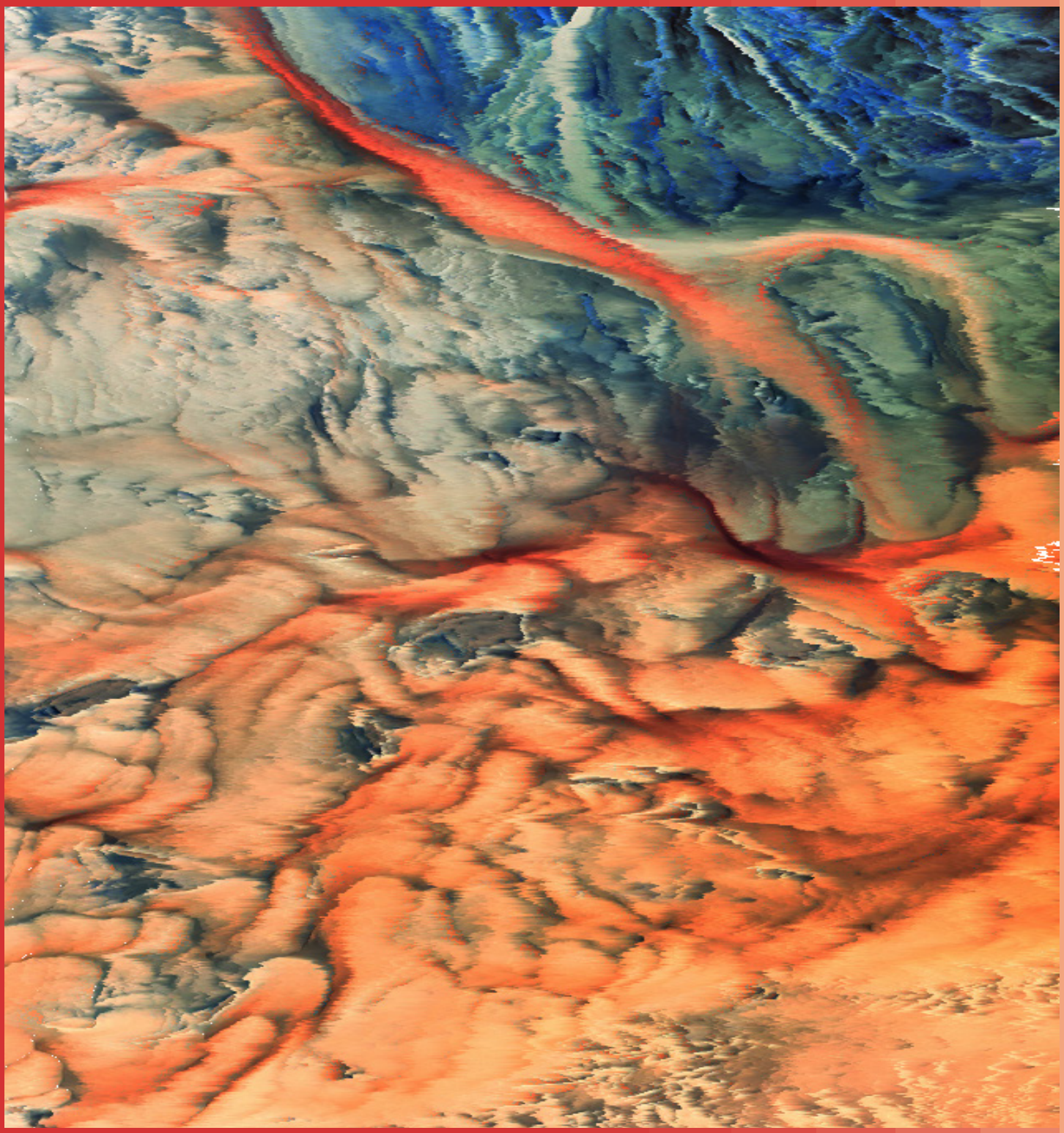
VESSEL

AUTUMN 2018

"IN DECAY"



VESSEL

VOLUME I

"IN DECAY"

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AUTUMN 2018

dimondale friday afternoon (et intravit Israel)

i

it takes more than you would think
to keep from wishing
for a fish hook to catch my bare soles
on the bank here: surely
there are some in the rain-naked mud.
otherwise, in this breeze, i may renounce all my principles.

ii

squalls swept hot and disordered all morning across ingham county. i
knew it would be a bad time
because everything turned green and luminous at
seven o'clock yesterday, a sure sign of calamity. but then the sun came out
and here
we are.

iii

i am ready for this dream to die, i promise. though it would
be so much easier if the
sky rather opened itself with lobs of thirty-four
degree slush, if it were april again,
and the land were still covered in matted skeins of icy
filth, air still cruel and xenophobic so the
dark triumph i will bring about by leaving
here may be burnished by the horrors of grim final days such as lansing
inflicts in late winter. but september
is the martyr of all months
and will not grant it. september marches
cheerfully and gently unto death; born always to kill, yet
at its own burning gives a sweet odor after the fashion
of polycarp.

iv

what have i
done, after all,
since coming back here but walk and walk,
feel sunset vibrate through me on the lake
and startle garter snakes down soft paths? certainly
i have not applied myself to any academic task of note
nor yet has sloth of mine borne consequences. you
might say it like this: beautiful things die in september,
but evil things only begin, so that a person says,
"we can deal with it later," "we have plenty of time to turn back,"
and so forth. and i have to remind myself just how much
i hate this place—how, secured in its pallid aspect (and that soon),
i will shake the dust off my feet in mason and dewitt
and piss in this river too, taking care at that time to be
upstream of eaton rapids. i am going to sit here on this bank
and think of how much easier it will be to do that
come december.

JAKE ZAWLACKI

Ashes and Earth

Six nights consecutive I woke to the smell
of earth. Dark pulp you imagine ragged
men searching for the planet's jewelry.
Scattered teeth ajar at discovery.

Six nights dreamt. Common metaphors.
I awoke to the smell of earth.

Six days spent. Excavating the contents of
my mind for meaning, as if meaning was
anything but necessary.

On the seventh I found my life in rebirth,
through flames.

Earth and ash. Both of the same.

The simple empire, our species, the two
skin sheathed creatures pulsing in the dark.
Perfect ogees.

Six days of earth, and one of ash.

A Closed Mouth

"Lunche!" screamed Cesar, mocking the broken Spanish and stupid compounds the bosses created to make fun of the workers. The 12 o'clock sun beat down on Jake's brow hard, cutting through the red bandana that held back the long hair he'd been growing for three years. The split ends that stuck up from the knot he tied his hair into were beaded with sweat and crusted with sunscreen from scraping his neck earlier. Fuck this job, a statement that sent his mind wandering down a hallway of closed doors that could've been taken to escape the bullshit farm work; his only opportunity. It seemed a college student in between his Sophomore and Junior years of school has the option of either kissing ass for an internship that doesn't pay or working a shit-job for the time being. The whole not-getting-paid-for-working concept was one he couldn't bring himself to accept. It'll make your fuckin' nuts drop, boy. His father had forced him to play basketball, baseball, and football throughout his youth- saw pushing the body to its physical extremes as a means of grabbing life by the balls with gridiron grip. It was an odd phenomenon considering Tony weighed somewhere over three hundred pounds himself; the product of a few Budweisers every night and frequent trips to Cookout that occurred once the arbitrary four-beer limit was exceeded. Now that Jake was home from school, his old man didn't have to drunkenly swerve between yellow lines and could rustle him up around 11 to be his designated driver for the night. Whack upside the temple, get outta your goddamn wet dream and drive me! The first thing he would see is the yellow-stained wife beater and unkempt beard of his father. Jake was usually in bed by 9 so that he could be up by 5 the next morning.

*

Blue television light flashed on the apartment walls in front of four blank eyes. Reyna and Mosquito washed down their chicken lo mein with lukewarm beer and watched The Big Bang Theory like every other night. He eased his hand over her smooth thigh. It was still warm from the sun it'd taken in that workday. Mosquito's hard-on was the only thing keeping him from cracking-up at Sheldon's stupid interjections. All he could think about was fucking her hard- stress about the faulty gears on the tractor, ordering plant pots, and dick-bosses coming out of his brain inch-by-inch with every thrust. She was all his and he wanted to let it her know it. Reyna scooted farther away from him on the dingy couch.

Can we tonight? For the past two months each time he made a pass, Reyna would have an excuse as to why she wasn't in the mood. What he didn't include was for that amount of time he'd been hitting his Backpages app often. Every other Friday when the checks went through and everyone was let off early at 3, he and the guys would hit a bar for a couple of drinks then he'd venture off alone to meet the woman he'd messaged for the night. It was usually successful and relatively cheap. The last time this happened, however, Mosquito was pushed off before he could finish and told to get the fuck out. His pants were void of the eighty dollars that were there before he took them off. Maybe I shouldn't do this anymore, he thought while heading back to the apartment blueballed that drizzly night.

Reyna looked down at her lap for a few moments without saying anything. Sure. She noiselessly stared at the ceiling the entire time.

*

Jake thought about all the other guys who lived in his dorm at UPenn and spat at the

ground. They were probably all sitting under palm trees in the Bahamas and sipping rum drinks with little umbrellas in them. When their night out at the club ended with no women coming back to the room like they do in the movies, Jake imagined, they would find comfort in the fact that they were just another group of fuckwad bros who swear their friendships come without a price tag. He told himself that's why he really didn't give a shit when he passed their dorm rooms and heard them whispering about how to impress the chair of the chapter and get into the frat they'd always dreamt of. Once as he stepped out of the communal shower, Roderick from next door didn't believe him to actually be a student at UPenn. You shacking up with a bitch in this dorm before heading to your McDonald's shift? He still sometimes felt the desire to rip off their shirt-whales and shove what they found valuable down past their taught, purebred jawlines.
Different worlds existing on the same hall, all the young men connected by a desire to move on up the social ladder. Their starting points, however, were scattered all over the place with most of them at his school falling much higher than himself; a typical scholarship kid who was offered a free ride based on some short stories he submitted to his county public school system. He was also a first-generation whose dad didn't give a god damn and would never have paid to have his boy's mind sucked out by the liberal think-machine. Thankfully for Jake, a few teachers had privately urged him to attend university and he took their advice. The rolling hills of North Carolina fragmented into hustling streets, buses, and the smell of stepped-on asphalt in Philadelphia. He loved it; the people he'd never know, the fact that the grocery store was no longer a 45-minute drive- all the charms of city life that he'd never had the opportunity to explore before.

*

So you're a college boy, huh asked Mike as they squatted next to one another and pulled weeds from the newly potted Japanese Maples.

Reckon so, food ain't gonna pay for itself so I came out here to try and make it happen. Jake was always conscious of how differently his coworkers treated him upon finding out he was a student.

Is it like that crazy shit they show in the movies? You get a lot of pussy? I bet there's some crazy ass parties man!

He thought of lying, giving a hard hell yeah and keep on pulling weeds. Why did it matter? Mike would only be a part of his world for three months and it'd might be fun to keep up an illusion.

Na man, I just study and work a couple of jobs to make ends meet.

You crazy? If I was you I'd be fuckin' like a sewing machine every god damn night! What's wrong with you? Thousands of women there and your ass is workin' away just like we do here!

I'm a shy guy. Jake thought of the late, Adderall-driven nights in the library followed by delivering pizzas. The only reason anyone would want to fuck with his broke ass is to piss her rich daddy off, anyway.

Maaan a closed mouth don't ever get fed- you won't take away shit from this job, but don't forget I told you that. A thousand no's are worth that one yes, my man.

The break bell rang and the two stood up. Jake tried to separate the advice's obvious nod to oral from the general sentiment of putting himself out there. Maybe his coworker was right. Wanna head to the 7-11 for some lunch? Mike winked.

As they turn onto a deserted logging road that was close-by, Mike pulls out a baggy that held a piece of the blunt they'd been hitting the day before. Man, when you get high this god damn

work is so much better- you don't even realize that shit's passin' by until the day's over. Just put them sunglasses on and smile like a motherfucker.

Jake knew this all too well and would continue to take it as sage advice. To always stay high- especially at times that it's socially unacceptable. When they returned to the farm, a sense of fear and ferocious joy grasped his heart when Cesar asked- what were you smoking with the black man? Nobody had seen anything they'd done but leave the parking lot. The thrill the two men got from having to hide their buzz from everyone working made them feel more alive than anything else ever had.

*

Jake thought of headlights coming down Main as he unzipped and took the much-needed after-work piss in his dad's backyard. Just being able to whip out your dick and let loose anywhere was a simple pleasure the city folks would never understand. One time when he wandered back to his dorm after a night of drunken revelry Jake decided that he was beyond aiming and proceeded to do it just like he had down at the old homeplace.

You know I could pop you for public exposure, asked the campus rent-a-cop. Jake quickly tied it off and put the horse back in the stable. If he had been a little drunker he would've told Paul Blart to fuck off and finished his ceremony in solitude. However, he made the gametime decision that it's probably best not to end up on WatchDog at the age of 20. A surefire way to ensure that every neighbor you ever have will surveil your house as their kids head to the bus stop.

Now, Jake was back where it all began. It was as if the two years of constant schoolwork and business meant nothing when he got back home. He was still the same weird piece of shit in everyone's eyes; the weirdo who, after middle school, never played sports or gave much of a damn about killing deer. Instead, he'd spend whole weekend days locked away in his room reading or listening to records. The momentary introversion, he decided, was only going to be a pit stop on the road to a City of Nights.

He'd almost escaped it this summer, gotten so close, was being considered for a paid internship that was opened up for the school's literary review. The opportunity was taken up by Chad Augustus III; maybe it was just happenstance that his father was the editor of the review 30 years prior. Instead, he ended up at Burnett's where Tony's high school buddy was the manager (yeah, he had connections too) and promised him the solid pay of $10 an hour and the chance to practice the Spanish he'd been learning in school. The last bit was said with a shittily pronounced si senor that many of the workers would laugh at behind Charlie's back. His turning around was one of the few moments each day when the workers could be at ease. Other than this and a strict 20-minute lunch, it was all work and supervision.

*

The men who worked at Burnett's Mill were always pissed at how the women got off the hook for the hard jobs. Rather than lifting trees in fifty-gallon pots of dirt and busting concrete, they were relegated to the duties of sweeping the shop and trimming plants.

They're more fragile than you, Charlie said for the umpteenth time in his cavalier manner. When Cesar turned to walk away Charlie winked at Reyna and patted her on the ass.

How about we go do some watering in the woods section? Those oaks that got shipped in last week are looking parched.

Reyna climbed into the rickety Farm Use F-150 and they headed off toward the woods. The rust on the old axels creaked with every stone that jolted the worn-out tires. The oaks needed water almost every day, sometimes twice.

*

Mosquito was in charge of the men's work team. He always worked quickly and with an unremovable smile on his face. Most of the workers said he felt this way because he knew that when the day was over he and beautiful Reyna could return to their apartment to watch telenovelas and drink Heinekens. To have a wife and home to themselves was what many of the men were toiling away in the hot sun for. One hazy day in mid-July they all realized that Mosquito's toothy smile came from elsewhere.

Each lunchbreak, Mosquito's Impala would leave a trail of dust down the driveway to the farm. When he and a couple friends got back that particular day, they grinned and scarfed down a few 50-cent 7-11 hot dogs. The bell rang after 20 minutes and, as always, everyone rushed back to work.

An hour later a tractor lies flipped-over in the middle of the boxwood section, steam emanating from its motor. Mosquito yells at Charlie not to call a fucking doctor and claims he'll be fine. The shape of a deep gash in his right thigh begins to be outlined on his jeans by blood.

If we call the police we've lost our work. They'll see the crew and know exactly what's going on, Charlie was preaching to a circle of overseers on the farm. How about we herd 'em up in the warehouse to hide and you call an ambulance- if a cocksucker dies out here we'll be more fucked than we would be dealing with Immigration, reasoned Randy. Nobody spoke against this proposition.

*

An hour later, red lights and the sound of a siren coalesce at the end of the driveway. They strap Mosquito onto a stretcher as he cusses them out in Spanish and push him toward the ambulance. Chupame verga, coño.

We're gonna need some form of identification for the patient, the driver explains to Charlie. The boss runs to Mosquito's Impala to dig for anything that might have his name on it. When he opens the driver door, three forties of High Gravity fall onto the dusty ground. You bean-eating motherfucker! Beige spittle collects in the corners of his mouth in-between shouts. Charlie runs at the stretcher with his head down like a buck in rut and a couple of EMTs hold him back. I should've expected this bullshit from y'all!

A tow truck follows an ambulance back down the driveway. The little Impala spits out dust from its back tires like always. This time, it never returned. Neither did the drunken smile that ensured the Burnett's Mill workers that they, too, could achieve the comforts of American happiness and domesticity.

*

Jake had never been so happy to be on an Amtrak.

Never again will I come back to this hellhole, he thought while looking at a passing cotton field. Soon, pungent defoliant would fill the air and signal the impending Fall. When the attendant brought him the greasy cheeseburger he ordered, Jake made sure to open his mouth as wide as possible with every bite.

Ache

I cannot remember how I got here,
The last book you read, I'm holding close to me,
I've been drifting, scattered like debris,
I am the broken fragments of you and me,

Here I stand, but an inch from icy waters,
Just minutes from being able to see,
The you I lost, the you that wanders,
The you that still lives inside my psyche,

My tears are dry, my mind now ponders,
My feet now burn submerged in the sea,
I can't feel any other emotions,
But the fierce ache in my heart that has silenced the banshee,

They say time does matter and time always heals,
But time for me is a long road of misery,
With the ache so numbing, time only reveals,
There isn't now and never will be a remedy,

The book in my hand now floats on the waves,
And the trace of a rose it did once hold shines at me,
Though the rose is gone, its essence left behind,
As evidence of existence in another entity,

I feel my soul breathe inside,
Like a lightning hit, you come alive in front of me,
Enlightening the traces of you that remain in my heart,
And as long as I breathe, you will exist within me.

KYLE CROMER

Life Like Weeds

I always made sure to see Grandmother when I was home. But this winter her health had taken a turn for the worse. At her age a urinary tract infection was common, and a persistent one could do you in. She'd been fighting it for about a month now but didn't seem to be turning the corner.

She was my mom's mother and I was her oldest grandson. I had more memories of her than any of the grandkids. I remember standing on a chair to reach the kitchen counter rolling dough for cinnamon rolls. Somehow in the process I would end up a total mess, butter up to my elbows and flour in my hair. Grandmother would always say she was gonna take me outside and spray me off with the garden hose. But oh boy, those cinnamon rolls. Didn't matter whether you ate them straight out of the oven or a week later, the best cinnamon rolls you ever tasted. Mom and my aunt have tried to replicate them, but nothing touches how Grandmother would make them. They never could figure out her trick, something that wasn't written in the recipe.

During the summers after Grandad passed I'd stay with Grandmother for weeks at a time, running wild out on the farm. I'd pick eggs from the chicken coop in the morning, and then I'd spend the rest of the day lugging my BB gun and my fishing rod around the property. I'd snag trout in the fishing hole on the far side of the farm or shoot swallows roosting in the rafters of the barn. When the weather was right, like just after a big rain, I'd hike up the mountainside looking for mushrooms. Grandmother had scared me enough about eating bad mushrooms that I never ate one without her inspecting it first. Before long I knew where to look, where all the good spots were, and what time of year I could find chanterelles and morels. And if I came back from the mountain empty-handed, I'd walk along the fencerows and pick stalks of asparagus that were taller than me.

In the evenings after dinner we would sit in thatched rocking chairs on the front porch and watch thunder storms roll over the mountains to the west. I never slept so well in my life as I did on those nights with all the windows open. The storm cooling the muggy day. The rain on the tin roof as my lullaby.

She hadn't been in the nursing home all that long. Before that she'd lived with my parents. It was right around the time I went to college that they convinced Grandmother to move in with them. For my parents, it beat having to be on call at the drop of a hat, racing over to her house whenever she needed them. So when I moved out, Grandmother moved in. She even moved into my old room, still decorated as I'd had it as a teenager - Washington Redskins wallpaper and emo rock band posters.

She lived with them for nearly a decade, the whole time I was at college and then grad school. But the older she got, the more cantankerous she became. She'd want this dish or that dish for dinner, always cooked a certain way. She'd insist on watching the 8 o'clock news every night at full volume. It was always too cold in the house for her, so she'd crank up the thermostat whenever she walked past it and my dad would turn it back down.

It seemed no coincidence that she became like that - more and more disagreeable - after they took her keys away. It had been her ability to drive, albeit quite slowly, that had provided a freedom that kept her content. Even though she'd never exactly been Richard Petty behind the wheel, it was last spring when my parents began to suspect she was becoming unsafe. She'd come home from the grocery store or the bank or wherever and have new dents in her big gold Mercury - dents she couldn't explain. But what really did it was when Mom was with her one day and Grandmother backed into a car in the Food Lion parking lot. Mom hadn't yet buckled her seatbelt and the impact

nearly threw her out of the seat. Grandmother didn't even notice. She'd hit hard enough to cave in the back bumper, but she just acted ho-hum, like it was a slip of the transmission or something.

After they took her keys, she still insisted on going everywhere she always had. This just meant that now Mom drove her. It was Tuesday trips to the grocery store, Wednesday dinners at her best friend Rita's, Durbin once a month. This was before Mom started fixing the place up too, before Grandmother let her touch anything in the house. Those trips were mainly to check the mail - she never got more than junk - and for Mom to mow the lawn as Grandmother sat on the porch and watched.

Mom taught part time at the local high school - ninth and tenth grade biology. One day while she was teaching Grandmother fell. Mom placed the most responsible kid in a class of ninth-graders in charge, and drove home in a panic. When Mom got there ten minutes later, she found Grandmother lying naked, scared, and a little bloodied on the kitchen floor. Grandmother had been feeling unsteady lately and Mom had gotten her to agree that she would only take a shower when someone else was home. And wouldn't you know it, the one time she ignored that agreement, that's the time her legs decide to give way. She somehow managed to catch the shower curtain on her way down, so hadn't broken a hip or anything, but her thigh had caught the faucet and given her quite the raspberry. She'd been too shaken up to stand and had to crawl to the phone in the kitchen and call for help.

After that Mom started losing sleep. It got so bad that one time on the way back from school Mom fell asleep behind the wheel and was rattled awake when she hit the gravel shoulder. Fortunately there was a shoulder, Dad had said. Fortunately she had drifted to the shoulder rather than the other lane. That's around the time they decided maybe Grandmother needed more care than they could give. Not Mom, not Dad, not Grandmother wanted to get to the point where they had to shower her or wipe her butt, but they were getting close. It wasn't a fight to get her to go to the nursing home. In some ways it might have been less heartbreaking if it had been a fight. You could see her heart drop when they told her. She just cried and cried.

.....

Is aging a disease?

There are some prominent biologists who sure think so. According to Wikipedia, "a disease is any condition which results in the disorder of a structure or function in a living organism that is not due to any external injury." Certainly by that metric, aging is a disease. Those that suffer from it share a common pathology - skin sags, bones degrade, hair greys, muscles atrophy, and the mind dulls.

For something that is a common feature of all life on this planet, it is surprising how little we know about the aging process. Only recently have we been able to shed any light on how aging occurs, much less why (if there is a why) it occurs.

So how does aging occur?

Soon after DNA was discovered to be the heritable material of cells, scientists realized that most diseases are caused by defects in the DNA - called mutations - and these mutations can be passed from parent to child. It was also discovered that most instances of cancer are caused by mutations acquired throughout the patient's lifetime. So if mutations are responsible for most disease, then wouldn't this also be the driving force behind aging? Surely it must be caused by the slow accumulation of DNA damage that occurred over decades of living. This came to be known as The Somatic Mutation Theory of Aging. [1]

A somatic mutation is an error in the DNA that was not inherited from a parent, but rather acquired in one or more cells of the body throughout the organism's lifetime. As cells divide, the theory goes, mutations slowly accumulate and eventually lead to aging of the organism. For example,

external factors such as UV light from the sun can break the DNA of a skin cell leading to a mutation in the genome. From that moment on, when this mutated cell divides, it will pass this mutation to all of its descendants. That's why if I could offer you only one tip for the future, sunscreen would be it. [2]

However, not all mutations are caused by environmental factors such as sunlight or cigarette smoke. Remember, we all started as one single cell that divided to eventually produce a full grown human. Since all cells in the body possess the exact same genome, this means that the initial cell that became you has had to copy its genome every time it divides. Our DNA replication machinery is good - really good - but it's not perfect. As with everything, there is a non-zero error rate in your cell's ability to copy a genome. And even if the error rate was one in a billion (it is actually slightly greater than that[3]), then that would yield six mutations per cell division. That may not sound like much, but consider that from the initial sperm + egg that formed you, your cells have divided enough times to eventually tally 37.2 trillion cells.[4] In that light, six mutations per division seems like a lot. No wonder the somatic mutation theory of aging held such sway.

But wait a minute, if you are acquiring mutations every time you step outside or a single cell divides, and mutations account for most diseases, how are you not dead already? Or, if you survived, why haven't you turned into Swamp Thing? Two reasons. 1) Your cells are very good at repairing DNA damage and preventing perpetuation of mutations. 2) Most mutations are completely and totally harmless. The reason that they are almost always harmless is because the genome is a very big place, relatively speaking.

The genome is comprised of six billion single base pairs (abbreviated A, T, C, and G), and most of this landscape is open space, with no known importance.[5] This means that most mutations (e.g. swapping a C for where a single T should be, or vice versa) can occur without any noticeable consequences. It's as if you dropped a grenade at an entirely random location in the nation of Canada. In all likelihood, that grenade would explode in the vast expanses of the Northern Territories, many miles from earshot of any human. That's why, when a mutation occurs, there is an excellent chance that it won't cause any noticeable disturbance in the functioning of the cell. There are however places in Canada where a randomly-dropped grenade would do some damage. In the same way, there are some regions, especially among the 1% of the genome that comprises your genes, where a mutation would be bad. It may even be so bad that the cell in which the mutation occurred could no longer continue to function. In that case, the cell would recognize this mortal wound and choose to no longer divide, entering a phase called senescence. Or, in more extreme cases, the mutated cell may decide that its continued existence constitutes a threat to the greater health of the organism, leading that cell to actively end itself through a program called apoptosis. And in the third and most rare scenario, a single mutation could prove utterly catastrophic to the health of the entire organism. This is when a single mutation in the exact wrong place in a cell's genome could impart tumorigenic potential, causing that cell to divide uncontrollably. And though cancer seems quite commonplace, it typically only occurs after many decades of random mutations. If you drop enough grenades at random, day in day out for the better part of a century, eventually you will drop one in the prime minister's office.

The somatic mutation theory of aging held for over fifty years. However, as cloning became possible, it called the theory into question. More technically named somatic cell nuclear transfer, cloning involves removing the genome (contained within the nucleus) from the cell of a mature animal, any cell really, and placing that old genome into a new single-cell embryo. In doing so, you are essentially creating a much younger identical twin of the original animal. However, since the cells used to create this identical twin were taken from mature animals, there initially was fear that the cloned animal would be born "old," with a lifetime's worth of mutations already accumulated in its genome. This was not the case. To everyone's surprise, clones were found to live just as long as the founder animals, in spite of the increased mutation burden. To really drive this home, some clever scientists

performed serial somatic cell nuclear transfer. They took an adult mouse and cloned it, then cloned the clone, then cloned the clone of a clone, for a total of 25 generations.[6] This means that the 25th generation of mice would be born with a total of 25 lifetimes worth of mutations in their genomes, and yet these 25th generation clones lived just as long as the original founder. So much for the somatic mutation theory of aging.

But it's not like mutations are doing nothing. In fact, biologists now believe that the random mutations acquired throughout an animal's lifetime are one of the primary ways that mutations - some of which could prove adaptive - are incorporated into successive generations. As such, they would be one of the major drivers of evolutionary adaptation.

While this may be true, I don't mean to say that the somatic mutation theory of aging completely missed the mark. Somatic mutations that accumulate throughout a lifetime do contribute in some small part to the aged phenotype. As the somatic mutation theory of aging asserted, mutations are one of the reasons that older cells function less effectively than young cells. As such, it is also one of the driving forces behind the gradual decline of an organism and its organ systems. But it is just one driving force, of many.

Telomeres, for instance, play a big role. They are long DNA sequences that cap the end of chromosomes.[7] And with each cell division, they shorten.[8] Eventually after enough cell divisions, they reach a critically short length, which provides a signal to the cell to stop growing and to enter senescence. This ensures tightly regulated development and acts as a cancer prevention mechanism. It is essentially a ticking clock that eventually tells a cell to stop dividing. It should come as no surprise that in order for a cell to become cancerous, it must find some way around the telomere shortening problem. This also means that during the process of cloning the old cell from the founder, this single cell of the nascent embryo must find some way to elongate its telomeres, in order to wind that ticking clock.

In addition to telomeres, epigenetics[9] also plays a critical role in development and aging. So as not to open up a whole 'nother can of worms here, suffice it to say that epigenetics are the diverse mechanisms by which cells regulate their genes. It is how your skin cells and liver cells and T cells and neurons can all possess the identical genome sequence, yet look and behave very differently. Think of each of your 20,000 genes (spread throughout the six billion base pairs that comprise your genome) as being an individual knob in a control room. There are precise settings for each gene, ranging from "off" to "on" that allow a neuron to act very differently from a skin cell. And in a young organism, these knobs are very precisely controlled. As you age, it has been found that epigenetic regulation starts to slip. Genes that should be off, turn on, and vice versa. The well-oiled machine that is the genome of a twentysomething eventually clunks and sputters.[10]

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At the nursing home they deemed Grandmother too much of a fall risk and tried to put her in a wheelchair, but she wouldn't cooperate. Her reasoning was sound - if she took to using a wheelchair she would lose what little strength she had in her legs and never walk again. She had walked with a cane for years, but that wasn't enough now, so last Christmas we bought her a walker. We even put tennis balls in her stocking, you know, to shove on the stationary legs of the walker to keep it from dragging the floor. She got a real kick out of that.

This was the first Christmas she couldn't join us, not even for a little while. So we all went to the nursing home after lunch and brought her food that she wouldn't be able to eat. We crowded around her bed, one of those hospital ones that raise up. There she was, with the long, grey hair she'd always rolled into a bun chopped short to brittle ends. In that bed - the hospital kind that folds in the middle - she looked so small and sunken into it. She breathed heavy at us as we leaned in to wish her

Merry Christmas.

She seemed to be in a real shock that day, so didn't have much in the way of conversation, but I'd been warned that even on a good day she might not remember your name. I had a lot of cousins who didn't visit very often, so a little forgetfulness is understandable. But my mom visited most days of the week and Grandmother started to forget her name. She'd mix up her and her sister, Nancy, who looked nothing alike. At least when I leaned in on Christmas, in spite of everything, I am certain she knew who I was.

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So if we're just now figuring out how organisms age, can we say anything about why organisms age? I mean, is this a question that can even be answered? Should we just as well ask why does the earth orbit the sun?

With all things biological, the only satisfying answer (if there is one to be found), must come from evolution. Though evolution operates with zero forethought, the reason why evolution shaped life in a particular way can often be back-calculated.

But if we think about aging, it seems to run counter to evolutionary objectives. Isn't evolution's one and only goal to perpetuate your genes - to ensure that you have as many offspring as absolutely possible. If that's the case, then why would organisms age? When aging causes a loss of fertility and eventual death, wouldn't an individual within a population that ages slightly more slowly have some selective advantage over its peers? And wouldn't any of that individual's offspring who were even more long-lived have an even greater selective advantage? Following that logic, if this is true, shouldn't all species tend towards longevity?

We know empirically that this is not the case. The lifespan of each species forms a bell curve distribution. And as far as we can tell, the average at the peak of that bell curve seems to be pretty static.

There are several possible explanations why this is the case - why populations do not appear to gradually increase in longevity:

1) Each species has reached its maximum lifespan.

That almost certainly is not the case. If it were, then how could the naked mole rat possibly live over thirty years, while its evolutionary cousin, the mouse, with whom it shares nearly all of its genetic code and epigenetic regulation profile, only live two? In this light, a mouse should certainly be able to be selected (or genetically-modified) to live at least as long as the naked mole rat.

2) Historically, aging has not limited fecundity.

This answer is a little more convincing. The thinking goes: Recently, and only among humans and their domesticated species, has the primary cause of death become aging-related morbidity. This has been the boon of modernization, that life is now comfortable enough and safe enough that virtually anybody in a developed nation can have as many children as their heart desires. However, for all other species, and for humans before the dawn of civilization, the primary cause of death was not aging. It was disease and predation. Hardly any animal lived long enough to become infertile, so of course, in most situations, genes that would help an animal tend toward longevity would have little selective advantage. That doesn't mean that it is biologically impossible for animals to live an extraordinarily long time. It just means that any animal that had genes that disposed it to age more slowly probably lost out to competitors whose genes imparted traits that were more important for survival, such as broader shoulders or longer claws.

3) There is an ideal lifespan programmed into each species.

This was the prevailing thought that preceded the somatic mutation theory of aging, that the decline and eventual death of an organism was programmed in. And I don't mean that the maximum lifespan of each species had been reached (as in #1), but rather that aging is a highly-regulated pro-

cess and the gradual decline of long-lived members of a population is intentional. Remember how I mentioned that the regulation of the cell's genome eventually becomes leaky, and genes that are "off" slowly turn "on"? Well, adherents to this line of thinking believed that this was by design - that there was an ideal lifespan, just as there is an ideal kidney size. This would mean that aging is not a bug, but a feature.

But why would aging be ideal, in any circumstances? If evolution's primary goal is to reproduce, then wouldn't an organism's gradual decline put that organism at a selective disadvantage? And, if a species' biological maximum for lifespan had not been reached, shouldn't evolution work to overcome that disadvantage?

If longevity were to occur in a perfect vacuum, it would be undeniably advantageous, as it would allow an organism to reproduce more of itself. However, we must not forget that evolution acts on many levels, not just the individual. What is good for a single organism within a population (and its descendants) may not be good for the greater population. And because the same evolutionary forces that act on that single organism also act on the entire population - in the long run, what is bad for the greater population eventually gets selected out.

The trait of speed makes a great example here. It's a trait that, from a single individual's perspective, is almost always better to have more of. Think of antelopes. Typically the slowest antelopes are caught by predators, so the faster you are, the more likely you are to live long enough to produce many offspring. Because of this, there is huge selection pressure against slow antelopes. But in that case, why haven't antelopes become faster and faster with each successive generation until they could maybe outrun cheetahs? I'm sure this is no simple feat – it could take several thousand years, maybe more - but there is no reason to think that this is impossible. Scientists who study this sort of thing (population ecologists) tell us that the real reason antelopes haven't gotten any faster over the last thousand years is because of what I just mentioned above – evolution acts at many levels, and what is good for individuals within a population can often be bad in the long run for the population. For a single individual, it is obviously better to be faster, especially to be faster than your peers. However, if over time a population of antelopes were to develop extreme speed, to the point where they could now outrun any and all predators, then there would be some pretty severe consequences. Less predation would quickly yield a population boom. Over-population in an environment with limited resources could then lead to a full-blown famine. And famines cause population crashes, which is bad for everyone. This is ultimately how all traits are kept in check, and evolution is very good at fine-tuning each trait to keep it in balance with what is best for the population and the ecosystem.

This "balance" with your ecosystem that I mention really underscores a common misconception in how we typically view evolution. We are taught to think of ourselves as single isolated (and very selfish) units upon which evolution acts. Those of us who live longer will produce more offspring. Those of us who are faster than our friends don't get eaten by the bear. We view ourselves and others just like us - all of our peers and all of our descendants - as single units upon which negative and positive selection pressures act. We view ourselves as struggling against a cruel environment for survival. And while Mother Nature certainly can be cruel, this "me against the world" notion is not at all accurate. Really, evolution is not so lonely, and far more often rewards harmony than selfishness. In this way, evolutionary forces mould you to function as an individual within your population, just as it moulds your population to function within its ecosystem – very much in balance with the environment and all others in it.[11]

So what does all this mean for longevity?

Just as excessive speed among a group of antelopes could quickly lead to over-population and a population crash, so too could excessive longevity. However, if all traits are variable, then couldn't a longer lifespan simply be balanced out by a lower birth rate? There's no reason this couldn't happen. Really, given how much of a time and resource investment is involved with rearing a child, why

not make this trade-off? The same could be said of speed too - why not swap extra speed or extra longevity for a lower birthrate so that a population crash is avoided? Wouldn't that yield a population that was more fit - one comprised of long-lived, super-fast individuals - than one comprised of pesky youngsters and those burdened with caring for them? This is a tough question and our best answer to this has come from a study that ran computer simulations of this very scenario. These simulations found that, in a static environment, populations which tend toward longevity at the cost of birth rate will consistently outcompete those with shorter lifespans and a high birthrate.[12]

In that case why don't all populations make this trade-off? Well, remember I did say that these simulations found longevity to be an asset in a static environment. The thing is, most environments on this planet are not static, at least not for long. Since the genomes and characteristics of individuals after reaching maturity are more or less fixed, when the environment they were born into changes, the members of the long-lived population have greater trouble adapting. The population with the shorter lifespan, on the other hand, is with each generation giving rise to new individuals with random mutations, some of which will make these youngsters better adapted than their parents to the changing environment. In this case, the costs to the population associated with raising offspring are outweighed by the benefits that accrue from some offspring being better adapted. When these two populations compete for the same resources in this dynamic environment, the long-lived population is not able to adapt as quickly and eventually loses out to the one with the higher turnover rate.

This brings home the idea I brought up earlier - that evolution acts at many levels. From your own evolutionary perspective, your demise is the absolute worst possible thing that could ever happen and you should pull out all the stops to delay its eventual occurrence. However, from your population's evolutionary perspective, what's ultimately best is for all of its members to die one day after having given rise to the next generation. I hate to break it to you, but evolution prioritizes the needs of the population way above your own. And your eventual death is part of the process by which populations adapt to a changing environment. It has to happen. Evolution essentially wants it to happen, and has over the eons dialed in the time frame in which it is supposed to happen. This is planned obsolescence. And death is truly a tool of evolution, requisite to impart change and adaptive fitness.

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It was only a few days after Christmas, but I was about to go back to California and didn't know when I would be home again.

As I pulled into the parking lot, I couldn't help but think how the selfish part of me had an easy time getting hung up on how much I hated nursing homes. There were the signs posted in front of all the guest spots labelled "Future Resident Parking." There were the rows of current residents that looked up from their puzzles and checkers matches to silently ogle you with their grey eyes. There were the darkened rooms, lit by the strobe of the television. There was the rotten hospital smell of what it must be like to get old. And then I pictured Grandmother, once the ornery matriarch of the entire family, sinking into her recliner with stains from the day's meals on her shirt. She seemed to gather new tics each time I saw her. Her speech drawn out by stutters and umms as her mind searched for something it would not find. And seeing her there on Christmas day - I don't know if it was the over-stimulation of the whole family crowding into her room or what - she had a deer-in-the-headlights look that stayed on her face, wide-eyed and pale. I also noticed the whole time how her tongue was working non-stop, spastically pointing and darting around her open mouth.

That's not the image I was met with when I walked in.

Mom told me they'd switched her antibiotics right after Christmas and her fever finally broke.

That was only like three days ago. When I walked in, she had just woken from a nap in her recliner and her eyes were so much brighter than they had been on Christmas Day, even brighter than most times I had been to see her before that.

I could tell this was one of her "good days."

"How're you doing, Grandmother?" I asked as I came in close to give her a hug.

"I been in better straights, that's for sure," she said, leaning in to meet me.

"I've seen you in better straights," I said, "that's for sure."

I pulled out the cheap office chair at her desk and took a seat. Leaning toward her with my elbows on my knees, I told her about my trip to Durbin a few months back. Obviously I didn't tell her how drunk I'd got – I wouldn't dare do that. Grandmother was a tee-totaler, had been all her life, was quite proud of that fact. In spite of the popular image of Appalachian folks as degenerate moonshiners, there are a good many who've never touched the stuff, especially older folks in her generation.

Instead, I talked about the house and all the work Mom was doing to keep it in good repair. I didn't mention how much stuff we'd thrown out, that might upset her, but I did talk about putting up a new coat of paint in the bedrooms, of shoveling moss off the roof. I also mentioned offhand how we'd stopped for breakfast at Station II, a firehouse-themed restaurant in the actual town of Durbin, before heading home.

"You know it used to be an old gas station, that place did, long before it was a diner like it is now," Grandmother said, with a little rasp in the back of her throat. "Well they claimed, Henry Ford – you know of course the cars back in the 1900s was pretty scarce, not many of em – but they claimed Henry Ford came through there, and stopped to gas up his car at that little pump they had there."

"Really?" I said, thinking how small towns all over the country probably told of the time Henry Ford dropped in at their little gas station.

"It's not there anymore, but they used to have this old pump out front, real different from the ones now," she said, her eyes lighting up as the memories really came to her. "And I remember that pump well. I mean, you've seen em. They're just bout eight or ten feet tall and they have a glass bowl up on top," she said making the shape of an orb with her sparrow hands. "And say you wanna put five gallons of gas in your car, well you started pumpin down here," she motioned, "and once you pump enough you see it come up to that gas bowl up there – five gallons or ten gallons or whatever - and then once you got that full, then they shut the pump off. And then they just put the hose into the car and pull a little lever over here. And that drained all the gas down outta that bowl down into your car," she said.

"Yeah, I've seen those big pumps with the glass bulbs on top at antique stores with Mom, but didn't know that thing would fill up with gas," I said, thinking a little on the mechanics of it. "How come they did it that way? Instead of pumping the orb full and then letting gravity drain the gas into the car, why not just pump the gas straight into the car like we do nowadays?"

"Pardon?" she said, cupping her ear.

I leaned in and said just a little louder, "Why'd they pump gas into the glass bulb first and not just straight into the car?"

"I dunno, just how it worked I guess," she said.

"True, not like I can tell you how the pumps today work exactly either," I laughed.

After a pause, she reiterated, "But Henry Ford did that. That's what I's told darn near every time we passed the station - he came by there and got some gas in his car once."

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Viewing longevity from a biological perspective seems to shed some light on the process, both how and why we age. But at the end of the day, can we do anything with this knowledge if it appears that evolution has already fine-tuned an ideal lifespan for us?

One of the most prominent aging scientists, Aubrey de Grey at the University of Cambridge, believes that we can. In fact, not only does he believe that it should be possible for a human to live for over 1,000 years, but he believes the first person to be able to live to 1,000 has already been born.[13] However, if we talk about death as a mechanism that prevents overpopulation and the catastrophic population crashes that follow, what do you think would happen if Prof. de Grey was proven right? What if some scientist tomorrow found some unexpected mechanism by which we could totally halt aging, and all of us were able to live to 1,000? Then what? Do you think we might have to worry a little about overpopulation, which was exactly the sort of thing natural aging was acting against? Still, let's not consider what would happen if this came true, but rather if this sort of thing - some halting of aging - is even possible.

It will take some time to see whether Prof. de Grey will be proven right, but for now the fact that someone respected in the scientific community can say such a thing really speaks to the great strides we have already made in understanding and treating aging. And even though our longevity has been dialed in over the course of human evolution, the scientific and medical tools of today have given us unprecedented power over our own biology.

There have been many incredible discoveries in the aging field over the last century. Perhaps the earliest discovery was that calorie restriction - simply reducing net caloric intake (enough to slow metabolism, but not enough to cause malnutrition) - significantly slows the aging rate. The subsequent boost to lifespan can be quite dramatic, with mice given 55-65% caloric restricted diets throughout their life exhibiting a 35-65% greater mean and maximal lifespan compared to mice eating an ad libitum diet.[14] This effect is not limited to mice either, with similar results obtained in rats, fish, flies, worms, yeast, and non-human primates.[15,16] Though plenty of nutritional supplements out there claim to make you live longer, hardly any of these have any scientific support. But, hey, some of them could work I suppose. However, if you want something that's most likely to make you live longer, as likely as anything we know of, then just eat less.

Another promising lead in the fight against aging came from a "parabiosis" experiment. In what sounds like a medieval torture exercise, scientists performed a parabiosis surgery, stitching the skin of two mice together at the rib cage. This allows two animals to share a circulatory system and effectively be pumping each other's blood. From an aging perspective, scientists wondered if perhaps there are circulating cells, proteins, or hormones that are specific to young and old animals. If so, then maybe creating a heterochronic parabiotic pair (i.e. stitching a young mouse to an old mouse) could have an effect on the aging rate of either animal. You could imagine it going either direction - the older mouse could have circulating factors that prematurely age the young mouse, or the young mouse could have circulating factors that rejuvenate the older mouse. They found that the young mouse didn't age any faster, but the tissues of the older mouse (muscle, liver, etc.) were better able to proliferate and regenerate when exposed to the circulatory system of a young mouse.[17] Hearing this, I couldn't help but think wasn't there someone back in the middle ages who bathed in the blood of the young for this very reason? There was - Countess Elizabeth Báthory. A Hungarian noblewoman from the sixteenth century nicknamed the Blood Countess, Báthory was a prolific murderer rumored to bathe in the blood of her young (and necessarily virgin) victims in order to retain her youth. In light of these recent parabiosis experiments, I would hate to think that she really might have been onto something.

Though caloric intake and circulating factors appear to play a major role in aging, they likely only affect a single dimension of the process. Caloric restriction acts to slow metabolism, which you can think of as the body's internal clock. And the circulating factors from the young mouse thought to

have the greatest rejuvenating effect are those hormones and signaling proteins whose levels decline with old age. It is then unsurprising that boosting the levels of these back to where they used to be can help rejuvenate aged tissues.[18,19] But earlier hadn't I been going on about how multifaceted the aging process really is? For instance, I was talking about how you have telomeres that progressively shorten with each cell division, eventually to the point that they tell the cells to stop dividing, to enter senescence. Then once cells senesce, they send pro-senescence signals to surrounding cells to tell them to stop dividing too (very much like one bad banana ruining the whole bunch). In addition to all this, you have the progressive leakiness of the genome - where genes that should be "off" slowly turn "on" - which is one of the most important factors that contributes to age-related decline. So you can clearly see if we are going to "solve" aging, then we need something that acts on all these processes simultaneously. Really, what are the odds that some fountain of youth like this exists? And even if it did exist, what are the odds that we could find it?

Well, it may have already been found. In 2006, one of the most important discoveries within the past fifty years was made by a stem cell researcher at Kyoto University named Shinya Yamanaka. Prof. Yamanaka found that he could take adult mouse cells from anywhere in the body and convert them back into stem cells - stem cells capable of recapitulating all different tissue types or even a whole mouse. In order to make this happen, all he did was deliver four specific proteins to the adult cells, Oct4, Klf4, Sox2, and Myc, which instantly became known as the "Yamanaka factors."[20] The scientific community was in complete disbelief when this research was published. That was, until the results were replicated again and again and again by stem cell researchers the world over. Very soon, it was found that these same four proteins served the exact same function in human cells, and could magically "reprogram" any cell in the human body (kidney cells, skin cells, neurons, etc.) to immediately return to a stem cell state.[21] Not only did these four proteins function this way in mammals, birds, and fish, but it was found that even many invertebrate species (with whom we shared our last common ancestor 550 million years ago) have this very same "reset switch" that could be flipped by the Yamanaka factors.[22]

So what exactly is going on when this reset switch is flipped? Are old cells just being tricked into acting like stem cells? Or if they are becoming true stem cells, because they are isolated from old adult cells, does that mean that what we get are old stem cells? Surprisingly that is not the case - researchers found that by every possible metric these old cells became brand-spanking new, indistinguishable from the stem cells of an early embryo. Even senescent cells resumed their growth, their telomeres elongated and the leakiness of their genomes became tight once again. This was true no matter how old the adult cells were. In fact, cells taken from centenarians (people over 100) were able to be perfectly reset by the Yamanaka factors. [23]

As much as any discovery in science, this one especially sounds too good to be true. Why would the cells of all species of animals possess virtually the exact same reset switch? They wouldn't have kept it, evolutionarily speaking, if it didn't serve some major purpose. So, then, what does it do? Scientists believe that this reset switch is never flipped in any healthy adult cells, and the process by which researchers are able to hit the switch is not thought to occur naturally in our bodies. But that is with one exception. This does happen within germ cells - among all sperm and oocytes. Before you pass your genetic code to your offspring, you need to make sure they are starting with a clean slate, rather than cells with shortened telomeres and leaky genomes. Your germ cells (i.e. your sperm or oocytes) initiate this reset switch so that all cells of the early embryo are brand-spanking new again.

So if your germ cells can do this, then why don't the rest of the cells in your body initiate this process at some point, maybe as more of a "refresh" button than a total reset? The answer to this likely resides in the prior point I made, that in a dynamic environment there is a need for turnover of organisms. Remember, as your cells divide, they acquire random mutations, meaning that each of your sperm or oocytes carry a genetic profile that is just a little bit different from that of all other cells in

your body. These changes unique to each sperm or oocyte are responsible for introducing genetic variation throughout the entire body of the next generation, some of which may help the offspring be better suited to their environment than their parents. In order for adaptation to occur in a dynamic environment, this turnover is entirely necessary.

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After that first mention of Durbin, Grandmother's memories flowed one to another.

"I ever tell you about my grandaddy's pet crow?" she asked.

"Nope, not that I can recall," I said.

"Well he had a pet crow," she said. "He found the thing, just a little thing, layin on the ground one day. Had fallen from a nest in the tree and was left for dead I guess. Well, Grandaddy nursed it back to life, feedin it milk and stew out of a little eye dropper. Once he realized the crow was gonna live, he named it Otis. And ol' Otis would perch up on Grandaddy's shoulder as he walked around town. They say crows are smart, and that was a fact with Otis. The bigger he got, the smarter and more ornery he got too. He would find ways to play tricks on Grandaddy and folks around town. He loved shiny things and pretty soon found you could get people to act real crazy when you took their shiny things, jewelry and such."

I laughed.

"And one day, the last day they ever did see Otis. He was perched on Grandaddy's shoulder, but kept pickin at him and actin real restless. But he stayed perched up there as Grandaddy walked into the little store at the old gas station, the one with Henry Ford. And at that store they didn't have but one set of keys," she said, with a big grin. "And soon as Grandaddy walked in, Otis saw them keys was layin there. And ol' Otis went over and picked up those keys, and flew out that window and they never did see him again," she laughed hard.

And I laughed too.

"Anyway, well that's true. He saw those keys just layin there, shinin like gold, and he just took em and they didn't have any way of gettin back in the store."

"That's funny," I said, "I've always heard that crows were some of the smartest creatures - that they can learn to drop pebbles into a glass to raise the water level enough so they can drink."

"Pardon?" she said.

"Crows are some of the only animals known to use tools," I said, leaning in and thinking how chimpanzees too use blades of grass to pull ants from an ant hill.

"You know they had a bear chained up in that yard," she said, more memories coming to her.

"What yard?" I asked.

"The yard beside the country store," she said.

"That country store a hundred years ago sounds more happening than Times Square," I said, leaning in and speaking loud so she could hear. "Henry Ford, pet crows, and bears in the yard."

She laughed. "Yeah, they had a bear. They had a collar on him and they'd trapped him. My Uncle Bob had trapped him and put a collar on him."

"I wonder what that was like," I mused, "putting a collar on a wild bear you trapped in the woods."

"I dunno how they did it. Probably had to knock him out or something first," she said, matter-of-fact. "And he probably weighed a hundred-fifty - two-hundred pounds. And they had him right there in the corner of that yard for years. But he got away one day. And he crossed over the mountain and started killin sheep over there. Over next to my house, killin sheep up along there. Course, anytime in the summer if a bear killed a sheep, all the farmers and ever'body would just come in like a posse, you know, after that bear and try and get him."

I laughed at the image of an angry mob with torches and pitchforks, not after Frankenstein's monster or anything, but combing the mountains of West Virginia for a pet bear who'd killed a couple sheep.

"Somebody in the posse said, 'That bear isn't actually afraid of people.' He really wasn't, because he lived there in the yard and they fed him and all that. So they said you better be careful with him. Make sure you got a good sight on him. But anyway," she said, feeling either her story or her memory lose steam, "so they never did kill him, as far as I know - they never did get him."

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From our limited perspective, we think of death as the end of the line. This is a common motif in the Bible, telling us, "All go unto one place.... The earth from whence they came. All are of the dust, and all turn to dust again. Adam's body was made of the dust of the earth, and so all his posterity, all of them, in which they agree with beasts, who are made of the dust also. And, when they die, return to it."[24] Sounds pretty definitive to me - especially because from our perspective this is the end of the line, once we die, our mind and consciousness ceases to exist in its current capacity. The credits roll and the screen goes dark.

For all I have talked about how evolutionarily unfavorable extreme longevity or even immortality is, there is an exception to all this. Turritopsis dohrnii is a tiny jellyfish found in the Mediterranean Sea as well as in the waters off the coast of Japan, and it is thought to be immortal. To achieve this, T. dohrnii has two possible life cycles (Fig. 9). One of these is driven by sexual reproduction, which we are all familiar with. The alternative one uses a process called "transdifferentiation," which allows a fully mature jellyfish (a "medusa") to revert to its larval stage. The larva is then able to mature again and engage this alternative life cycle indefinitely. In that case, how come our oceans aren't just teeming with these little guys, each one smaller than a blueberry? Didn't I initially say that an immortal species would cause a population boom and subsequent crash? Apparently, in spite of its theoretical immortality, this jellyfish isn't some pinnacle of evolutionary achievement. Rather, most jellyfish succumb to predation or disease, keeping the population in balance with its environment.

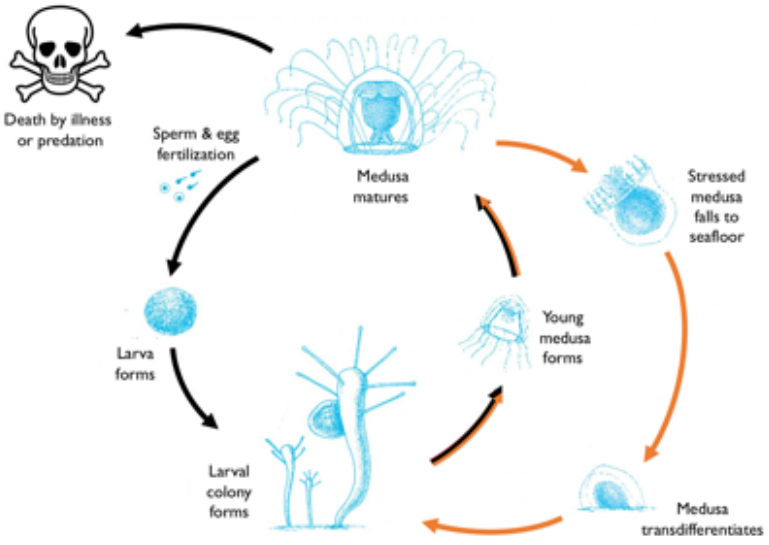

Fig. 9 - T. dohrnii life cycle. The "immortal jellyfish" can engage two different life cycles. As with most eukaryotes, sexual reproduction can produce T. dohrnii larvae that eventually mature (black arrows). Alternatively, a mature jellyfish, a "medusa," is able to revert to the larval stage, then mature again - apparently indefinitely (orange arrows).

Thinking about this from the jellyfish's perspective, I couldn't help but wonder what happens when T. dohrnii oscillates between mature and larval stages. If the jellyfish were capable of having memories and thoughts, do you think it would retain these after it transdifferentiates, essentially pressing the reset button? If somehow we could harness the power of the immortal jellyfish and revert you to an infant - albeit an infant wiped clean of your memories and thoughts and everything you carry around with you that makes you you - then would this be a form of immortality you would want?

We don't have to wait to answer that question. Believe it or not, we have the power to do what the immortal jellyfish does right now. It wouldn't be exactly the same thing, but it would achieve the same ends. The way we could do this would be to come to you on your deathbed and take a sample of your cells, and we could give these cells the Yamanaka factors. We then could implant these cells into a womb and a perfect clone of you could be born. Voilà! You're immortal! And when that clone is on its own deathbed we could clone that clone and so on - we already know that we can do this for many, many generations.

For some reason, this doesn't seem like the immortality that Aubrey de Grey was imagining. Surely he pictured something akin to a T. dohrnii medusa that just lives and lives and lives, without ever having to press any major reset switch and wipe the hard drive. But let's say we eventually are able to attain that kind of immortality then the fear of death should be totally gone, right? Do you think the above scenario would do anything to relieve our fear of nonexistence? From your own perspective, whether you die with no fanfare or are cloned on your deathbed, your lights are going out either way. If your lights eventually come back on in an infant who carries your exact genetic code with no memory of having lived your life, is there any difference between that and what the jellyfish does? Whether you are the clone of a dying man or an infant being born for the very first time, isn't it all the same to you? And how does that compare to the normal process of having children and grandchildren who you know will continue to walk around, to live full and imaginative lives, and to propagate your genetic code long after you're gone? Are all of the above just variations on the same thing - immortality in different forms?

The immortal jellyfish's reversion to the larval stage certainly is strange, no doubt about that, but it is only one of many forms of reproduction on this planet. Bacteria undergo simple cell division - they begin by copying their cellular components and eventually pinch off a piece of their membrane to give rise to the next generation. Yeast bud in a similar way to create daughters. In comparison, human childbirth appears to be infinitely more complicated - a man and a woman must meet and hopefully like each other enough to become pregnant. For nine months, the single initial cell divides many times over, eventually forming a pipe that allows it to leach nourishment from the mother directly into its bloodstream. After the single cell has divided enough times to tally 1.9 trillion, give or take,[25] it needs to be excreted from the mother and walk around as its own separate being.

Though a longer and much more involved process than the simple budding of yeast, it is still more or less the exact same process that achieves the exact same ends. In all organisms, this process allows for the introduction of genetic variation into the coming generation that provides the necessary change upon which selective pressure (i.e. evolution) is able to act. Over inconceivably great spans of time, life flows from one generation to the next. And the slow generation-to-generation change (as Darwin called it, "descent with modification") that accompanies this flow has yielded the diversity of all life covering this planet, from cheetahs and antelopes to redwood trees and saguaro cactuses, from kings and peasants to E. coli and the flu virus. This process unites all life into a single tree, everything living cut from the same cloth.

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And I had really meant to do it, but in the end I couldn't bring myself to ask about her dead older brother, Harvey. I fully intended to, it's half the reason I came to see her - it was something I couldn't ask with everyone else there on Christmas. People never talked much about him, I sensed that over the years. What little I had heard led me to believe that World War II really fucked him up. I hadn't known about all the physics stuff, but I knew a few things. I knew he was there when the Allies landed on the beaches of Italy (Normandy gets all the glory, but Italy was taken using the same amphibious landing tactics almost a year earlier) and had experienced more or less continuous combat every day for the better part of a year. I think something like 200 days consecutively. His tour ended when he had been shot, the bullet entering where his neck met his shoulder and leaving somewhere below his ribs on the other side. I heard how he had crawled to safety with a soldier he would never see again. I heard how miraculous it was that the shell had not pierced major organs, how he had not bled to death. Now that I think about it, I had heard most of the concrete facts about his active duty, but hardly anything after. I just know that nobody ever really talked about after.

Looking at her there in her big recliner, on a really good day, I couldn't bring myself to ask about Harvey - how it had ended for him.

For the rest of my visit, after she'd passed to me so many memories of her world, we talked about California and how I had to come back to Virginia, how my parents missed me.

Sensing my visit coming to a close, she started to cry - just a few tears and a sniffle that she wiped on her sleeve.

I came in close to hug her goodbye and she held onto my arm just above the elbow.

"You know," she said, "life's so short."

References

1. Curtis HJ. The somatic mutation theory of aging. 1965, Contributions to the psychobiology of aging 69-80.
2. Schmich M. Advice, like youth, probably just wasted on the young. 1997, Chicago Tribune.
3. Milholland B, et al. Differences between germline and somatic mutation rates in humans and mice. 2017, Nature Communications 8:15183.
4. Bianconi E, et al. An estimation of the number of cells in the human body. 2013, Annals of Human Biology 40(6):471.
5. Genes are the most important regions of the genome. They code for the proteins that regulate and execute all cellular functions in every cell in your body. The human genome has roughly 20,000 genes. Of the six billion base pairs that comprise the entire human genome, genes constitute only about 1% of that space. The rest of the space used to be considered "junk" DNA, but we now know that's not exactly the case. And while there is some undeniable "junk" DNA - such as ancient viral DNA sequences that have long been deactivated through mutation that just so happen to have been passed down from our ancestors - much of the genome that doesn't code for genes is involved in complex regulation of the 20,000 genes. Still, the genome is a very big place that is quite sparsely populated, kind of like Canada.
6. Wakayama S, et al. Successful serial recloning in the mouse over multiple generations. 2013, Cell Stem Cell 12(3):293-7.
7. The human genome - billions of As, Ts, Cs, and Gs - is divided among 23 chromosomes. Chromosomes are the little X-looking things inside the nucleus that you may remember from high school biology class. That X is comprised of long stretches of your genome (like a string), wrapped around big protein balls (for lack of a better term). I find it helpful to picture a

chromosome as kind of a string wound around many successive balls, and two of these stretches of string wrapped around balls are linked in the middle, forming an X. Rather than allowing your genome to just float around your cell, these balls provide stability and protection. They also help regulate it.

8. How much telomeres shorten per cell division varies by species. For humans, telomeres shorten by about 50-100 base-pairs per cell division. And without doing something about these shortening telomeres, most cells cannot divide more than 50 times before they senesce.

9. The Greek prefix "epi-" in "epigenetics" means "on top of" or "in addition to" traditional genetics. What it means is genetic regulation that is "on top of" the exact genetic code of your genome. The spacing of the protein balls around your genome is a good example of this, and that's just one of many ways in which your cells regulate their genome.

10. Sen P, et al. Epigenetic mechanisms regulating longevity and aging. 2016, Cell 166(4):822-39.

11. As a member of a population, you are a single unit comprising a superorganism. Just as a single cell among all the cells of a human body, you are a part of something much larger than yourself. In modern terms, you are a single unit that together with other single units comprises your local community, your corporation, your nation, upon all of which evolutionary forces act.

12. Werfel J, et al. Programmed death is favored by natural selection in spatial systems. 2015, Physical Review Letters 114(23):238103.

13. De Grey ABN. Escape velocity: Why the prospect of extreme human life extension matters now. 2004, PLoS Biology 2(6):e187.

14. Anton S & Leeuwenburgh C. Fasting or caloric restriction for healthy aging. 2013, Experimental Gerontology 48(10):1003-5.

15. Heilbronn LK & Ravussin E. Calorie restriction and aging: Review of the literature and implications for studies in humans. 2003, American Journal of Clinical Nutrition 78(3):361-9.

16. Mattison JA, et al. Caloric restriction improves health and survival of rhesus monkeys. 2017, Nature Communications 8:14063.

17. Conboy IM, et al. Rejuvenation of aged progenitor cells by exposure to a young systemic environment. 2005, Nature 433(7027):760-4.

18. Loffredo FS, et al. Growth Differentiation Factor 11 is a circulating factor that reverses age-related cardiac hypertrophy. 2013, Cell 153(4):828-39.

19. Katsimpardi L, et al. Vascular and neurogenic rejuvenation of the aging mouse brain by young systemic factors. 2014, Science 344(6184):630-4.

20. Takahashi K & Yamanaka S. Induction of pluripotent stem cells from mouse embryonic and adult fibroblast cultures by defined factors. 2006, Cell 126(4):663-76.

21. Takahashi K et al. Induction of pluripotent stem cells from adult human fibroblasts by defined factors. 2007, Cell 131(5):861-72.

22. Rosselló RA, et al. Mammalian genes induce partially reprogrammed pluripotent stem cells in non-mammalian vertebrate and invertebrate species. 2013, eLife 2:e00036.

23. Lapasset L, et al. Rejuvenating senescent and centenarian human cells by reprogramming through the pluripotent state. 2011, Genes & Development 25:2248-53.

24. Ecclesiastes 3:20. These words are popularly attributed to King Solomon to whom God visited in a dream and granted great wisdom.

25. Sender R, et al. Revised estimates for the number of human and bacteria cells in the body. 2016, PLoS Biology 14(8):e1002533.

* This is a chapter from a larger project, tentatively named Mother Nature's Son.

Trust

Life will have you learn all kinds of lessons,
If you are paying attention to its insights,
If you look closer, there is always good reasons,
For everything that happens in hindsight,

Sometimes it isn't about persistence,
Just about the time being right,
When you know who you are in every sense,
And what you want is clear in sight,

There will be no looking through a jaded lens
Vibrant realities will take flight,
Sometimes all it takes is an instance,
So, leave no room for fright,

It was never extrinsic in any sense,
You needn't find comfort in another's virtues outright,
It will all come down to your core, your essence,
Trust yourself and everything else will turn out alright.

Ghost Town Sunset Pictorial

Ghost town sunset, pictorial
A sluice box bubbling with placer gold
complex mineral claims
underlay the structures
withered to a state of extreme dilapidation

I brought you this scraggly ghost
exposed by this daguerreotype
moldered in neglect
Roofs sagged, the weeds reclaimed their own
desert twisters, pack rats, and termites

I began to seek a respite
from grey sameness, in tinder dry flanks
I pried it apart
board
by complaining board

A new bonanza west of the Sierra
from then on was agleam with the prospect
quick cash
Jerry-built, on the heels of another find
Coloma was already moribund

Once rollicking, those who flocked in great numbers
barely covered by the patina of present
such stout defenses became a virtual necessity
Not far from here is a tomb-like cement jail

Qu'est-ce qu'il dit?
true ghost town
partial ghost town
tourist ghost town

Dozing on a mud flat
Drawbridge, laced with catwalks
the depression killed that town
lonely proclamations, restless, almost desperate
ill-fated, engulfed by sagebrush

Cherche, l'âme sœur

Late to boom, early to bust
after shedding the skin of uproarious youth
Better-known ghosts, gaunt skeleton
of the old high bridge ore mill

Buckboard

Concord coach

Top buggy

Covered wagon

Conestoga

Senior citizen of lone brush prairie

old utility wagon,
slowly
engulfed
by
chaparral.

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