

JULIE HEFFERNAN

Self-Portrait as Great Leap, 2021
Oil on canvas, 102 x 76 in.



COURTESY THE ARTIST

STEVEN LANG

The NOvA Experiment

extraterrestrial life-form trying to communicate with us. Another was that my newest algorithm was failing miserably. Yet another was that I was hallucinating the entire situation, which in my case is often the simplest explanation.

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The NOvA Experiment Far Detector sits 5 miles from the Canadian border, 35 miles from the nearest single-screen movie theater, 60 miles from anything that could pass for a shopping mall, and—as the subatomic particle flies—approximately 502.6 miles from the Main Injector at Fermilab National Accelerator Laboratory in Batavia, Illinois. The facility, hidden deep in the woods of northern Minnesota, looks innocuous enough on the outside, but on the inside sits a six-story lattice of PVC tubes filled with fourteen thousand tons of dense liquid scintillator surrounding a matrix of hyper-sensitive photon detectors that can pick up some forty thousand cosmic rays per second. Impressive? Sure. But most of what NOvA detects is trivial interstellar noise. Our purpose—*my* purpose—is to extract data from that noise concerning something far more interesting and far more elusive: *neutrinos*.

Neutrinos are infinitesimally small subatomic particles about which very little is known, other than that they are electrically neutral, are nearly massless, come in three known varieties, and are exceedingly difficult to detect. That neutrinos are difficult to detect might be the scientific understatement of the millennium. A neutrino can fly through a *billion miles of solid lead* without hitting anything. And the universe is absolutely crawling with them. A trillion neutrinos just passed through your hand. As a woman in science, I sometimes feel like a neutrino myself.

All of this is what made the detections last night so remarkable. The event lasted for just over four minutes and stopped after almost two hundred likely neutrino detections, all of which were recorded for later analysis. After that, there was nothing but the usual background noise.

“We should call Fermilab,” Seth said, pointing straight up and looking almost desperately serious. “Something’s up there.”

“Bad data,” I said, “could fuck up our renewals.”

Seth nearly dropped his iPad. “What are the chances this is bad data?”

Just after midnight, Seth and I were alone in the control room, occasionally observing random particle collisions, but mainly watching separate episodes of *Star Trek: The Next Generation* on our iPads. Seth was watching his favorite episode, “The Pegasus,” directed by LeVar Burton, from season 7. Lots of Picard, lots of Riker. As usual, Seth was subvocalizing along with the characters, his Adam’s apple dropping low for all the Captain Picard lines. I was skipping around in season 6, unable to settle on a particular episode for very long. A few minutes before midnight, I was on the brink of nodding off when the detection monitors began roiling with activity.

“Lydia, what the hell is *this*?” Seth leaned back in his chair and gazed up at the screens. Every few seconds there was a collision pattern consistent with a neutrino detection. I checked the location of the activity. After a few minutes I determined that the source—narrowly focused and perfectly following the Earth’s rotation—was either in geosynchronous orbit or simply hovering somewhere above the detector.

“This can’t be happening,” I said. “We wait weeks for a single neutrino detection. What could possibly explain this?”

“Well, there must be *some* explanation.” Seth said this with all the authority of a virginal altar boy. “Aliens, maybe?”

Yes, one possible explanation was the presence of an

“All I’m saying is that it needs further analysis.”

“Of course it needs further analysis.”

“I mean it needs further analysis *by me*,” I said, “which will take time. For now, we should just go back to our cabins and sleep on it.”

“Sleep on it?” Seth’s face crumpled. “Aliens are basically knocking on the front door, asking us over for dinner, telling us that life as we know it is *over*, and all you got is ‘*sleep on it*?’”

“We could do worse than to sleep on it. Besides, it’s midnight on a Saturday during Christmas break. We’re only here to log hours. There’s no one at Fermilab to call right now.”

“What if there’s another detection event as soon as we walk out the door?”

“My algorithm will record it and we’ll have it all tomorrow. Don’t worry.”

Seth’s face went blank. “What, me worry?”

A joke—if that’s what it was—meant Seth had conceded, at least for the time being.

* * *

We packed up our things, secured the facility, and headed out into the subzero night. As soon as we were outside, we both looked straight up.

“I suppose we could have come out here earlier,” Seth said. “See anything?”

“Just stars,” I said. “But it’s supposed to snow later.”

“Just what we need.” Seth shuddered at the thought. “More snow.”

We huddled together for warmth and started off toward the cabins Fermilab rents for NOVA staff at a resort down the road from the detector. I have my own one-room cabin, as does Seth, but we spend most of our time together in mine because it’s marginally warmer. The cabins are old and cramped, but clean and efficient, ideal for researchers—kind of like the International Space Station but with gravity and knotty pine.

“You know,” Seth said as we entered my cabin, “we could be famous in a month with this detection event. Only aliens could produce a neutrino beam this focused and powerful.”

I cranked up the thermostat. “Is that what you’re hoping for?”

“I’m not hoping. It’s the truth.”

“I don’t think humanity is ready for first contact,” I said.

“That’s not for us to decide.”

I didn’t necessarily agree, but I let it go. I undressed and climbed into bed. With some reluctance and a couple of deep shivers, Seth did the same. He leaned in and kissed me softly on the neck. After a minute of that, he took a deep breath—preparing for what, I don’t know—and that was when I saw our son in the opposite corner of the cabin. Our son hadn’t even been conceived *of yet*, at least not by Seth, but there he was. He looked to be about three years old. He was on the verge of tears, trying to get juice from an empty bottle. It hurt that he couldn’t see me, that I couldn’t get up and comfort him. But, of course, he wasn’t really there. It was only my mind playing tricks on me, yet again. Maybe that fact hurt the most.

I’ve suffered from hallucinations for years. The medication I’m prescribed keeps them to a minimum, or at least it did until recently. In our few months together, I hadn’t yet told Seth about the depth of my illness, or my exact diagnosis: schizoaffective disorder.

“What’s in the corner?” he asked.

“I thought I saw a spider.”

“Did you?”

“Yes, but it’s gone.”

“Gone,” Seth moaned, “for now.”

Seth caught my mood and turned his attention to his iPad. Eventually, he drifted off. The wind outside howled, the cabin creaked and groaned. With all that was occupying my mind, I knew I wouldn’t be getting much sleep. In fact, I got none at all.

* * *

When I was in high school, I read nothing but science fiction and physics books. I signed up for every AP class my school offered and skipped gym whenever possible. I did my homework under a blanket with a flashlight and ignored the voices in my head. In an incident burned into my memory, I got hauled away from my junior prom in a straitjacket. (Yes, they still use those.) I attended a different high school for my senior year, a year that was, by contrast, a blur. I can thank my previous prescription for that. I managed to get straight As anyway—except in gym—and somehow I got into MIT. Amid regular hallucinations and

recurring psychotic episodes, I earned a PhD in computer science and eventually took a job as a data technician at Fermilab. My innovative AI research played a big role in landing the position, but so did Fermilab’s inclusionary hiring initiatives. My mental health history is known only to a select few.

Seth and I met at NOVA over the summer. When I first saw him, he was suspended on a steel grid over the detector array photographing some faulty wiring with his iPhone. He looked like a young Carl Sagan, with his helmet of dark hair, green wool sweater, and gold corduroy pants. And he had a Starfleet pin on his sweater. The pin got us talking, but it was his Carl Sagan-ness that really got to me. Carl had been my hero since my parents gave me *Cosmos* on DVD for Christmas when I was five years old. I watched it daily for years. At that time, he was in the midst of a very public battle with brain cancer. I cried for days when he died. Years later, when my own illness began to progress, I cried even more. But now, none of that seems to matter. Because now, all that matters is the fact that one questionable detection event is putting all my progress at risk.

* * *

It’s just before dawn, and I’m standing at the foot of the bed staring at Seth. He’s snoring steadily, his head hanging off the side of the mattress, mouth wide open, the whites of his eyes visible through quivering slits. It looks like he’s *od’ing*, but he’s just dreaming. I glance around the room, expecting to see our son again, maybe older this time, maybe even holding a baby brother or sister. With some relief, I see nothing. There is a hint of sun showing through the east window. I decide that a walk out to the lake might help clear my mind, help me decide what to do next.

I choke down a dose of my paliperidone, dress in my warmest gear, and head outside. The early morning sky is clear, the air bone dry and wickedly cold. Enough snow fell overnight to cover up all recent signs of human activity. I march past the lodge and down the unplowed road toward Lake Kabetogama. Near the lake, another, much older, lodge sits derelict, abandoned, surrounded by boarded-up cabins, some with more paint peeling than not, others nearly collapsed, all of it beautiful in a way. On the decrepit porch of one of the larger cabins stands a clutch of old snowshoes sitting out for anyone to use. I strap on a

pair and continue toward the lake. Near the shore of Sullivan Bay, I see a fishing house out on the ice. The snow surrounding it is untouched, and smoke is rising from the metal chimney. I wonder who might have spent the entire night in that cramped little icehouse.

As I make my way onto the lake, I see an open padlock dangling from the doorframe. The wind picks up, driving waves of snow across the surface. I look back toward shore. My snowshoe tracks are nearly gone. At this moment I realize I should have told Seth where I was going.

The wind changes direction. The icehouse door flies open, and a man sticks his head out. Time to turn around. As I take my first steps back, a voice calls out: “Greetings!”

At first, I don’t stop. Nothing about this voice is menacing enough, and, given that I am alone in the middle of a frozen lake, it would take more than this voice to make me stop.

“Lydia, I’ve been waiting for you.”

This does make me stop. I turn around. In the doorway of the icehouse stands an older man with shaggy dark hair and pallid skin. He’s wearing a brown corduroy blazer, a cream-colored turtleneck, red snow pants, and green suspenders.

“It’s frightfully cold out here.” He waves me over. “Come inside.”

My first thought is that he will try to smother me, cut me up, and use me as ice fishing bait. But, as I approach, I see the gleaming eyes of a man who could not possibly do me any harm. As I reach the doorway, he extends his hand. “I’m Carl Sagan.”

My entire childhood flashes before my eyes. I reach up and shake his hand. He gestures for me to enter. I twist my boots from the snowshoe bindings and step into the icehouse. The door slams shut. In the corner, there is a small woodstove with a fierce fire burning. He adds a split log from a woodpile I swear was not there five seconds earlier. A single, tiny window opposite the door is steamed over and dripping wet. He invites me to sit down. There is no furniture, so I unzip my jacket, let it fall to the floor, and sit. He sits facing me, his surprisingly limber legs crossed tightly, his fingers laced together like a sprung Venus flytrap. Of course, it is highly likely that I am alone in this icehouse. But this is unlike any hallucination I’ve ever had. It’s the first one that I don’t want to immediately end. I think about

the paliperidone coursing through my body. Maybe the dose needs to be adjusted up, or down. Maybe I need yet another prescription. Maybe I'm out of maybes.

"I have all your books!" I blurt out. "And *Cosmos* on DVD."

He tilts his head back ever so slightly in what I take to be a gesture of appreciation.

"And I have a poster of you in my bedroom."

"You mean your *childhood* bedroom?"

"No, my bedroom now," I admit. "And my childhood bedroom."

He smiles and, perhaps owing to his experience with fans, changes the subject. "Lydia, regarding the signal, was there anything in the upstream architecture that might have caused a false detection—particularly one of such intensity and duration?" His eyes are glistening, his pupils dilated. He is more handsome in person than I would've guessed.

"Well, maybe," I say, as if I hadn't thought about it all night. "I have a subroutine that randomly inserts data to make it appear as if a neutrino has been detected. I use it to test my algorithm. But I have to run it manually. Could the subroutine have found its way into the live data stream without my knowledge?"

"As with so many of life's great mysteries, the answer to that question will surely lead to many more."

A gust of wind lurches the icehouse. The door flies open again, and the cold air rushing in is a relief. I look out and see nothing but a patch of bright white. When I look back, Carl is gone, and there is no longer any question that I am alone.

* * *

NOVA will soon be replaced by a far bigger detector, the Deep Underground Neutrino Experiment, DUNE, now being built in a former mine in Lead, South Dakota. Seth and I both want to end up there in a few years, so we're determined to make our mark here while we can. Though both NOVA and DUNE can detect neutrinos from any source, the primary source is beamed straight through the earth's crust from Fermilab in Illinois. When the beam is on, we know exactly what we're looking for—and when to look for it—down to the picosecond. Still, we have to wait days or weeks for a neutrino to strike an atomic nucleus inside

the detector. When it finally does happen, photons are released, and—because neutrinos can't be seen or studied directly—we study the properties of the resulting photons instead. Their energy, inertia, and direction help us make highly educated inferences about things like the big bang, or black holes, or how the universe might end.

As a technician, my primary responsibility is to quickly distinguish useful data from background noise. We can't possibly store all the data that comes in. It would be terabytes every hour. Instead, we keep only what potentially has some value—far less than one percent—and analyze that. My algorithm has to make split-second decisions about what to purge and what to keep. And my algorithm has never fucked up before.

* * *

Seth is just waking up when I return. I'm drenched in sweat. I kick off my boots and start peeling layers. As I strip to my underwear, Seth's head pops up right on cue.

"Okay, I'm Riker and you're Troi. Where's your wig?"

"Not right now," I say. "We have to talk about the detection event."

Seth throws off the covers and sits straight up. "You mean the detection event that has no reasonable explanation other than the presence of extraterrestrial life? You mean the detection event that could be the single greatest discovery humanity has ever made? You mean the detection event that will render us living legends in the field of particle physics? You mean *that* detection event?"

"Sounds like you have a plan."

"Of course I have a plan."

"Well I have a plan, too." I slip into the bathroom, leaving the door ajar. "I'm going to take a shower."

I crank the hot water and step into the tub. Predictably, Seth lasts thirty seconds before he draws the curtain back and gets in with me. He has the Troi wig. I shake my head at him and pour out some shampoo to wash my comparatively boring and straight hair. He drops the wig, and the thicket of dark curls sloshes around the bottom of the tub. Seth is fully erect, beaming. I pick up the wig, slosh shampoo all over it, and use it to jerk him off. From the look on his face, this is a fantasy he never even knew he had. When he's done, he cleans up the wig, rings it out, and drapes it over the curtain rod. Then he looks at me and

I shake my head again. "Later," I say. "Let's go back to the detector and check for any new data." He nods and gets out. I turn my attention to shaving my armpits.

* * *

An hour later we arrive at NOVA and head straight for the break room. Fermilab keeps the freezer fully stocked with Totino's pizza rolls. Seth pulls out a full bag, opens the door to the microwave, and dumps the entire thing onto the carousel.

"I'm setting it to stun," he says, for the millionth time. The microwave—which has been souped up some by one of the technology grads—cycles up, and the pizza rolls begin to sizzle. "Should we go check the overnight detections?"

"First I want to make sure what happened last night doesn't have some kind of logical explanation."

The microwave beeps three times, and the sizzling pizza rolls go quiet. Seth opens the door and scrapes the rolls onto a large white platter. I follow him down the hall to the control room. As I sit down and log in, Seth holds the pizza rolls in front of me. I pop one in my mouth and chomp through to the greasy cheese inside.

"Care to expound on your 'logical explanation' hypothesis?" he asks.

"I'm going to run my test detection subroutine manually," I tell him. "If we get a repeat of last night's multi-detection event, we can safely assume my algorithm made some kind of magnificent blunder."

"Why didn't you say something about this last night?"

"That the upstream architecture could misbehave hadn't occurred to me. That's one reason I wanted to sleep on it."

I execute the test. A single detection is registered, then nothing. Seth's shoulders rise up and in, and he tilts his head back as if he can spot particle reactions somewhere off on the horizon.

"I might need some time alone," I say. "I have to concentrate."

Seth picks up the remaining pizza rolls and walks wordlessly back to the break room.

I check the logs. Nothing of consequence was detected for the past eight hours. I weigh my options. If we turn the data over to Fermilab, it will be pored over by every

particle physicist on Earth. And with that kind of scrutiny, people are going to start asking questions. Questions about my algorithm—and possibly about me—that I'd rather not have to answer. Since practically all we do is delete data, deleting the detections from last night will not raise any suspicions, except with Seth. Believing I can manage his objections later, I copy the data in question onto a portable hard drive and disconnect it from the network. This copy makes it seem less treacherous when I proceed to delete all traces of the detection event from the server. I stuff the drive into my coat pocket and walk out of the control room.

Seth is slamming pizza rolls over the sink. "I'm going to take a good look at the detection data myself later," he says. He's nearly halfway through the bag. "I need answers."

"You do that," I tell him. He's a wizard when it comes to solving mysteries hidden in the math of particle collisions, and I can feel his desire to lose himself in this huge cache of data. "I'm going back to my cabin to rest. I'm not feeling so well."

Seth puts his hand up to his own forehead. "You're sick?"

"I'm just tired." I split the fingers on my right hand into a Vulcan salute. "To put it mildly."

With the data in my possession, I leave NOVA and make my way down Ash River Trail. I stop at my cabin and, unadvisedly, take another dose of paliperidone. In the bathroom, the Troi wig is drying on the shower rod. Though it's still damp, I grab it and stuff it into my coat. Then I set off toward the frozen lake once again.

* * *

Schizoaffective disorder normally manifests itself later in life, but I was diagnosed at a young age, just nineteen, during my second year at MIT. My mother is a registered nurse, and at the time she helped me find a psychiatrist who would take me at my word that I wasn't using hallucinogens. That was no easy task, probably because most of them use hallucinogens themselves. But when your brain and your brain on drugs are exactly the same, there's no need for psilocybin or LSD. There *is* a need for a reprieve, though, since this disorder doesn't wear off like acid. Hence the medication. Which has clearly stopped working. Hence the return of my hallucinations.

Six years ago, I was huddled in the corner of my dorm room at MIT enduring visions of my skin flaking off like

the paint on those old cabins. I fought my way through because I had something to prove. I came to NOVA with something to prove as well, namely that I could perfect an algorithm to find a neutrino in a proverbial haystack. And I succeeded. Or at least I succeeded up to now. I've long had the propensity to see things that aren't actually there, but I never suspected I could pass that trait along to a computer code.

When I was younger, my hallucinations were almost always scary. Murder victims. Rotted corpses. Bullets with my name on them flying by in slow motion. But over time and with treatment, my mind calmed significantly, especially once I arrived at NOVA. Here, I have a sense of purpose beyond mere survival. Seth, though, has given me something more than that—a glimpse of the future, our future.

The moment we met, when he turned his attention from his work to me for the first time, it was almost scary. I felt like he was seeing past my diagnosis, past all the trouble I'd experienced, to the real me, to the person I've been hiding away all these years. As wonderful as that moment was, I knew that my schizophrenia would eventually come between us. It was an instant, painful realization: sooner or later, I would have to tell him everything. I wanted to put it off for as long as possible. Keep waiting. Keep hiding. Keep wearing the mask. A monarch refusing to leave her cocoon. Refusing to believe I could possibly survive outside it.

Or maybe I'm just kidding myself. Maybe Seth isn't the man I think he is. If my brain can fool *me*, why can't I fool my brain? And yet, the possibility remains that even if I'm wrong about Seth, I'm right about the detection event. It's not aliens. It's bad data, the result of something I overlooked in my algorithm. There is no other reasonable explanation. Of that I'm almost entirely certain. But, of course, I wish I were *more* certain. Not 99 percent certain. Not 99.995 percent certain. *One hundred percent* certain. Because, perhaps above all else, I want to be the woman scientist who is utterly certain she is right, no matter what the nearest man has to say about it.

* * *

I head straight across the lake. A ferocious wind ripples the fabric of my jacket. Through the blowing snow, the icehouse fades in and out of sight like a weak signal

disappearing into white noise. I lean into the wind and keep moving. When I finally get close enough to knock, I don't have to. The door swings open. I see no one inside. I step in and pull the door closed. The interior is the same as before, with one difference: there is a mirror on the back of the door. I look at myself, take out the wig, and put it on. I look ridiculous and turn away. A tube of lipstick appears on the windowsill. I pull off the cap. The color reminds me of the lipstick I wore to my junior prom, a fire red.

As I'm about to apply the lipstick, there is a sudden, high-pitched whine. Glittering into existence in front of my eyes is Commander Deanna Troi, ship's counselor on the USS *Enterprise* NCC-1701-D. She is stunningly beautiful: glossy lips, flawless half-Betazoid skin, brilliant blue uniform, unbelievable hair. The wig is an embarrassment. I take it off. She gestures toward the lipstick, and I hand it to her. She applies a thick layer to her already sumptuous lips.

"I really don't think it was aliens," she says, handing back the tube. "I mean, Occam's razor and all."

"I would tend to agree," I say, "but that's not what Seth thinks."

"It's not what Seth *wants*," she corrects me. "Humans are particularly susceptible to that kind of thinking. But you know, I do like him. In a certain sense he reminds me of Commander Data."

"Commander Data?" I can't believe I'm having this conversation. "Why Data?"

"Like Data, he desperately wants to reach his full potential, but he really doesn't know why."

"Is that a good thing or a bad thing?"

"It's not exactly the worst trait in a human being," she says. "But it can get in the way sometimes."

"In the way of what?"

"You'll find out soon enough," she cautions. "For now, let me do my job as a counselor. I recommend you figure out what's most important to you in the long run: your reputation, your health, or your relationship with Seth."

Before I can ask even one of the ten thousand other questions I have for her, she taps her Federation pin and dematerializes. I feel woozy, fall to the floor, and bury my face in the wig. I begin to sob and struggle to imagine a future in which the sobbing subsides even a little.

After a few minutes there is a knock at the door. I stuff the wig into my jacket and zip it up. Whoever is out there,

or whoever is inside my head, I want nothing from them other than to be left alone. But soon the door swings open, and, of course, there is Seth.

I sit up. "How did you find me?"

"I didn't. I followed you."

"Why?"

"Well, you deleted the detection data, for one thing."

Seth clears his throat. "That, and I'm worried about you."

"I told you, I'm just tired."

"It's not that."

"Then what?"

Seth looks like he is going to burn up. "I saw a prescription bottle sitting on the bathroom sink this morning."

I must have forgotten to hide it. I shake off the wooziness and struggle to my feet. "Do you know what that medicine is for?"

"I think so."

"I was going to tell you."

He shakes his head. "It's not my business," he says, sounding mostly sincere. "I just want to make sure you're okay."

"I'm okay, considering. Or, at least I will be. I just need some time."

A drift of snow falls off the roof of the icehouse and lands in front of Seth with a thump. I step outside and face him. I want to tell him more but don't know where to begin. I try to make eye contact, but for some reason he's looking right past me, across the lake, toward Canada. Even on a clear day it's difficult to see all the way to the other side, but Seth seems focused on something. I search the horizon for whatever it might be but see only the lake ice as it meets the overcast sky. Seth lets out a long and—in this cold—very visible sigh. He wipes his eyes with his overstuffed mittens.

"Why did you delete the detection data?"

"Because it can't possibly be right."

"Well," Seth lets out a grunt, "without the data, we'll never know for sure."

"If it *was* aliens, they'll try again."

"When? Tonight? In a thousand years?"

"It had to be my algorithm. There's no other explanation. I'm just glad we were the only ones here to see it screw up that badly."

"Lydia, your algorithm is brilliant. *You* are brilliant. If there's a problem in your code, we can deal with it. But we

can't just delete a detection event like that one." He looks at my jacket and sees the wig. "You wear that around?"

I pull it out. "Not exactly."

Seth looks back in the direction of the detector, then at me. "Put it on."

"Now?"

"Please."

I put the wig on, flip the curls over my shoulders, and shake my head. The air is frigid. Seth's cheeks are rosy, his nose chafed. He is sniffing to keep it from running, or maybe to keep from crying.

"We never even checked the UFO forums," he says. "Maybe someone reported something."

"Most UFO sightings in Minnesota happen in summer, not winter," I say. "I think it's all the helicopters spraying for mosquitoes. They do it at night so no one gets sick."

"Does it work?"

"Not really. Some people still get sick."

I reach into my pocket and pull out the drive. Seth lights up when he realizes what I'm holding. I hand it to him. He's going to have a field day with this data. I probably won't see him for a week, which is fine. That will give me some time to get my medication adjusted. It will also give me time to discover the fault in my algorithm that will explain everything away. Everything except the fact that our son is standing right behind us in the door of the icehouse, and only I can see him. I squeeze my eyes shut and will him away.

Seth, for his part, is staring across the empty lake again. As far as I can tell, there is still nothing to see. No shoreline, no sky, no trees, no structures. Only a blank, white void. Or, if there is something there that only Seth can see, it's passing right through me undetected.

Steven Lang is a writer and artist from Minnesota. He received his BFA from the University of Minnesota, Twin Cities. His short fiction has been published by Milkweed Editions, the University of Minnesota Press, and the journals *CutBank*, *Chestnut Review*, *Slush Pile Magazine*, and *Stonecoast Review*. He is at work on a novel and a collection of linked short stories.