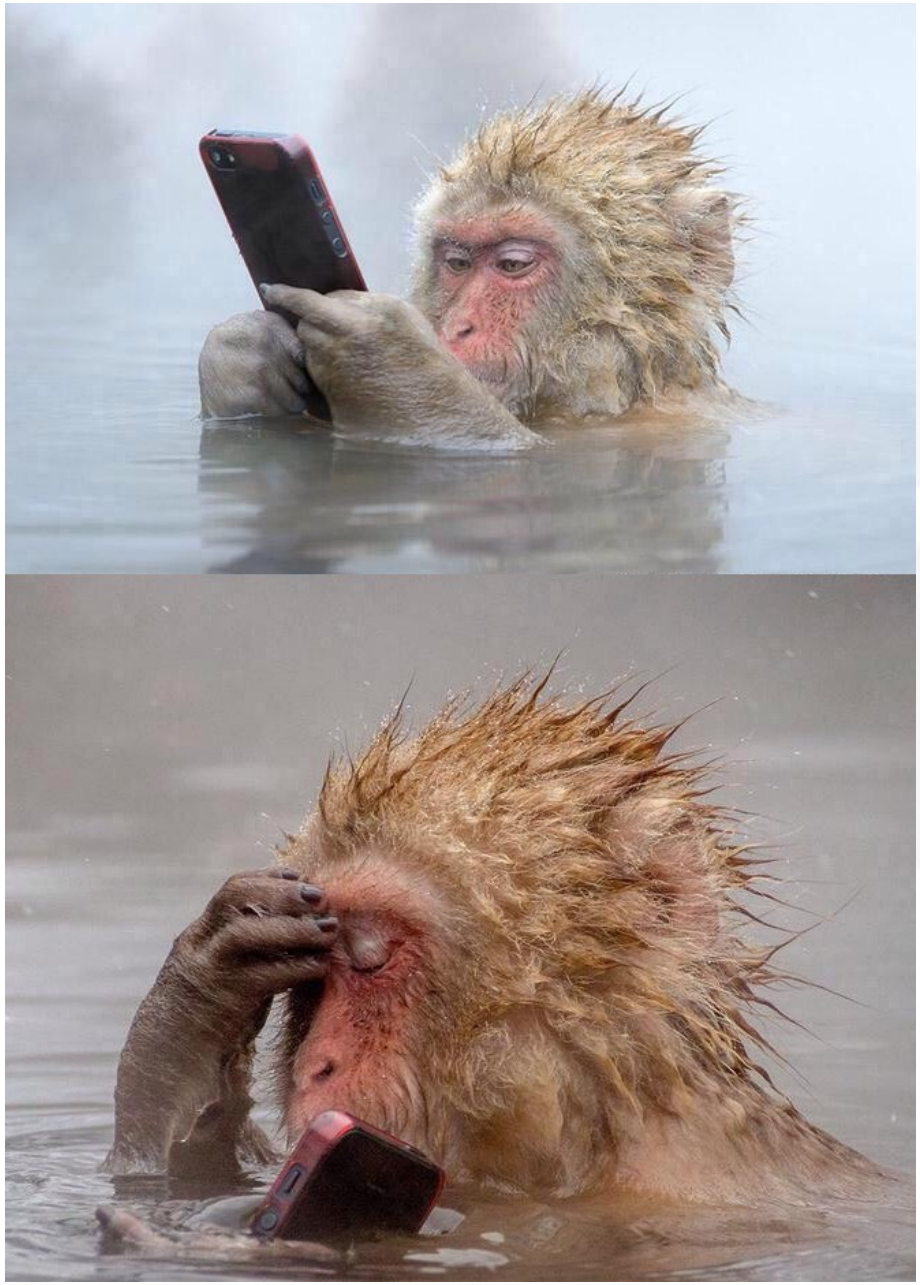
On Careers and Becoming a Great Scientist.

(Richard Wheeler)



Please no photos/audio/video recording, no laptops, no phones. If you want to play on your phone, go do it outside.

Don't make me release the phone stealing monkeys. They are having a bath, which they call an *onsen*, and do not like to be disturbed.

← *They will check your browser history, and then it will be awkward.*

This Presentation

Topics: What's a career? Am I having one? How can I become a great scientist? What are the fields of the future? Where can I get funding?

Throughout the talk I will try to pause for questions.

This Presentation

This presentation is very information dense – you will not get all of it. But the slides will be distributed so you can also read through it if you ever want to. Apologies to any poor soul who has had to sit through it before. I couldn't think of how to improve it, so I just added more monkeys.

This may be the only career workshop you ever attend, and so I have tried to get a lot done. :>)

A Magic Trick.

In this presentation I perform a simple, and very slow, magic trick. It may take you a week to recognise, or a year, or never.

I have done it for nearly 20 years, and a few months ago, someone finally figured it out. See if you can spot it. In my lecture on Friday in a week I will explain it.

But this very slow magic trick works on you whether you spot it and understand it or not.

About me…

Am I qualified to speak to you about careers? Absolutely not. Probably no one is. In fact, I've never even *attended* a career planning lecture unless I was the one giving it.

I am always shocked by the career planning I advice I see being given online and at workshops. Pure fantasy – *Lord of the Rings* level fantasy.

About me…

I think I am often asked to speak on career planning and at conferences simply because all the bad things that can happen to you in your career have already happened to me.

So I was asked to speak to you on the theme of being independent in science and how to consider your career objectively.

First Of All.

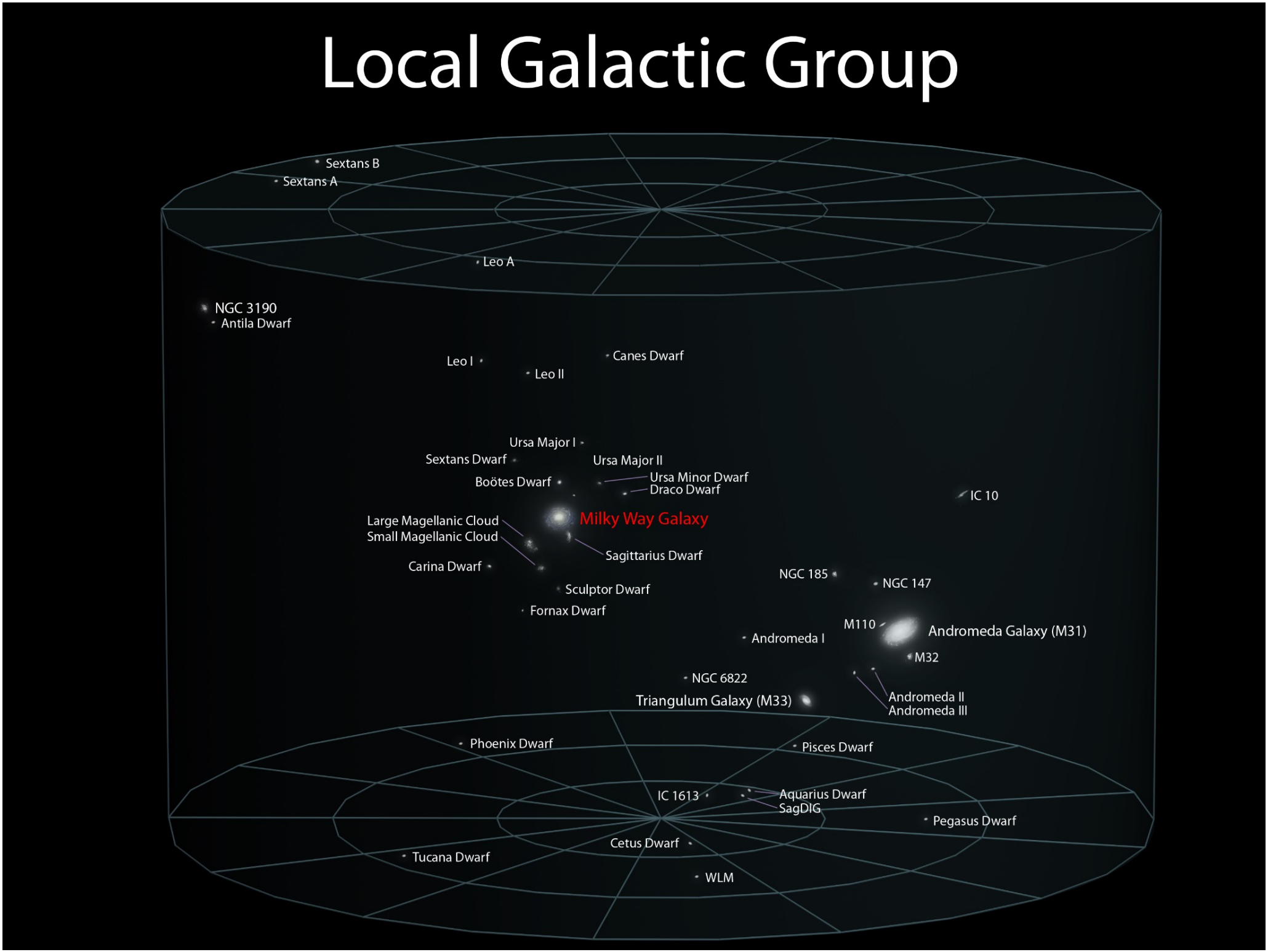
CONGRATULATIONS. No matter what anyone says, doing your PhD is a great idea. One of the only things that really matters to your career and life is education.

I believe undergraduate, Masters, and PhD degrees should be free and **mandatory**.

What I tell children: *you can do anything you want in life,* ***after you finish your post-graduate work.***

Let’s briefly think about the big picture, where we are now**, why science careers matter.**

Local Galactic Group



Maybe too far out.


Ah yeah, there we are.

A tiny rock floating around one of a billion trillion suns in the universe.

There are over 700 quintillion planets in the observable universe, and we are only one.

There must be billions of planets with intelligent life besides ours. Right?
The universe must be teeming with life.

I mean, what's so special about our little rock?


Water

Very little water

Water

Still very
little water

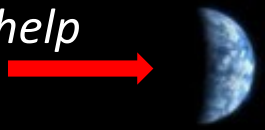
Coffee, Ice Cream,
Cats, Waffles

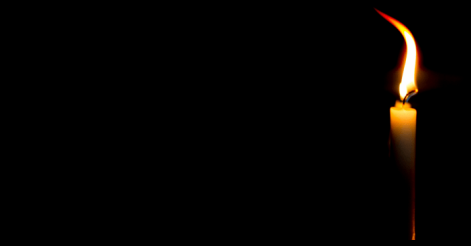
But the truth is we might be *it.* We might be the only planet with life in the universe.

We may be the one and only great cosmic accident.

The universe may not even exist if we are not here to observe it.

Lonely,
send help



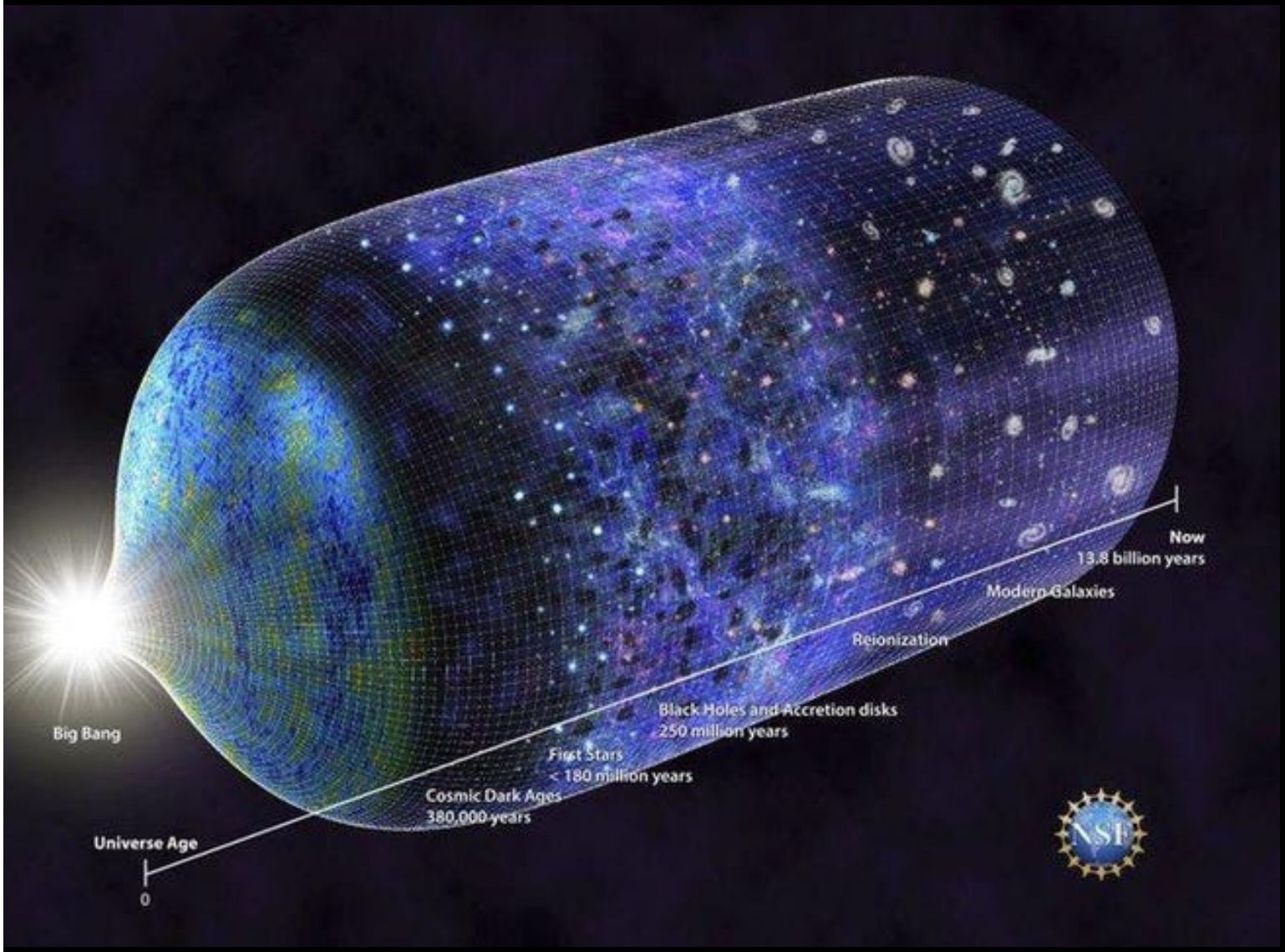


We may literally be the only flicker of life in the universe, existing now, for a tiny period of time.

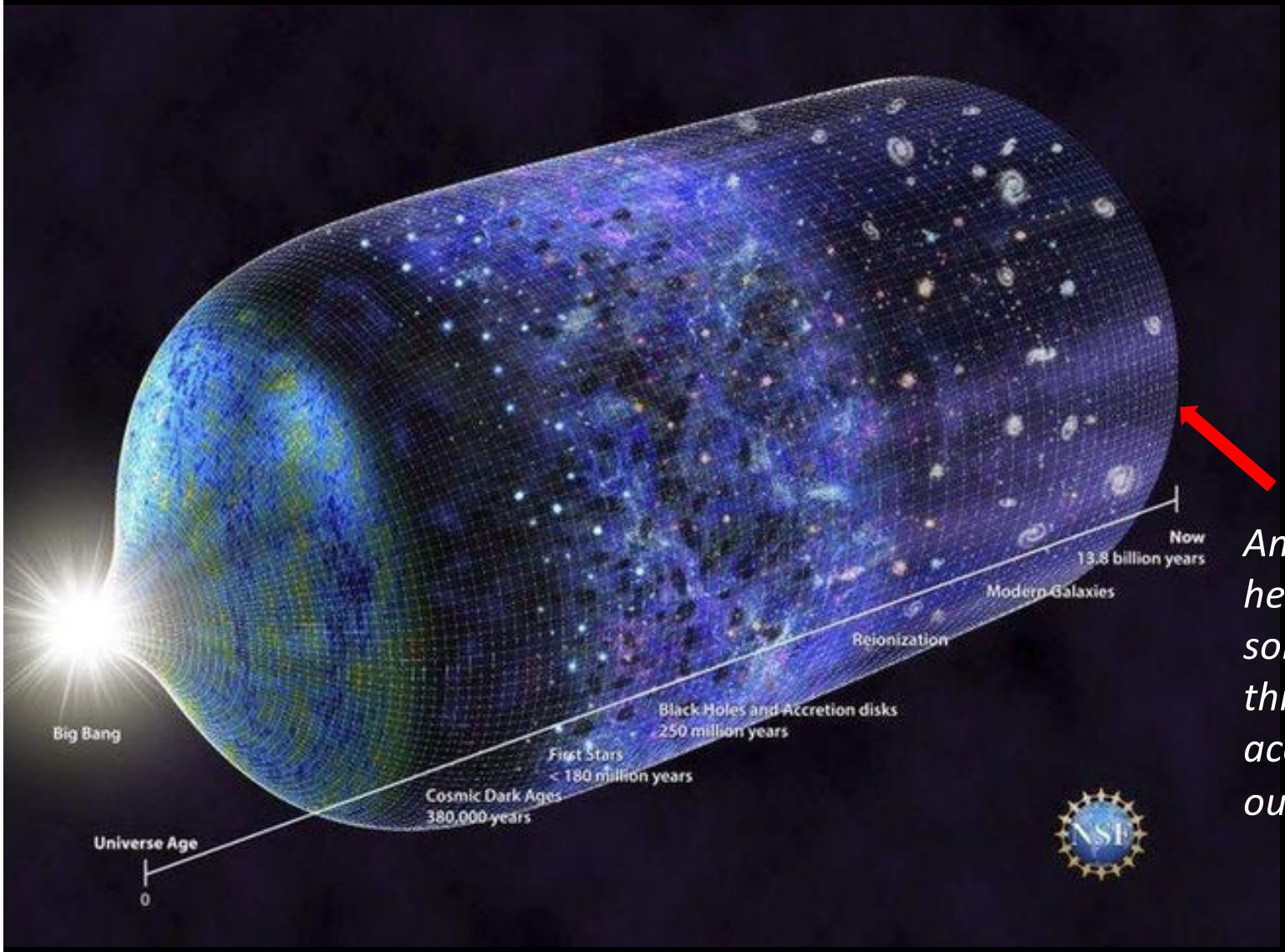
So it is worth saying something about time.

We know almost nothing about time.

It’s probably something like this.

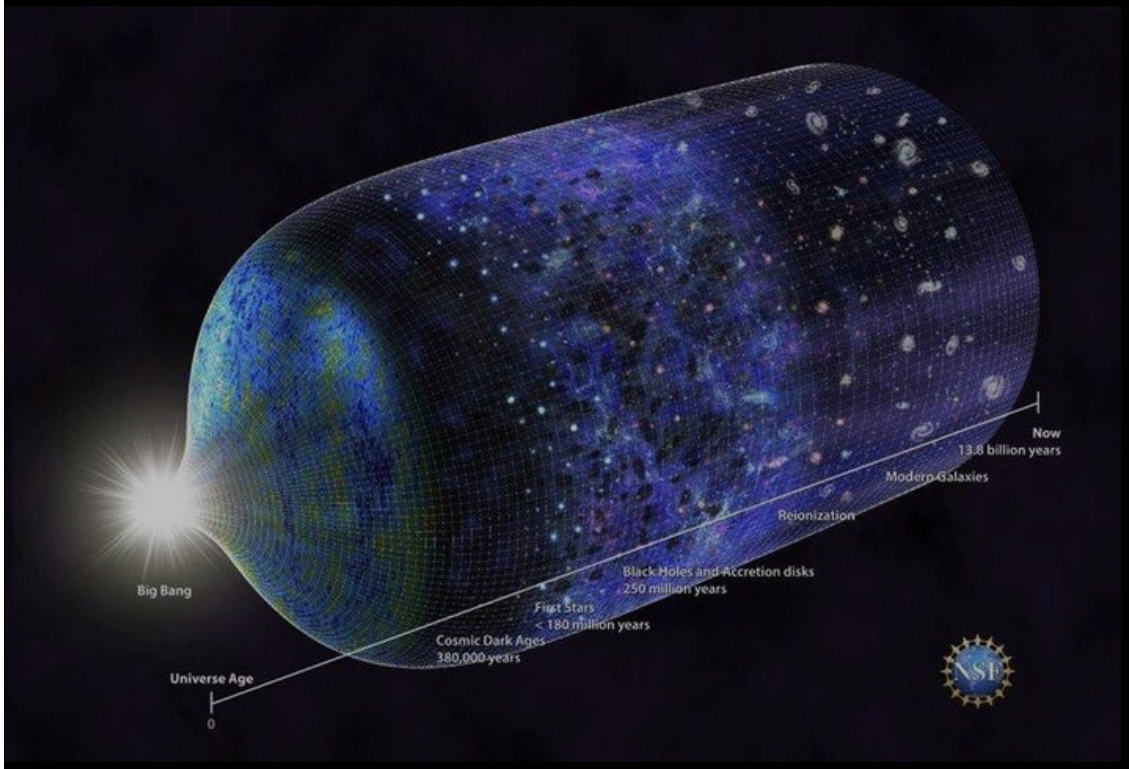


It’s probably something like this.

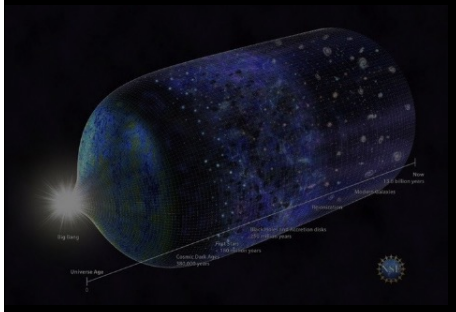


And we’re probably over here at this edge somewhere, enjoying this extreme cosmic accident by playing with our mobile phones.

But this is not what time feels like when you are an animal on this tiny planet. We cannot feel cosmic time, geological time.



We probably were not born to understand time.



Time feels differently to us.

This is what time looks like to us.

And the truth is, we do not live in a very good era. We may not live in an era with a lot of *human time* left.

These are not probably *good times*, but it is hard to know.

If you are under the age of 35 or so, you will be one of the first generations in which your primary job will be to save this planet, maybe the only one with life in the universe, from extinction.

That’s a lot of pressure.

And the truth is that the people who came before you, all those generations back to the stone age, were very stupid and very selfish.

And my generation was, too.

But there were always a few people, maybe one in a hundred, or a thousand, who were extraordinarily talented and skilled.

And they were called teachers, scientists, artists.

And this very small number of people created water purification, and vaccines, and a million other things we really need to be more than just sad dying animals on a drying rock in the desert of this universe.

And that’s the truth.

Life on the planet is now dependent, as it always was, on the efforts of a small group of very smart people trying very hard to save the planet and ourselves.

Your PhD supervisor wants you to be one of those people, and so do I. You will have to succeed where we have failed.

When I am asked if someone should pursue a career in science or academia, I do not say it is a good job.

I say it is the only job now that matters.

And this is truly a golden age for science.

It is not an overstatement to say that life on this planet now depends on how quickly you can become very, very, smart and hard-working, and undo the damage every other generation has done.

You will be underpaid. You will be overworked. You will be lonely, and alone with ideas no one understands, and that is what they call *independence*.

That is how it is to be a great scientist, and it is lonely, and it is sad, and it is glorious. And it is maybe now the only thing that matters.

On Career Planning

In making this presentation, I spent some days surveying career counseling and planning materials online, including from Cambridge, Harvard, MIT, Stanford, etc., and the big consulting agencies.

It was all fantasy garbage, I took nothing away from it, learned nothing relevant. The focus was always on how you can become a good *employee.*

Things People Won't Say

So what can I tell you about careers that would really matter?

That you cannot see on YouTube? In a TED talk?

Things People Won't Say

Here are some things you will not hear people say about careers, but they are true:

- Most people, the majority, do not have careers.
- Most people, the majority, are bad at their jobs.
- Many people, maybe most, never know what they want to do with their lives or what career they want.

You may never know what you want to do in life. And that's okay.

Reality

People will tell you a career looks like this:

Reality

But it’s really more like this:

And often like this…

You should probably read Driss Ben Hamed Charhadi's *A Life Full of Holes*

And sometimes like this.

But most of the time like this.

But most of the time like this.

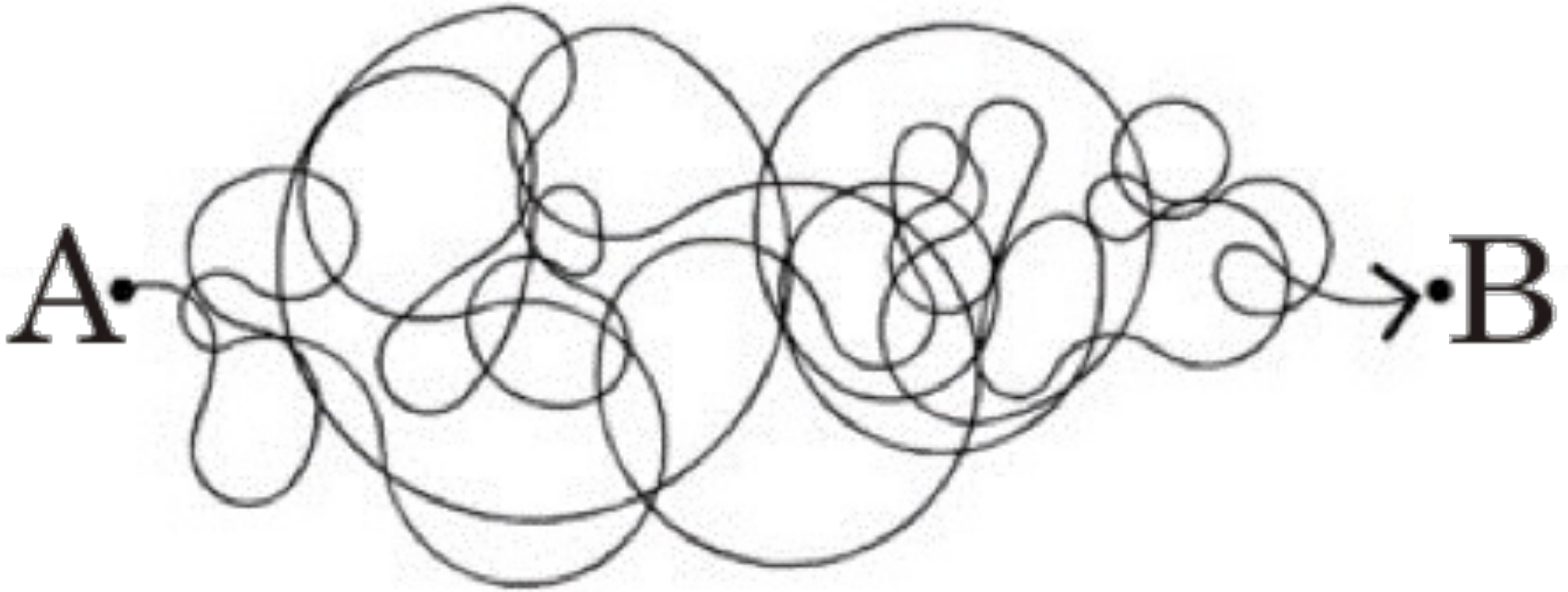
But most of the time like this.

But most of the time like this.

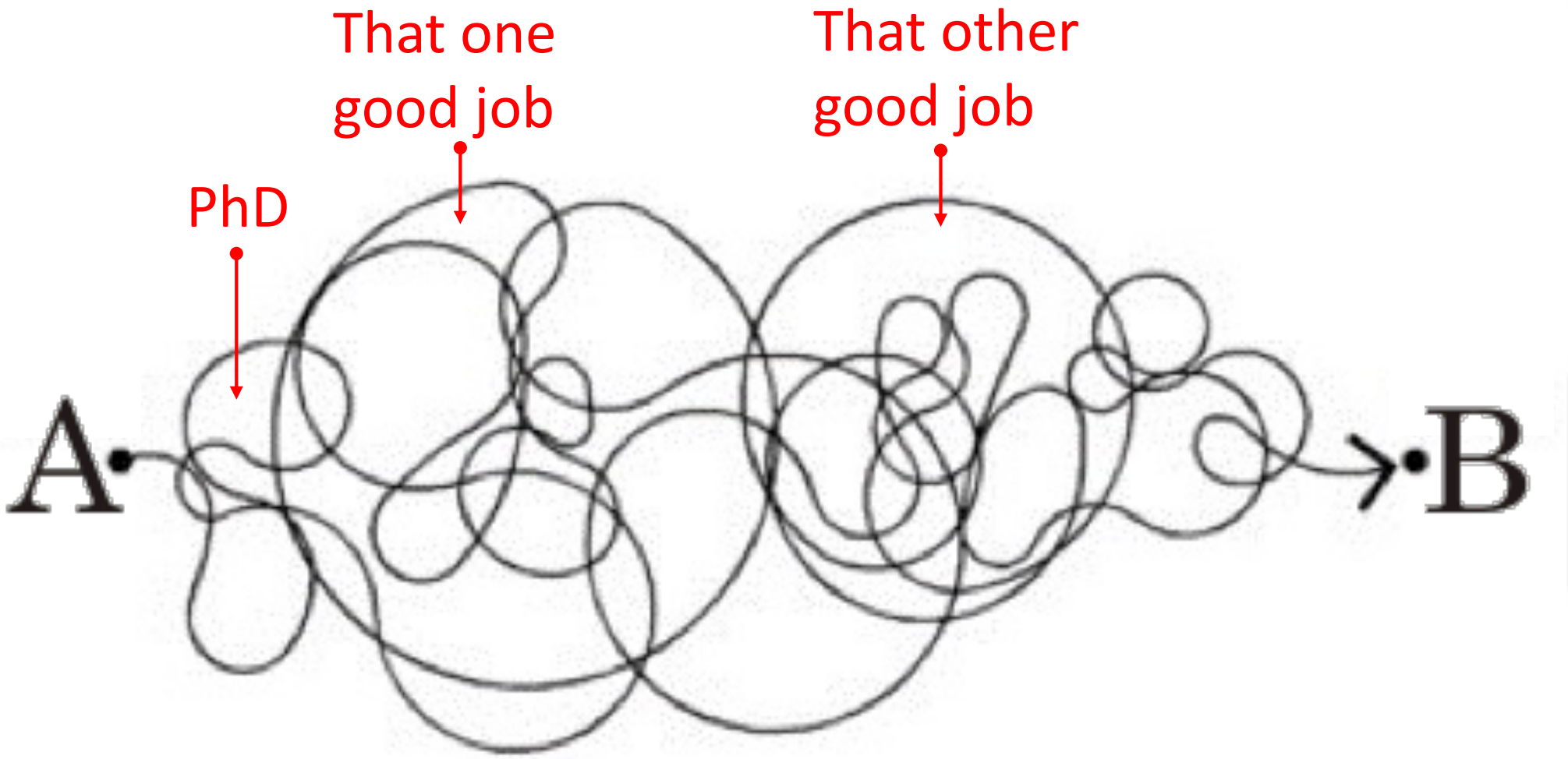
But most of the time like this.

Your Career, From A to B

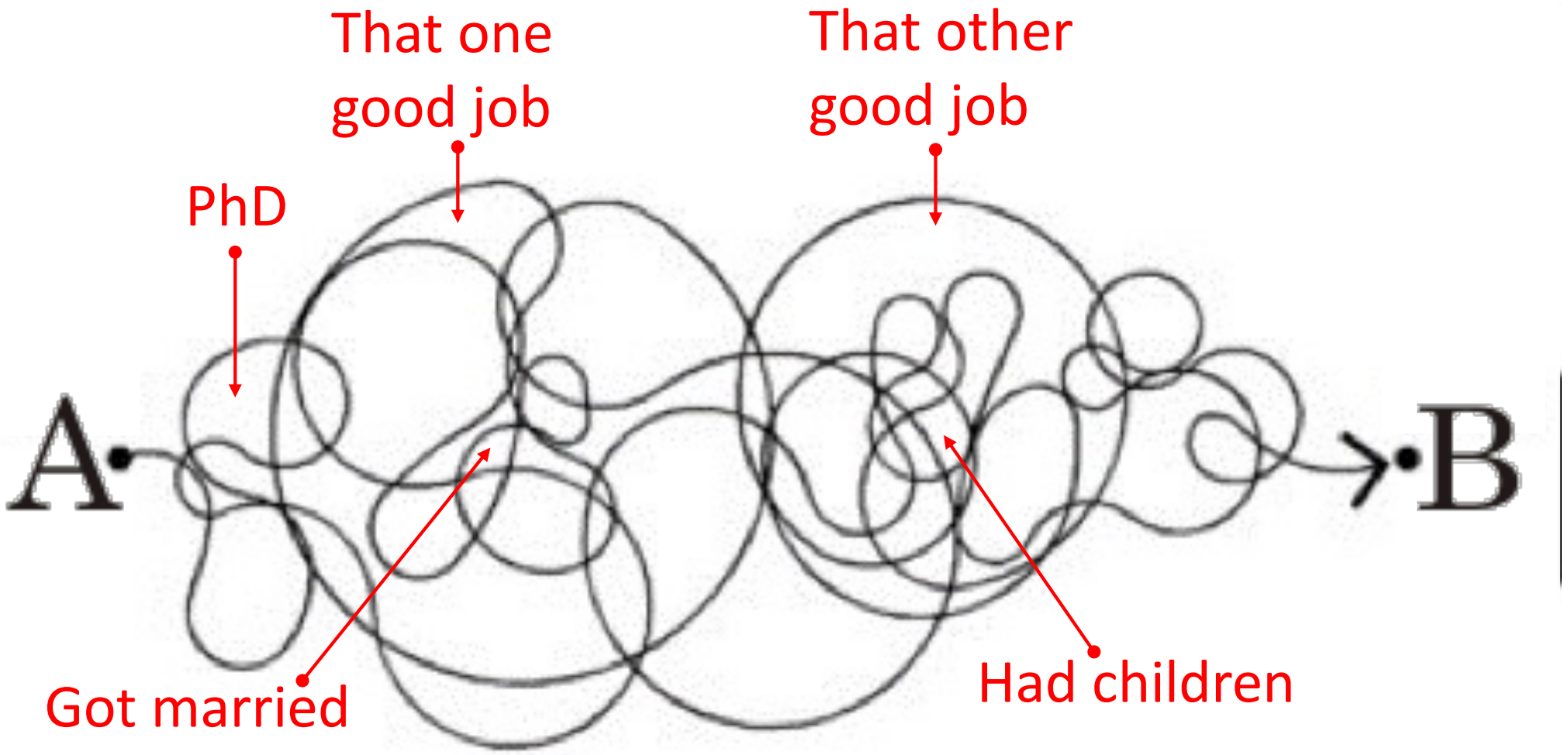
Your Career, From A to B



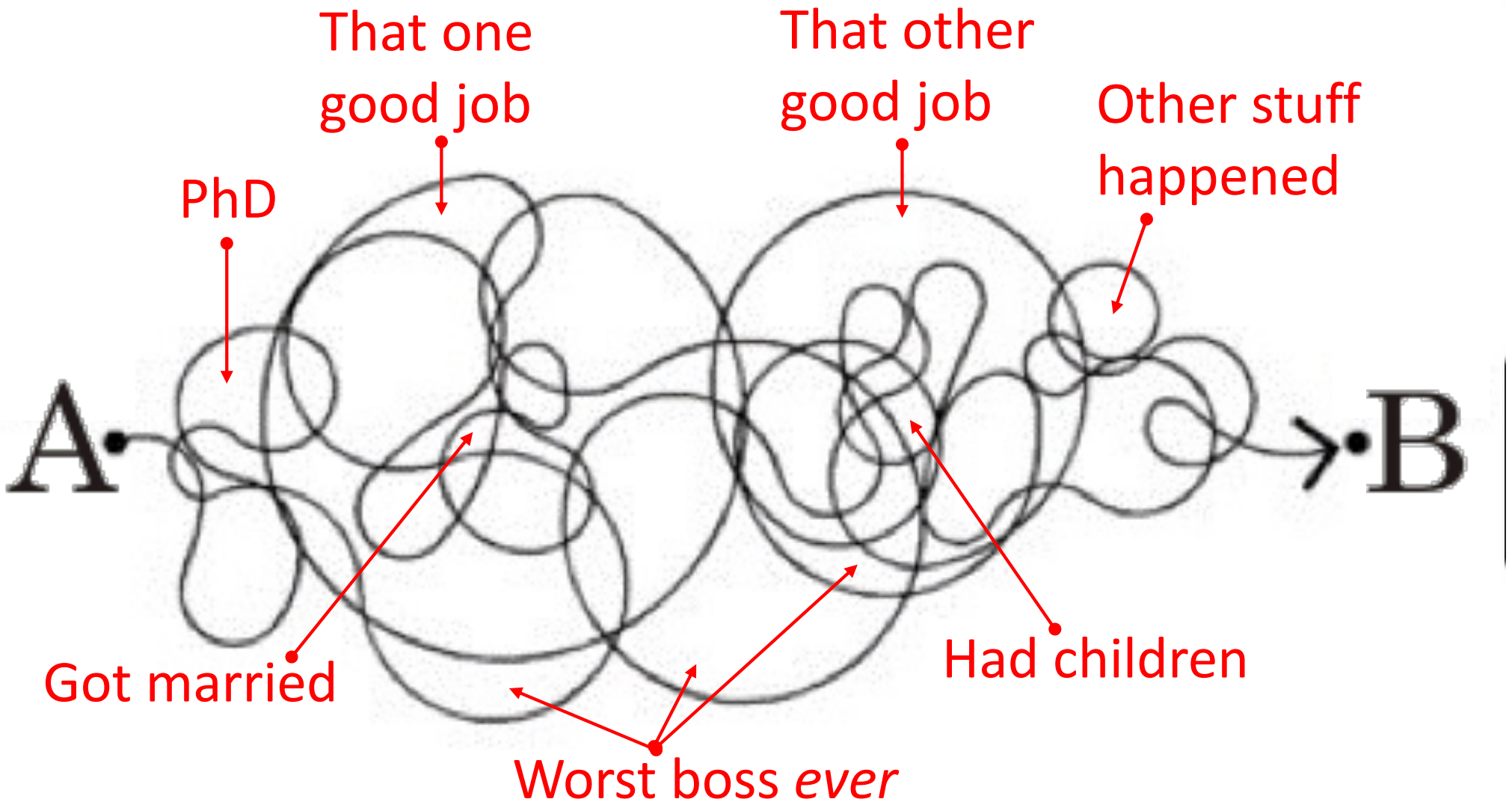
Your Career, From A to B



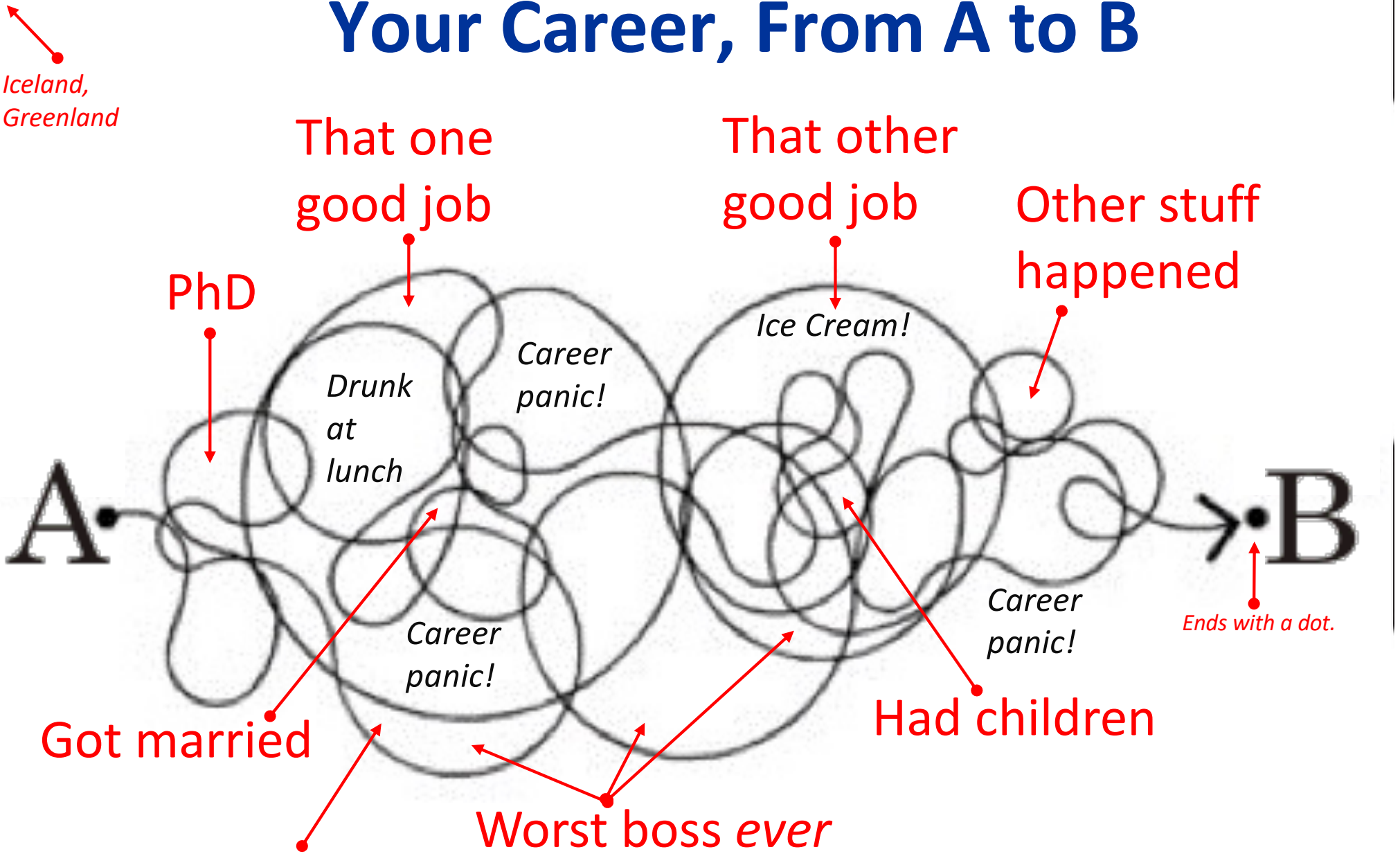
Your Career, From A to B



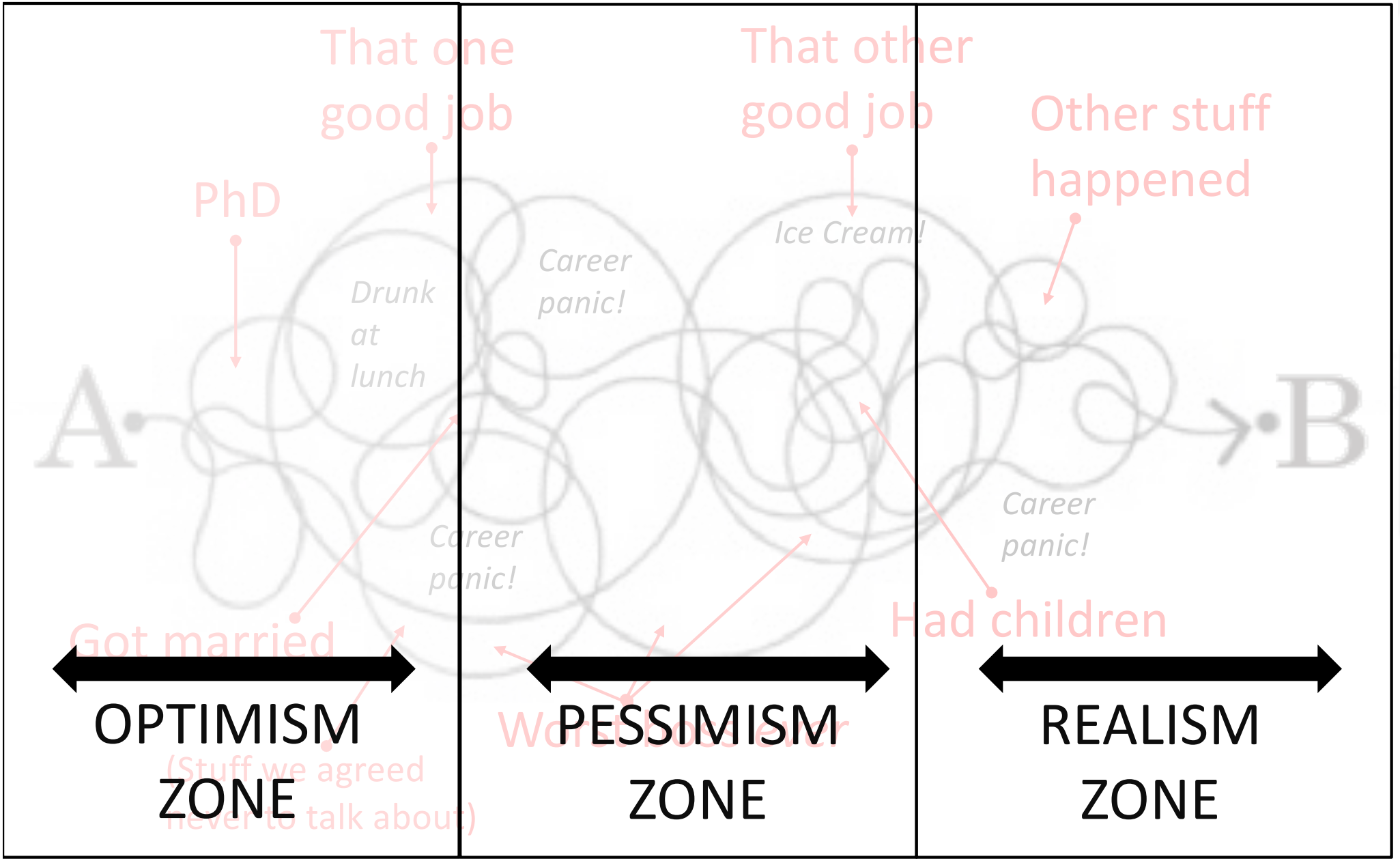
Your Career, From A to B



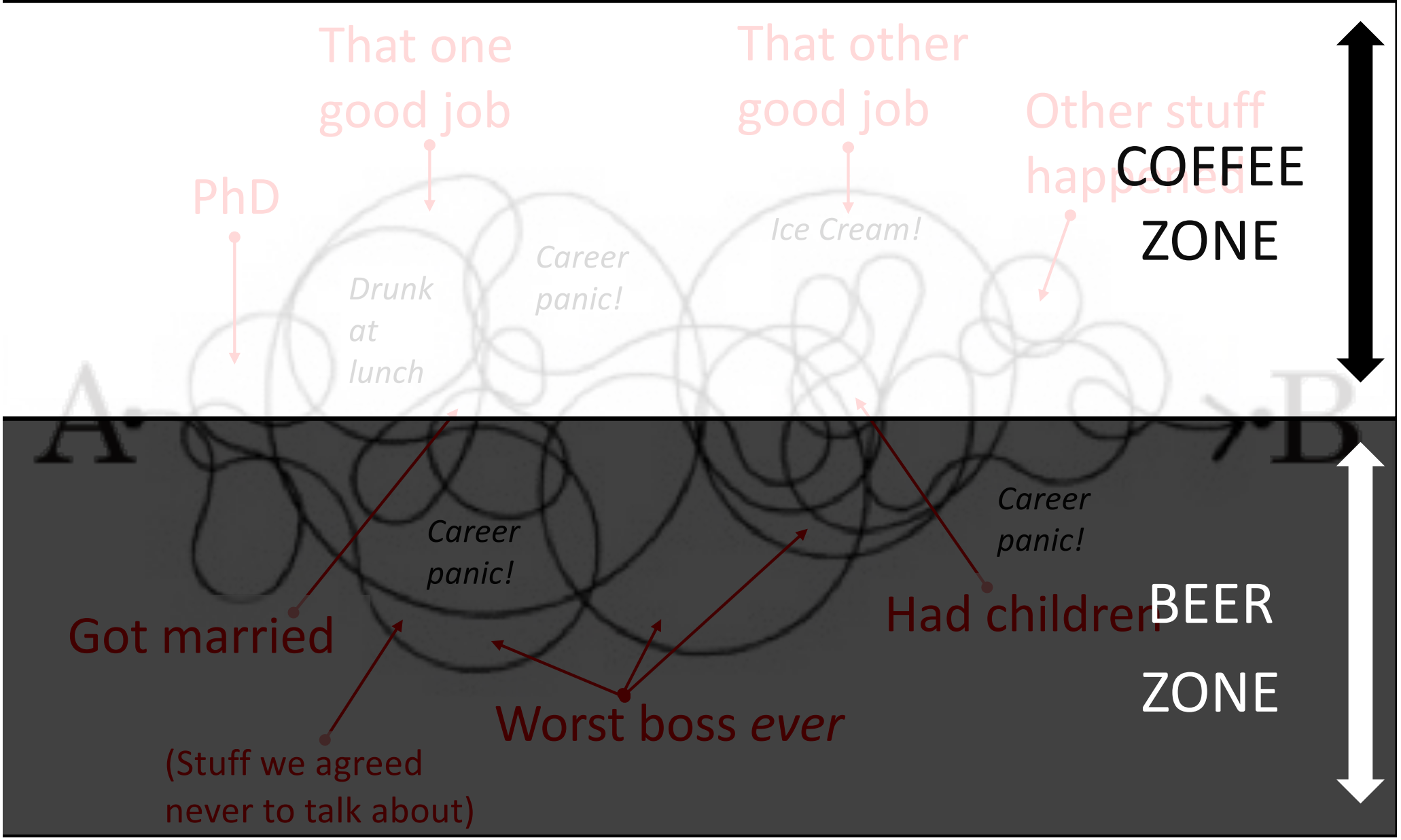
Your Career, From A to B



Your Career, From A to B

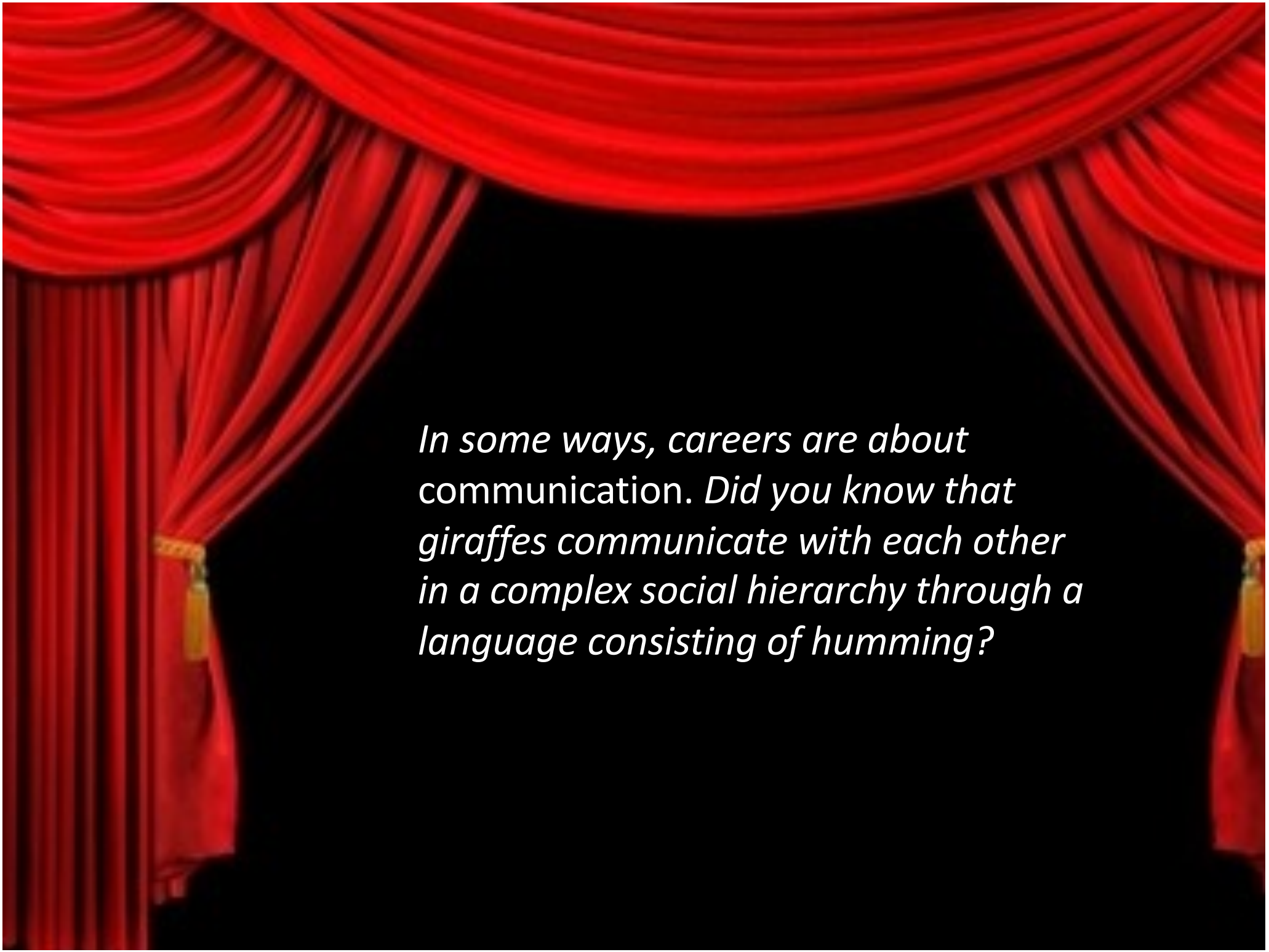


Your Career, From A to B



Careers are a Learning Process

Unless you are going to be a dentist or an accountant, prepare for having many careers and having to learn as you go. Especially in science.


In some ways, careers are about communication. *Did you know that giraffes communicate with each other in a complex social hierarchy through a language consisting of humming?*

We only discovered this in 2019. They also raise their baby giraffes in community creche groups.

There is even a giraffe restaurant in South Africa.

Do We Learn From the Past?

The truth is that every generation lies endlessly to the generations after it. The generation before me lied about virtually everything, and it's my generation's job to lie to you. We all lied because we do not want you to think everything is hopeless, whether it is or not.

The truth is that few of us who came before you were really adults with rational reasons for doing things. This has now become obvious in world politics and society. Like you, we were stupid, lazy, horny, incompetent, greedy, and dishonest. We all felt like imposters and frauds and lost children, who stumbled from one dumb thing to another.

And we called the heroic fantasy of our actions *history,* and our path through disaster a *career*. Never doubt the truth of this.

The Truth Is…

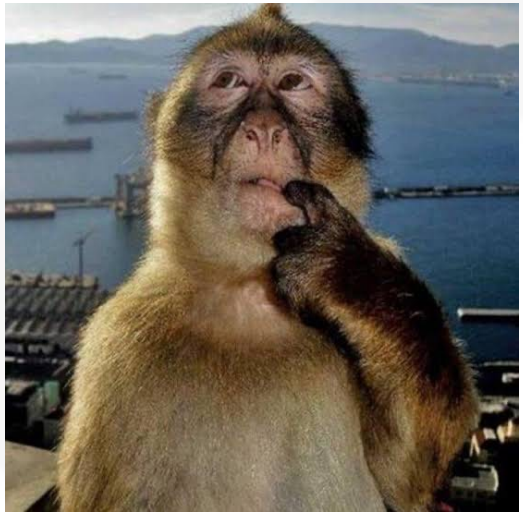
…humanity's endless lying to the next generation is now endangering life on the planet, and cannot continue.

So. Please try to be honest with those who come after you. We all deserve it.

Some Difficult Facts

- You will not be having a career for life. You may not end up in the field you are in now. Things change quickly.
- It is unlikely you will be doing research after 40 years of age.
- You may not know what you really like in life yet. Some of you will never know what you like and are good at.
- You are unlikely to be recognized as a talented wonderful genius, and if you are, people will hate you for it. Sorry.
- Your supervisor would probably love to have you stay in academia, but it might not be possible.
- You will not make what you are worth, probably ever.
- *You are on your own.*

Questions?



Briefly, something more fun.

Have a Guess?

Reykjavik, where I live, has many famous cats. Many of them seem to have jobs and careers. (Diego, at right, works in A4, Hagkaup, Dominos, a Suzuki dealership, and a furniture store - he now has his own fandom, fan fiction, and line of toys…he's obviously having a better *career* than any of us…)

Most cats you see out in Iceland will only cross the streets at a crosswalk. They go along the sidewalk until reaching the crosswalk, look, then cross at the light. Even in the countryside they do it if there is a crosswalk.

Any guesses why they do this? I lived there three years before figuring it out…

Answer: Geothermal.

Metaphor for a Career in Science.

Speaking of smart animals, I have tried hard to think of a good metaphor for a career in science. I finally found one that applies to me, anyway.

The Long Climb.

The Long Climb.

iceland scientific

You should probably read Thomas Mann's *Magic Mountain*

The Long Climb.

iceland scientific

You should probably read Herman Hesse's *Glass Bead Game*

But why?

iceland scientific

You should probably read Walter M. Miller 's *A Canticle For Leibowitz*

Why did she start climbing?

I'd guess she started climbing because she believed that whatever was up there would be better than what's down here.

That's a life in science: it is one long act of irrational optimism.

We do it as part of a collective longing for a better future.

What is a Career?

- A career is the sum of what you contribute professionally throughout your life, and is likely to be made up of different jobs, roles, and levels of quality.
- But a career is only a small part of your life, and is only worth as much as it lets you have a *happy* life. Most people's careers make them very **unhappy**, because they feel trapped, and "need the money".
- **Mostly, a career is the narrative we create to explain and justify ourselves to the world of work, when in fact, there generally is no consistent or coherent narrative.**
- Very few people know why they do what they do. No one really has a plan. Look around you. Humans are not very good at things, and are generally not acting rationally or for considered reasons.

Your Memories

It may help to recognize that your career is largely a narrated projection of your ego to the outside world.

We make a narrative to suit our identities, so that our lives have development arcs, like in the movies.

We create narratives for our careers to match external expectations. *This is a recipe for disappointment.*

Self-deception.

Self-deception about yourself and your career is natural, but generally toxic to doing great work.

When people ask me what I do for a living, and I feel that it is appropriate to be honest, I usually say that *I have no idea, whatever I can, I guess.*

The Point.

Your career is mostly an illusion that you create for other people; the only real part is your personal development towards a happy life, and having a positive impact on the world around you.

Actually, having a good life is often easier to achieve than you might imagine: *find something you love more than yourself and devote yourself to it.*

Let me explain something strange and difficult.

Difficult: Acting and Actors

- Adult life is primarily play acting; mammal behaviour and learning rely heavily on pretend.
- The world of work is mostly about social intelligence, not your abilities and work output.
- Autism, smiling, 40 years old.
- Why psychopaths succeed: history is primarily made by the mentally ill. It is important to understand this because it explains much of the insanity you see in the world.

Understand Your Needs

Everyone is different and need different things from their work.

- Unhappy careers often start with people choosing whatever they can get for a job, and then staying with it through path dependency. Frustration sets in because of the mismatch between forward options and personal needs.
- Unhappy careers often have confusion between *money* and other needs like usefulness, respect, recognition. Money does not fix an unhappy career. *Do you want to be rich and unhappy?*
- Unhappy careers often have an element of social pressure to achieve in a field at odds with personal needs and desires.
- Some career paths lock you in, with little flexibility.
- People in unhappy careers often feel trapped, powerless, and like they have no choice but to continue doing what they do.
- Why did I leave the University of Edinburgh? Two reasons…

You should probably read Gunter Grass' *Danzig Trilogy*

Understand Your Needs

People with happy careers usually say that they:

- Feel useful in their job
- Are learning new things
- Have flexibility to do things in their own way and time
- Are effective at what they do
- Have someone they can learn from
- Feel valued for their contribution
- Can see how they might evolve in their organization
- *Assembled their jobs out of many roles and types of work*

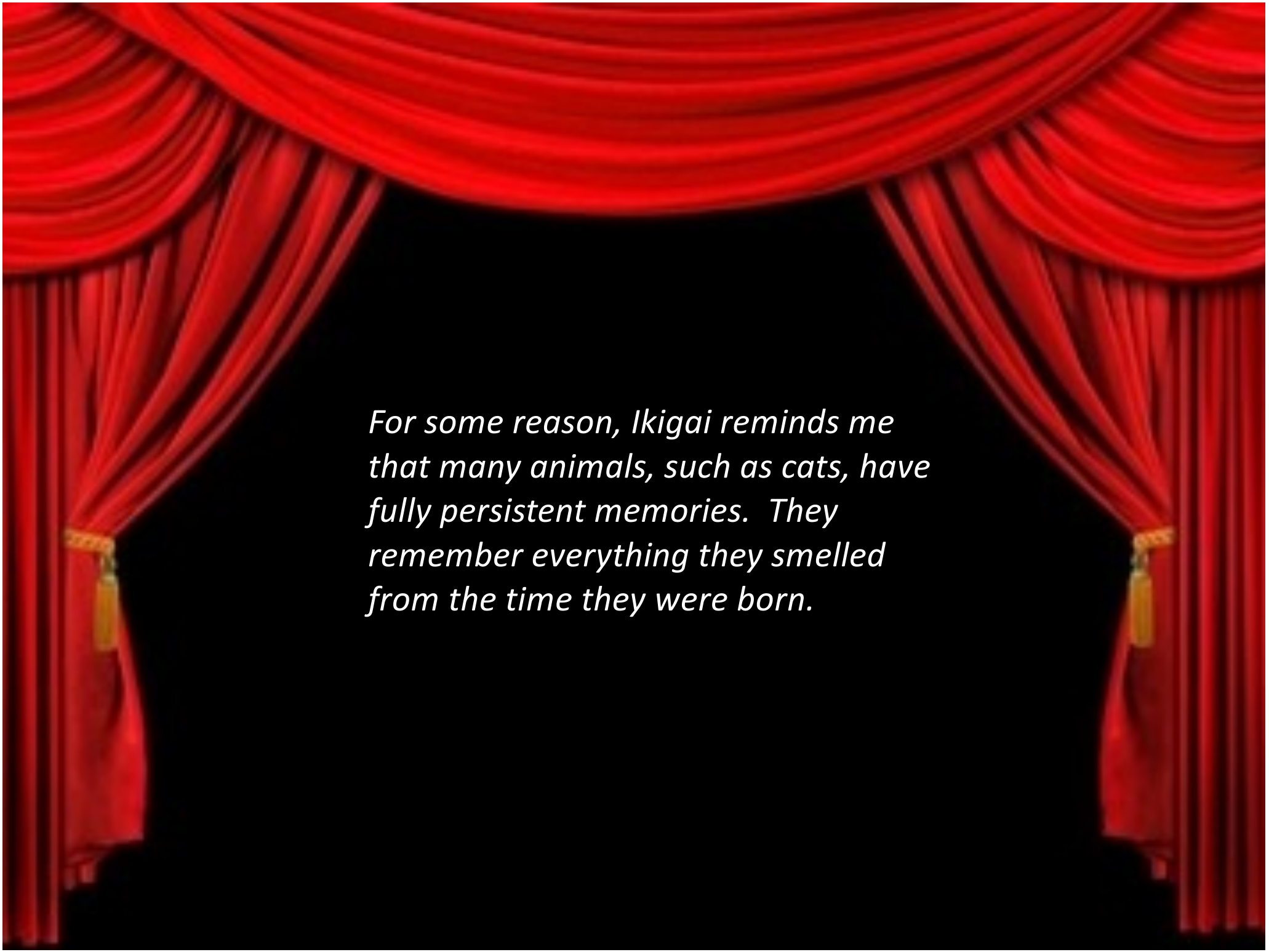
These are good starting points for what to look for in a job that can contribute to your career. *Note that money is not mentioned.*

Wait, What About Money?

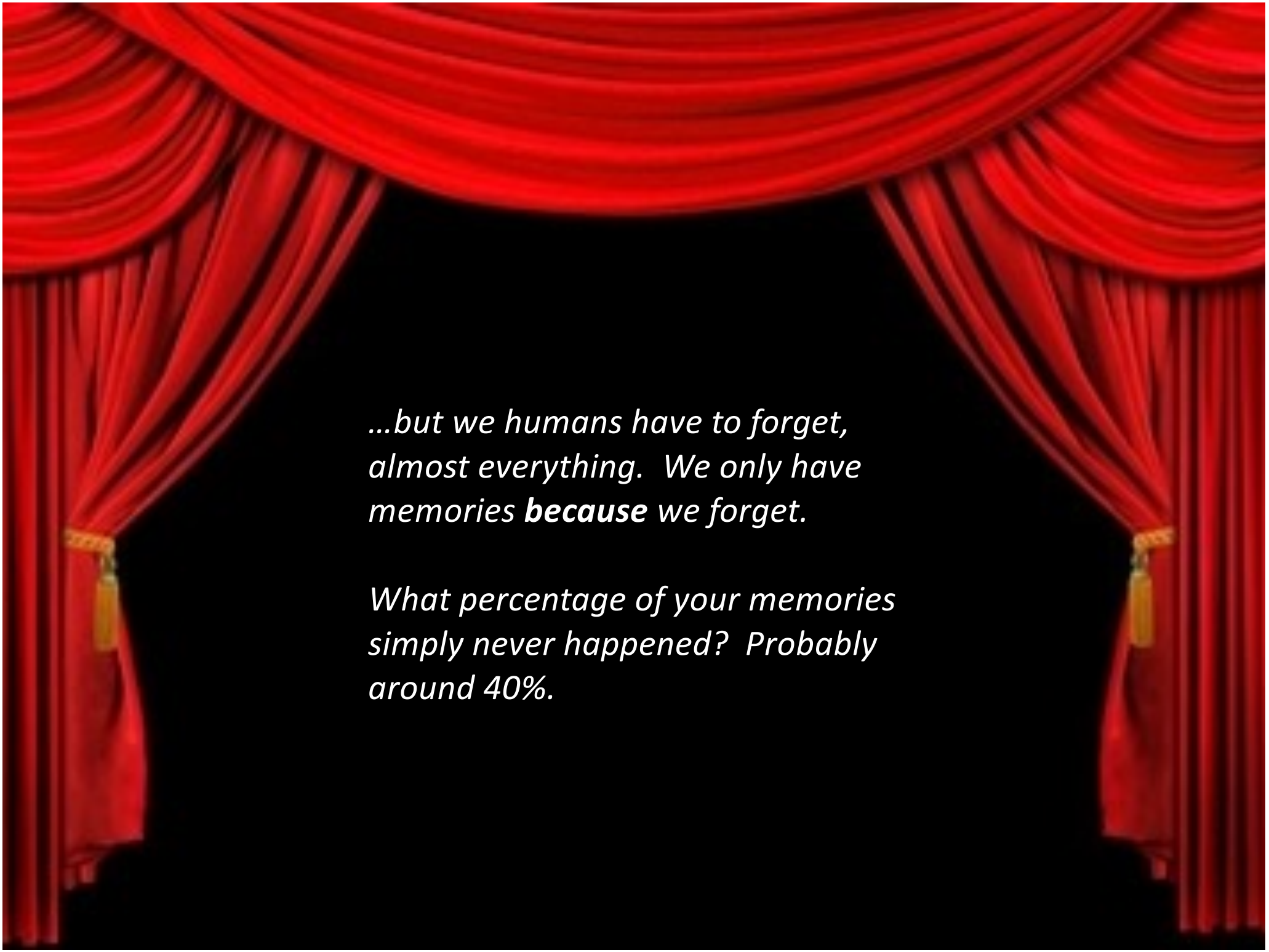
We all need a living wage, but many people ruin their lives thinking they want money, and this fallacy becomes tangled up with their careers.

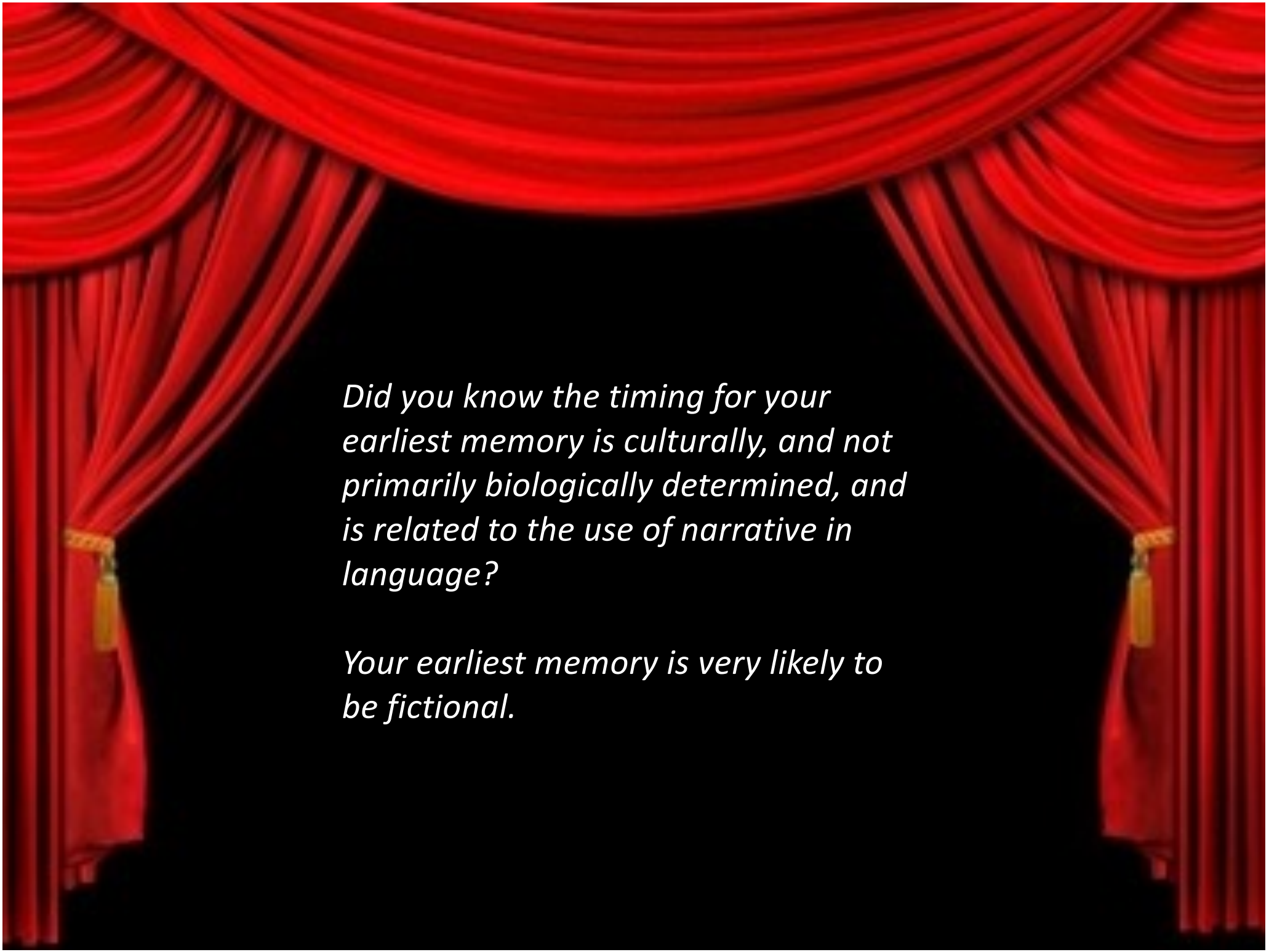
- Many academics who think they want money actually want recognition. Many business people who think they want money actually want to be seen as a success by society. Most people think they would be happier with more money, and sacrifice their lives for it.
- Money becomes a surrogate for things that are *missing.*
- What amount will make you happiest? Statistically? About €55,000/year.
- Don't ruin your life chasing something that will make you miserable.
- *What do you really want? Money? Freedom? Stability? Love?*

You should probably read Canetti's *Crowds and Power*


For some reason, Ikigai reminds me that many animals, such as cats, have fully persistent memories. They remember everything they smelled from the time they were born.


* Cats probably have a type of synesthesia, which I also have. This means their sense of smell and taste and hearing and sight connect with each other and combine in unusual ways.


*…but we humans have to forget, almost everything. We only have memories **because** we forget.*
What percentage of your memories simply never happened? Probably around 40%.


Did you know the timing for your earliest memory is culturally, and not primarily biologically determined, and is related to the use of narrative in language?

Your earliest memory is very likely to be fictional.

Developing Your Career - What Works?

- Explore everywhere you can, know you will have to learn new fields and apply your skills. Travel.
- Work is essentially a social experience, and you will have to learn social skills. Many of the people in my field have Asberger's or some form of autism.
- Enjoy your failures. The world is not made up of winners and losers, but those who try and those who don't. Try. Keep trying. Get excited.
- Be prepared to change, and change jobs, and change your work focus. Apply your skills in other domains.
- Study. Study. Study. The future belongs to people who know as many pieces of the puzzle as possible. First five hours of every day…

What Else?

- Find mentors and ask for help and advice. Be honest about what you want in life and from your career.
- Be prepared for change, and to go it alone.
- Be prepared to leave jobs that are not making you happy and are not helping you advance towards happiness.
- Don't fool yourself. Don't get dragged into things with no win conditions.
- ***Let go of your ego.*** **The majority of your poor career decisions will be because of your ego, and/or your need to feel important or successful, even when it is an illusion.**
  Story: me at WHO HQ in Geneva.

You should probably read the Philip K Dick biography *The Man Who Remembered the Future*

What else?

- Consider making a career development plan with your supervisor or mentor.
- Help people around you. Volunteer.
- Seek out challenging environments where you will be in over your head. Start at the top – visit your dream job. Be bad at things.
- Understand that you are unlikely to exist in academia now without bringing in your own funding. Learn how to engineer good proposals.
- Don’t look for friends and understanding at work, look for respect. *If you want a friend at work, get a dog.*

Proposals, ugh. :>(

I mentioned engineering good proposals. This is now a great, essential skill. I will be giving a lecture in a week on how to do this, including writing, formulation, etc. Attend if you can!

Probably, your first proposal will be for a national grant (ARIS funding), but might also be a Marie Curie Postgraduate Fellowship, or an application idea for a post-doc. These are all different, and writing a journal article is the *opposite* of writing a proposal. Attend next week's writing workshop?

What else?

- We live in a collaborative age with regards to research and science. Find collaborators that make you much better at your job.
- Consider spending blocks of a month at different organisations with people you might want to work with. As a PhD with little experience, it is one of the only ways you can prove your worth to top people.
- Unfortunately, proposing and managing projects is now required for many careers, so develop these skills early.

Some Secrets. I Guess.

- Much of your “career”, since it is a narrative, a story, can be engineered in some ways, as can your professional activities. (story: EU working group on teledemocracy)
- Most advertised jobs do not exist. Interviews are simply social theatre. (story: Stanford)
- When you see someone having a good “career”, it is likely they are just good at PR and image.

Some Secrets. I Guess.

- Place is important, lifestyle is important. (story: on lifestyle - life at Bletchley Park).
- Probably your best course is to find something scientific you love, and then find funding (the ten proposal phenomena).
- **Your ego is your enemy.** Do not believe your own CV, and don't think the work world is an honest game. Most very senior people do not even have CVs because they do not want to contribute to the creation of more fiction.

Some Secrets. I Guess.

You are very unlikely to get a job now by watching for job postings, you need to go the opposite way, find the right organization, whether hiring people or not, and bugging them non-stop. Story: colleague in Iceland.

Questions?

AI.

Artificial intelligence will transform the world of work, careers, research, and scientific discovery, the same way the first industrial revolution did. You will have to be ready, and smart about it.

AI is my field, and I have devoted my life to it. Please understand: *AI is making you stupider, every time you use it.* AI helps you *pretend* to be a scientist, not *become* one. Is that why you went into science, to *pretend* to be one?

I will be talking more about AI and the future of research science in my lecture in a week on Friday at 11.00, courtesy of the post-graduate school, MPS.

Okay, we should probably talk about AI and science. Questions?

…let me just run that through ChatGPT…

Some Secrets. I Guess.

Be useful.

…or, how to get involved in almost anything.

A Summary on Careers.

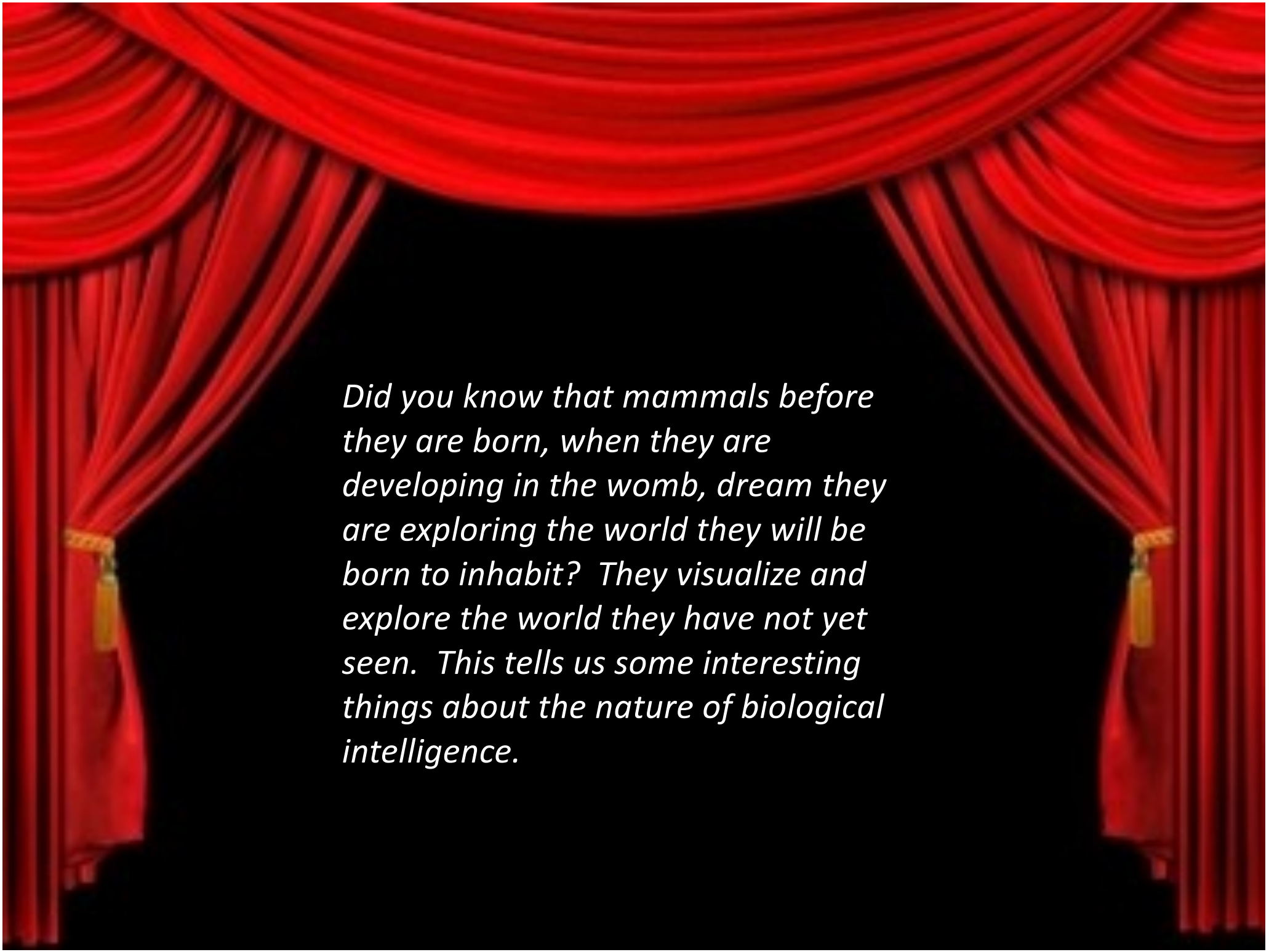
To *summarise*:

1. Science is wonderous, glorious, transcendent.
2. Jobs and the world of work are mostly shit.
3. The past sucked. Science is about inventing a better future.
4. Careers are mostly imaginary, and CVs fiction. Don’t lie to yourself.
5. Devote your life to science.
6. Racoons are amazing.

You should probably read Rafi Zabor’s
The Bear Comes Home

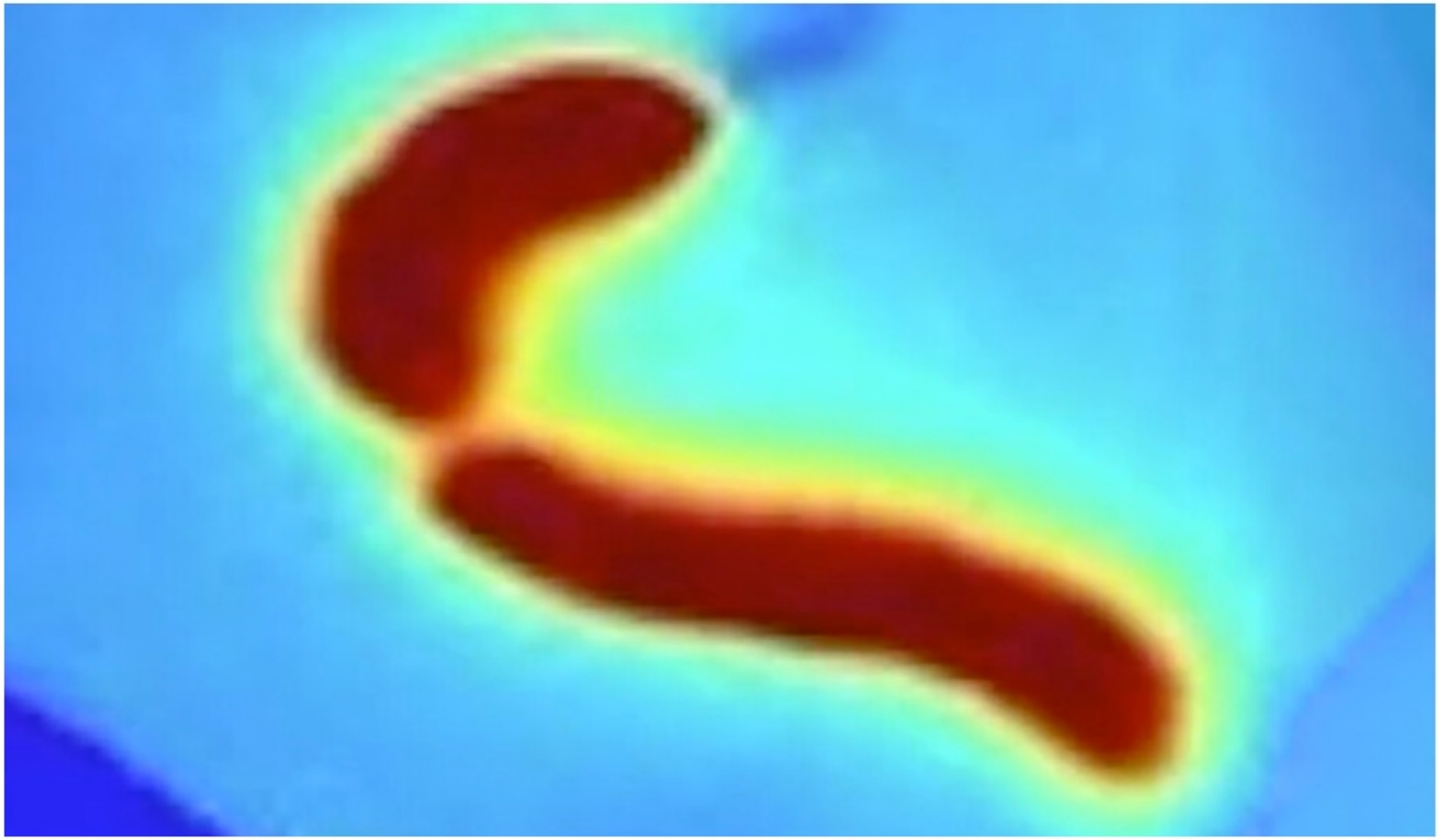
On becoming a great scientist…

You should probably read Rafi Zabor's
The Bear Comes Home


Did you know that mammals before they are born, when they are developing in the womb, dream they are exploring the world they will be born to inhabit? They visualize and explore the world they have not yet seen. This tells us some interesting things about the nature of biological intelligence.

Eyes wide shut: How newborn mammals dream the world they're entering

By Bill Hathaway | JULY 22, 2021



Retinal waves in neonatal mice

As a newborn mammal opens its eyes for the first time, it can already make visual sense of the world around it. But how does this happen before they have experienced sight?

Things We Now Know.

Some ideas to consider when contemplating your career. Not specifically about careers and career planning, but hopefully useful.

Things We Now Know.

Your instincts drive your perceptions, opinions, and decisions; they are not based on facts or reasoning. You are not rational in your personal, nor scientific lives.

Things We Now Know.

Your perception of yourself is mostly a fantasy.

Your mind is observing your body and projecting meaning and feedback onto it. This is why out of body experiences are easy to simulate, and why the mind may not really need the body at all. Your mind is just observing you and making up stories about what it sees you doing. Humans are *theory of mind machines*.

Things We Now Know.

Much of who you think you have become, you were born as. People mature at very different rates. Many people never mature at all. Adult life is full of play acting. If you want to understand human interaction, study puppetry.

Things We Now Know.

In my generation, many believed that humanity would advance when knowledge advanced. This was one of the main tenants of the Enlightenment (the perfectibility of humankind).

This was very naïve of us.

Things We Now Know.

It seems like now, everything is recorded, everything is retained, everything is searchable.

But the truth is, the vast majority of human knowledge is lost from one generation to another.

Things We Now Know.

Your generation will face existential threats of climate change and mass social, cultural, and political disruption. We are entering an age of mass climate migration.

We are now all in the planetary engineering business – it is now humankind's *only meaningful occupation*.

Things We Now Know.

Some people have supernatural talents, and they are the primary leaders in science. The story of π…

In research, you may fail because you are seeking knowable outcomes.

About Great Science and Creativity

About Great Science

When we think of great scientists, we think of their great ideas, but this is only partially accurate.

Great scientists become great because they are always open and exploring.

You should probably read Arnost Lustig's *Diamonds in the Night*

A Note on Confidence

Some of you may think you cannot become great scientists. Every young researcher feels like they are pretending, that they are a fraud, and are not really good at what they do.

This is the human condition. You will develop confidence eventually. Why? Because confidence is knowing that what lies behind you is likely to be worse than what lies ahead.

Expressed mathematically:

A Note on Confidence

$$confidence\ (C) = \frac{time\ (T) + coffee\ (☕)}{bad\ experiences}$$

You should probably read Robert M. Pirsig's
Zen and the art of Motorcycle Maintenance

Getting Started

Now, let’s think more about how great scientists get great ideas.

But first – did you know bumblebees dream?

NAUTILUS

ASTRONOMY ENVIRONMENT EVOLUTION HISTORY PHILOSOPHY PSYCHOLOGY ZOOLOGY

ZOOLOGY

The Dreams of a Bumblebee in Autumn

Yes, bees dream. We can even imagine what.

BK By **Brandon Keim**

3:00 PM CST on February 11, 2026

A bumblebee sleeping on a purple flower.

When I was younger, autumn's beauty was uncomplicated. Now I've reached the age when autumn is a reminder of mortality. Gloriously turning leaves foreshadow their own fading; cool breezes promise the coming cold. The people I love will die and so will I, whispers the season, and on those bittersweet days I take solace in New England asters: a tall, purple-blossomed perennial found across much of the United States and Canada, blooming in early autumn and remaining in flower until the season's end, long after other blossoms are a sun-hazed memory.

iceland scientific

You should probably read Iceberg Slim's *Mamma Black Widow*

Discovery

Science is a voyage of discovery, and while you may know the direction, you rarely know the destination.

Do not be discouraged by not having great ideas or breakthrough concepts. Most of science's greatest discoveries were accidents, but the people who made them had special qualities that they developed to know where to look for things, the *direction of curiosity*.

Your supervisor or mentor may help you choose directions and help prepare you, but everything else is up to you.

Ideas…

Having innovative ideas is usually about *immersion* in your field, and *exposure* to other fields and ideas unrelated to yours.

Up your game. Find people much smarter than yourself; find the best people in Europe and visit them. Be passionate, be excited, have high standards.

Stand next to geniuses. Seriously, this works. Find a genius you are afraid of, and then bug them constantly over coffee.

Questions

Becoming a great scientist is not about finding great *answers,* it is about finding great *questions.*

This is the root of all great research proposals: questions that make the reader *excited about their field*. These new questions seed the creation of new fields in research and science.

If you want to be creative and do great work, do not seek answers, but hard and weird *questions*.

Do not underestimate this: good scientists get you excited about their work; great scientists get you excited about *your own* work.

Tips on Getting Started

- Begin developing your big idea by constantly exploring new directions around the things that interest you most
- Begin understanding your process, how you work best, how you are best able to be creative
- Begin making images and graphics illustrating your ideas
- Think of *who* you want to work with, make a list, and begin contacting people when you can
- Discuss your ideas with your supervisor or mentor
- **Lists of ten things**

Creativity

Creativity is primarily a *feeling,* not a *process.*

Creativity is not logical, it is an instinct. And this instinct is specific to context and place.

What Works: Find Your Space…

On the importance of **place.** Environment may be one of the main determining factors in how happy and creative you are. You might be in the wrong *building*.

Inspiration will not come to you, you must go to it. Where is your inspiration?

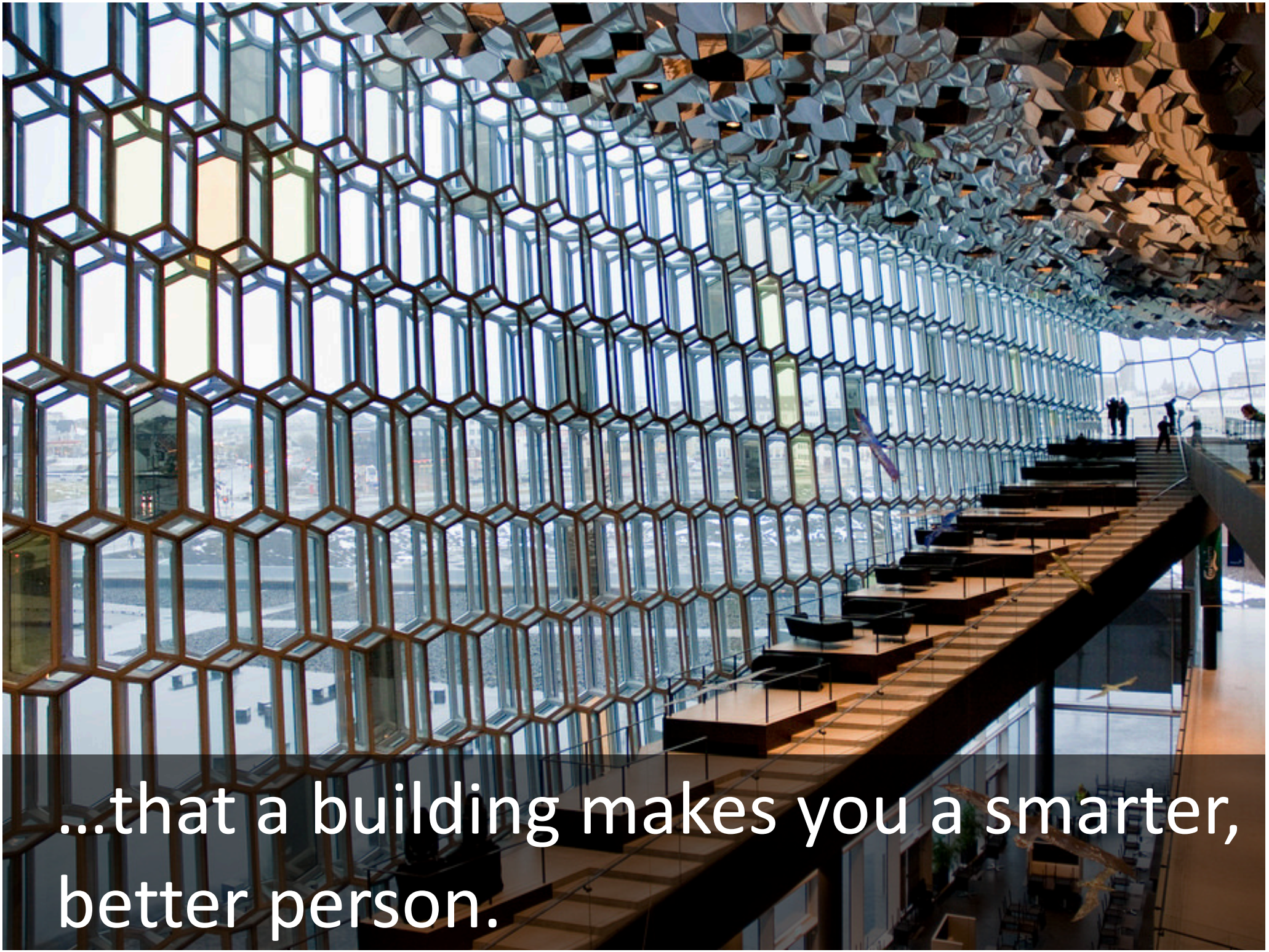
Story: Ásmundur Sveinsson Museum in Reykjavik, Iceland


“I love my job and love coming here to work…”


“…because this building makes me smarter…”


“…this building makes me a better person.”


Think about what it means…


…that a building makes you a smarter, better person.

Bad ideas.

Good ideas.

Find your space that makes you a smarter, better person, and good ideas may find you.

A short summary.

Being around smart people makes you smarter. Being around stupid people makes you stupider.

Being around inspirational places makes you inspired. Being around awful places gives you poor ideas.

Every time you use ChatGPT, or browse social media, you are getting stupider. By a lot. You are not Facebook or Chat-GPT's *customer*, you are their *product.*

Questions?

Who Succeeds?

It’s not smart people, it’s those who *try*.

Very smart people often do not really need to try very hard. You meet a lot of smart people who never succeed in science because they never learned to try, they lack discipline.

Timing.

Timing is also very important. Great events make great people and great scientists, and so creative and "lucky" people often have a skill for where to *be* and *when*. "Luck" in the career sense is actually something you can engineer, like knowing where to go fishing.

People say I have been very lucky in my career(s), but it's mostly that I've known where to be and when, and then I *observe and engage*.

Fields of the Future

I think these will be great, critically important jobs in the future:

- **Anything responding to emerging emergencies in climate, food, water, energy, ocean health, human movement and immigration, nutrition, WEF nexus…**
- Anything in ambient and distributed intelligence
- Anything in chemistry, physics, materials, biology
- Anything in regenerative engineering, geoengineering, planetary engineering

Herd of 170 bison could help store CO2 equivalent of 43,000 cars, researchers say

Free-roaming animals reintroduced in Romania's Țarcu mountains are stimulating plant growth and securing carbon stored in the soil while grazing

European bison disappeared from Romania more than 200 years ago, but the species was reintroduced to the southern Carpathian mountains in 2014. Photograph: Michel Doutemont

A herd of 170 bison reintroduced to Romania's Țarcu mountains could help store CO_2 emissions equivalent to removing 43,000 US cars from the road for a year, research has found, demonstrating how the animals can help mitigate some effects of the climate crisis.

European bison disappeared from Romania more than 200 years ago, but Rewilding Europe and WWF Romania reintroduced the species to the southern Carpathian mountains in 2014. Since then, more than 100 bison have been given new homes in the Țarcu mountains, growing to more than 170 animals today, one of the largest free-roaming populations in Europe.

How to Become a Great Scientist

I've spent a lot of my life seeking out great scientists and trying to understand what makes them any different from we mere mortals. Was it just luck? Were great scientists born geniuses? Is there any hope for the rest of us to do great work?

There are a few things they all had in common.

Here's eight things we can all do to become great geniuses who produce astonishing research.

How to Become a Great Scientist

1. **They all worked with other geniuses in the field.** Example: Donald Michie, one of the main founders of machine learning, worked with Alan Turing as a code-breaker at Bletchley Park. Also, great events and environments make great geniuses; they *rose to the occasion*.

Find geniuses in the field and work with them. Find great events and be part of them.

How to Become a Great Scientist

2. **They all were slaves to their curiosity, and never stopped exploring new ideas, new fields.**

Indulge your curiosity and explore outside your own field.

Always keep learning. ***Change what information you consume.***

How to Become a Great Scientist

3. **They all did what they loved**, and were almost entirely useless when they were not doing something they loved.

Understand what you love and what really motivates you. What would you be doing even if it was not your job?

How to Become a Great Scientist

4. **They were all utterly fearless when it came to failure.** They were never afraid to play the fool, ask a dumb question, or look stupid. This is very hard for many of us.

Know that you will fail a lot, get used to looking stupid.

How to Become a Great Scientist

5. **They all, every one, had a strange talent for putting themselves into foreign, hostile, challenging, alien environments.** Story: Donald Michie and the Russian ants.

Once every year, spend two weeks in a physical and knowledge environment totally alien to you.

How to Become a Great Scientist

6. **They all were natural seekers of the *root nodes of things*.**

Try to follow chains of thinking back as far as they can go, to the absolute roots of knowledge.

How to Become a Great Scientist

7. **They all found *questions* much more interesting than *answers,*** and spent most of their time formulating the questions, not seeking the answers.

Concentrate on the big questions not being asked, rather than formulating answers to nearby questions. ***Find places in your research field where questions pour out.***

How to Become a Great Scientist

8. **They were all thinking big, and were inspiring to everyone around them.** One reason is that people are excited by the big questions. By the big answers? Not so much.

Think big. Be excited, be enthusiastic about what you have chosen for your life's work. Find people who excite you with their ideas.

*A **good** scientist makes you excited about their ideas, a **great** scientist makes you excited about **your** ideas.*

What's it Like to Win a Nobel Prize

1. An award from dynamite.
2. Shock, happiness, overwhelmed.
3. Paperwork, pictures, paperwork.
4. Guilt, feeling like a fraud, sadness for the great scientists you've known. Everyone thinks you are now rich, when in fact…
5. Expectation that you will step aside and become a statue near the cafeteria. It often ends your career.
6. A Nobel Prize is about your ego, and your ego is the enemy of science.

You should probably read Robert Heinlein's
The Unpleasant Profession of Jonathan Hoag

Be hopeful, be optimistic.

Science is the *priesthood of reason*, never lose your faith.

You should probably read Apsley Cherry-Garrard's *Worst Journey in the World*