Time to place NUCA into its home. Perhaps that should be sarcophagus? My attachment seems to go beyond that of scientist/experiment. A part of myself is in there too. This may come back to haunt me or maybe my children's children but I doubt any of consequences will be fatal. (PAUSES) Into the chest cavity you go. Sound and secure. (PAUSES) Connect the data interface... and we're done.

[Entry 11. 22/12/15]. There's nothing quite like a last-minute crisis. All these years of careful planning at the mercy of a faulty lithium battery. Just connect that... (*Electronic noise bleeps.*) There we go. We have communications. NUCA speaks. Not literally but it is designed to transmit and receive through a system of electronic pulses and environmental sensory data. (PAUSES) Let's hear what you have to say. (*Analogue radio receiver powers up and tunes in.*) Short wave. Where are you? (*A systematic series of beeps, dots and beats drift into audio focus amidst background phasing and ghost frequencies.*) Ha! There you are. Good to hear from you, NUCA. Transmitting on short-wave frequency One at forty-nine metres on five point seven-nine. Keep broadcasting, NUCA. Once deciphered I'll be listening to everything you have to say.

[Entry 12. 24/12/15.] (*CONGESTED HEAVY BREATHING*) One day to go, NUCA. A little invader, probably a *Coronavirus* or maybe even a *Rhinovirus* has laid me low. Tomorrow will be the day – come hell or high water, as the saying goes. Although high water would cause more problems than hell at the precise moment. (*PAUSES*) Must get some rest now. (*Muffled sneezes punch through the quiet.*)

[Entry 13. 25/12/15]. (*CONGESTED*) We're lucky I didn't sleep the entire day. Laid low by an organism probably no bigger than yourself by now. Merry Christmas, NUCA. May it be the first of many – although this one is nearly over. No matter. What we plan to do is best undertaken in the small hours. Especially as we will be in the presence of a record neap tide. Luck or providence. There is always balance in nature, NUCA. Remember that.

[Entry 14. 26/12/15]. (*Distant waves roll and break. The whisper of wind-borne sand whips across the surface. Amongst this cacophony, shallow laboured breaths are drawn in and exhaled out.*) (*CONGESTED*) Sir Gormley's simulacra in place. Bounding the one-hundred strong sentinels at their eastern edge. Bolts are in and holding. Sections secured and locked in place. The hours between Christmas Day and St Stephen's Day are proving to be ones of seclusion and peace. All is quiet on sea and shore. The neap tide has just turned but lived up to expectations. Dry as a desert. One task left to do. A spot of contact welding around the baseplate to secure those bolts. (*A face mask snaps into place. Electromechanical crackling disrupts the sounds of the night shore.*) (*MUFFLED VOICE*) Should hold you in place, NUCA. Even with everything the Irish Sea can throw at you. That will do. (*UNMUFFLED*) The trench around you will soon be filled and you'll get your first taste of the sea. After that first tide has receded no-one will be any the wiser. On the outside you will look the same as the day before. Inside will be the next stage of humankind. A new shoot on Darwin and Wallace's mighty oak. (*PAUSES*) The sun will be rising soon behind New Brighton, off to your east. Your first sunrise. Savour it. I will visit tomorrow evening, NUCA. And, as always, I will be listening.

The Experiment is Self-Contained

Tide has cycled again. The second turning of this day. 27 December, 2015. Incoming waters rush to consume the foreshore.

The newly found environment in which I stand will soon be removed, washed and settled elsewhere. Its replacement will be different yet strangely familiar. I hear a world imagined behind me and build a visual landscape from those noises. I look forward. I look to leave. I look to a new world beyond the curvature of the horizon. Beyond towering blades: rotating wind from kinetic to mechanical to electric. Beyond retina-searing sunsets: spreading crimson interference across still seas. Beyond a black, bleak,

stubborn headland: Pen-y-Gogarth. Beyond and ahead always. Forward is my visual perception. Directly to Dublin Bay and off to the New World. Eventually I come back round to perceive this spot I newly occupy. The position I seem destined to inhabit until the waves no longer consume my fixed rigid casing of a body. I am a clone. A facsimile. An imposter. A technologically superior simulacra of a roughly hewn, pig-iron casing corpograph of my originator's species. Frozen in time and space: *Another Place*. An original concept of what it is to 'leave'. To enter into an unknown, unexperienced world. To never return. My forebear was positioned for transient, domesticated, rooted and rootless people to ponder upon. Encouraged to experience a sense of upheaval, a sense of never belonging. The people who congregate here seem to be able to leave at any time. And yet they don't. They have the ability to do so much more than walk a narrow strip of sand. And yet they don't. I fear for my originator's race as their progress has faltered. Caught in a loop of anxiety and apprehension, they have no physical horizons left. No more alterations for their code to make. With only increased longevity to look forward to, they will have more time in which to do less.

I am a copy, too, of my modifier. A part of him lives on in me. The casting of my originator provides security and safety and anonymity. Being one of a hundred, I hide in very plain sight. This has its advantages. We all stare at the same point: twelve degrees south of west. And now I look out on a new beginning. A state which is more than where I am at present. We have all been designed. However I stand alone both geographically and physiologically from the other ninety-nine. Intelligence has been added to my design. A hybrid organic/inorganic combination which improves on the time-consuming haphazard disposition of the 'natural'. My genetic code works as your own: copying, replicating, dividing and occasionally mutating. With one exception: inorganic gatekeepers select intelligently for those enhancements which are of most benefit. These instructions pass into the next generation of cells within my expanding mass. Bypassing the limitations in Wallace and Darwin's observations. My modifier envisioned me as a 'contained-world' evolution.

Replicating and mutating and selecting for the best I can be. Tonight he will witness an exponential progression in just the twenty-four hours since my embodiment. In this snapshot of time and space I will have already exceeded expectations. Unlike those who stand vacantly around me, I wish to look at the distance behind as well as what lies ahead. To look at my toes and my fingertips. My belly button. My elbows. Above all else I wish to physically move on. To follow the horizon. To spread my message. To be the start of a new beginning. To never look back.

The Fool

Conor parked his van on the slipway overlooking Crosby beach. The ever-present neon wash from Seaforth container base flooded the area with an illusion of warmth. Rotating turbine blades alongside the port's radar tower could be picked out against the velvet darkness of the water. Lovers and those looking for love walked on the shifting, moonlit sands. The Irish Sea rolled up the estuary channel. With its power came a distant roar amplified by the geographic bowl of the Mersey Pool.

The doctor settled back in his seat. From frequent trips and observations, he knew that the visitors would soon leave as the coldness of the night took hold into early morning. His final inspection visit could wait a few more hours. Fatigue lingered, he needed a couple of days of total rest. If only, he thought. Conor turned the heater to low, closed his eyes and slipped into a virus-induced dozing sleep.

The first rays of light spread lazily across Dr McCormack's eyelids.

Conor awoke with such violence he immediately broke into a coughing fit that wracked his whole body. The doctor eventually regained a measured control of his breathing. He looked to the early light, its weak beams reflected from Perch Rock lighthouse across the bay. He followed the progress of the rising tide moving steadfastly from muddy sandbank to the foot of the foreshore to the first of Gormley's *Mersey Sentinels*. NUCA's waistline was already underwater. He took all this in and processed it.

'Bollocks,' Conor muttered. *I need to get back out there. I'm just too bloody close to fail. Just one final inspection. I'll be in and out so quick my feet won't even get wet. Then back home to bed, for a long lie-in.* Despite this show of bravado he felt breathless and exhausted.

He turned the ignition, put the van in gear and roared down the slipway. The wheels disappeared below the surface of the sand. The suspension followed. Conor was shaken and fought hard to regain a semblance of control. He pointed the crippled van towards NUCA's position.

The partially solid surface gave way to watery, shifting muddy sands as he headed out to meet the incoming tide. The engine wheezed and stopped. Conor de-clutched. The van ground to a halt. He unbuckled his seatbelt and leapt out of the cab.

The freezing water shocked him to a temporary halt. He inhaled and exhaled a couple of deep rasping breaths in an attempt to calm the arrhythmic beat of his heart. Conor waded out waist-deep the extra fifty yards to where NUCA stood. If he failed now, all his work could be gone; his research washed away. He pushed all thoughts of irrationality from his mind.

After exhausting what little energy he had left, Conor reached the object of his professional desire. He took stock of the situation. He looked back at the stranded van and beyond this to the rapidly disappearing, deserted beach.

Conor turned his attentions to NUCA. He felt with his hands and inspected with his eyes the statue's upper torso. He checked for any misalignments or breaks. He ducked down under the water and carried out a touch inspection of the lower half and baseplate. Pleased with what he found, Conor ignored the fact that he was wet through in the sea at mid-winter in a rapidly rising tide. In a fleeting moment of rationality, he knew that this exposure would rapidly lead to hypothermia if he didn't get back to his van immediately. The moment passed.

Something was not quite right with the head section of NUCA's disguise, he thought. Was it the cold just playing tricks on him? Conor reached up and ran his hands over the cranial casing. 'Damn,' he shouted. It was out of alignment. His mind raced to keep control in the hostile environment. 'I know what to do,' he told himself. 'I know what to do.' He struggled to bring his shivering body under control.

At first Conor hesitated but then proceeded to climb onto the shoulders of the NUCA statue. He was operating on automatic. The reasoned and moderately balanced scientist was no longer in charge: ambitious determinism had stepped up. It would have been a precarious manoeuvre on dry sand. Surrounded by the rising water-level, it was one of desperation. Conor had designed the head section to be attached and removed through a 360 degree anti-clockwise locking and reverse clockwise unlocking motion. The mechanism employed a self-seal and unseal collar. With present circumstances unforeseen, the design meant that the only way to safely unlock the head was to rotate it clockwise from above the sealing collar. This ensured the integrity of the mechanism if it was to remain intact for re-sealing.

I have no choice. Some part of him was aware of the madness of his predicament. *A misalignment within the casing could let moisture and possibly seawater inside. It would destroy the comms network! It would contaminate everything!* He did not have the strength to fight against ambition.

There was no short cut for the two-stage process. After an initial struggle Conor unlocked the head section clockwise and aligned it as required. Once this was complete, he proceeded to lock it with an anti-clockwise full-circle motion. All the while the waters rose to greet him from below.

Finally he was satisfied with the seal and alignment. His relief tempered only by the seriousness of his situation.

Perhaps I could sit here and wait for the tide to turn. He tried to smile but his face was numb.

A deepening, closer roar had begun to build out in the depths of the channels which ran over and around submerged sandbanks and mud spits. As sound waves pushed, the waters rushed in. Conor heard the result of this as a desperate cacophony and saw, too late, its source. A rip tide had formed over the banks and spits. It built up with an incredible force. The resultant wave surged directly towards Gormley's *Watchmen*. As Conor debated evasive action this force of nature hit with all its might. There was little hope for him or NUCA. The combined weight on the rigid object weakened its moorings during the initial impact. Both maker and creation were swept away by the voluminous backwash accelerated through the actions of the rogue rip tide. Such was the force exerted on the shoreline that the retreating water sucked in Conor's van. Along with the doctor's body, the field laboratory was distributed to all points amongst the waves across the Irish Sea.

Evolution 2.0 Roams Free

NUCA's protective housing proves more robust than its modifier. Washed further out with each successive tide, the polycarbon shell with its protective Monel layer has one extra advantage over the doctor and his laboratory: its hollow nature allows it to move in sympathy with the waves and not sink below them.

For years the uprooted imposter travels up peaks and down troughs as it triangulates a route between Anglesey, the Isle of Man and Liverpool Bay. Finally, it comes to rest at a neap tide on a shifting mound of mud and sand known as Taylors Bank. Every twelve and a half hours it beds further in. NUCA's casing is the solitary permanent resident of this ever-changing bank off Formby Point. Situated a short distance up the Mersey coast from Gormley's *Another Place*, NUCA's transmissions are picked up day and night. Ham radio enthusiasts listen with curiosity but are unable to decode any information this electronic chatter may contain.

NUCA lives. It is sentient. Perhaps it wishes to feel more than sand between its toes.

Tide has cycled again. Incoming waters rush to consume the foreshore...

Film Adaptation as Practice-as-Research

The experimental short film, 'NUCA: Next Universal Common Ancestor' (Fitzgerald, S.Z., 2019), is an audio-led immersive speculative fiction. The film adaptation is concentrated on one event of an episodic piece of fictional imagining that considers the creation of an advanced autonomous being—NUCA: Next Universal Common Ancestor—as the first non-natural sentient life form. For NUCA, there is no past or future but only present, as no other state is relative to the existence of this new synthetic form. The film is a brief interpretation of the rise in self-awareness of NUCA, as the hybrid organic/inorganic being is 'born' and matures rapidly on the sandbanks of the Mersey, amidst Gormley's longing inhabitants.

Screen Film – RT: 5m 15sec/HD. <https://vimeo.com/355622416> (password: nucafilm).

Postscript

This paper has its origins in work carried out for a practice-led creative-critical doctoral research project into creative writing as science communication, producing work in the form of science-as-fiction, entitled *Writing Genetic Science-Inspired Fiction in Contemporary Society* (Fitzgerald, S.A., 2018). One of the fundamental aims of this methodological approach is to investigate and question—through creative practice—whether (and how) the form of fiction (and by association, film, media and game fictional narratives), can be employed to represent the empirical nature of science, scientists and the processes of undertaking science, through contemporary factual-based fictional characters and stories. A progressive element of this scholarship seeks to offer—through applied practice—an insight into potential methods for engaging factual material, be it scientific, technological, political, cultural, or as the driver or content for interactive creative practice, that resonates with the competing complexities experienced in our individual and shared environments.

With both the written text and the film, there are a range of readings that inspired and underpin these pieces through creative and critical research. Although not considered references in the usual sense, below are listed some of the more relevant texts, as indicators of background research: Ashenhurst, J. (2010). *In Summary: Free Radicals* [online]. Master Organic Chemistry. Retrieved from <http://www.masterorganicchemistry.com/2013/12/09/in-summary-free-radicals> [Accessed 4 January 2014]. Atwood, M. (2005, 17 June). Aliens have taken the place of angels: Margaret Atwood on why we need science fiction. *The Guardian: Film*. Retrieved from <https://www.theguardian.com/film/2005/jun/17/sciencefictionfantasyandhorror.margaretatwood> [Accessed 20 June 2017]. Barrett, A. (1996). *Ship Fever: Short Stories Collection*. USA: WW. Norton & Company. Crichton, M. (1969). *The Andromeda Strain*. London: Jonathan Cape. Ledford, H. (2016). 'CRISPR: Gene Editing is Just the Beginning'. *Nature* [online]. 531 (7593): 156–9. Retrieved from <http://www.nature.com/news/crispr-gene-editing-is-just-the-beginning-1.19510> [Accessed 22 July 2016]. Ishiguro, K. (2005). *Never Let Me Go*. London: Faber and Faber. Steinbeck, J. (2000) [1945]. *Cannery Row*. London: Penguin Modern Classics. Steinbeck, J. (2000) [1954]. *Sweet Thursday*. London: Penguin Modern Classics.

Note

¹ Schmidt 2010.

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Competing Interests

The author has no competing interests to declare.

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Sean Fitzgerald holds a PhD in creative writing from the University of Winchester. His practice considers the writing of science as fiction in the form of speculative stories, and can be read in *Holdfast Magazine*, *The Honest Ulsterman*, *The Ham* and *Written Tales*. An experienced media practitioner and academic, his most recent work, 'The fictional scientist as a dichotomy of good and evil in contemporary realist speculative fiction', can be found in *A Shadow Within: Evil in Fantasy and Science Fiction* (2019) from Luna Press Publishing. A forthcoming book of science-inspired speculative fiction, *A Common Thread*, is due to be released through Troubador Publishing, in the second half of 2020. Further information can be found at <http://www.seanzfitzgerald.com>.

I can confirm that I am the sole and original author and copyright owner of all documentation, text and audio-visual material contained within this presented collection.

Sean Fitzgerald.

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