
Reopening 2021

This exhibit places American art squarely in the center of a conversation about Humboldt’s lasting influence on the way we think about our relationship to the natural world.

This exhibition will be the first to examine Humboldt's impact on five spheres of American cultural development: the visual arts, sciences, literature, politics, and exploration, between 1804 and 1903.
The Adventures of Alexander Von Humboldt by Andrea Wulf

What I will talk about
(and you will chat about)

1. Alexander Von Humboldt
2. What he accomplished with little or no US fanfare
3. Why he is probably the least known polymath
4. Humboldt’s relationship to biodiversity and climate
5. Human induced climate effects (HICE)
6. Acceptance and denial of HICE
7. Similarities with denial and acceptance of Covid-19
8. Where do we go from here
9. John Donne
Alexander von Humboldt’s holistic description of nature was a great source of guidance and inspiration for the young Charles Darwin sailing on the Beagle.

Humboldt established the foundation for the Earth Sciences: the integrated system of knowledge on which human society may depend in the face of global climate change.

Through Humboldt’s observational records an important trend emerged through his techniques of observation, scientific instruments used and unique perspective on nature.
A naturalist figured out climate change in 1799. The world forgot him.

More places, plants and animals are named after Humboldt than anyone else.

His diary entry in November 1801 revealed that he worried about a future in which humankind might expand into space... and spread our lethal mix of vice and greed!
“The most dangerous worldview is the worldview of those who have not viewed the world.”

Alexander von Humboldt Scientist
Friedrich Wilhelm Heinrich Alexander von Humboldt (14 September 1769 – 6 May 1859):

- Prussian polymath
- Geographer
- Naturalist
- Explorer
- Proponent of Romantic philosophy and science.

Humboldt's quantitative work on botanical geography laid the foundation for the field of biogeography.

Humboldt's advocacy of long-term systematic geophysical measurement laid the foundation for modern geomagnetic and meteorological monitoring.
Humboldt was born on September 14, 1769, in Berlin, Germany.

His family belonged to a prominent Pomeranian family, and so they were able to afford private tutors to provide the boys a good education in mathematics, languages and classic.

As a child, Alexander had a hobby of collecting and labeling different plants, insects, and shells.

At the University of Frankfurt Humboldt developed an interest in botany, geology and minerology.

His mother died when he was 27, in 1796 and this left him a good inheritance which would pay for his future explorations.
On the 5th of June 1799 Humboldt set sail aboard the ship Pizarro.

He had a 6-day stop at Tenerife, where he explored the Teide volcano.
Other notable experiences from his explorations in South America included being able to see an amazing meteor shower the “Leonids”

Humboldt was the first person to connect altitude sickness to a lack of oxygen, due to his many mountain climbs and his own personnel experiences at high altitudes.

Humboldt captured and dissected electric eels from which he received a number of electric shocks himself.

After a great amount of exploration in South America, Humboldt visited Washington, D.C.

He stayed for three weeks during which Humboldt was able to have several meetings with President Thomas Jefferson who called Humboldt "one of the greatest ornaments of the age."

In 1804, Humboldt travelled to Paris and he spent his time writing 30 volumes about his different field studies.

He stayed in Paris for 23 years, meeting and discussing with other bright minds of his age.
Eventually the fortune from his mother’s inheritance ran out. Humboldt then found a stable source of income and became one of the advisors of Prussia’s King.

He was invited to Russia in 1829 and on his extensive journey found diamonds in the gold mines of the Urals and collected data for an isothermal world map.

In 1827, Humboldt visited in Berlin, giving public lectures. These lectures became so popular that he decided to write all his research in a work which he called the “Kosmos”. The first volume was published in 1845 when he was 76 years old. Five volumes in total were published, the final volume posthumously.

Humboldt died on May 6, 1859. To this day, he is known as one of the most significant contributors to the earth sciences.

The German author and poet Wolfgang von Goethe said of the explorer and scientist, "Spending a few days with Humboldt is like having lived several years."
It is impossible to pigeonhole Humboldt. A brilliant observer and recorder of the tiniest details, he was also able to zoom out and see the bigger picture, mapping the relationships between biology, meteorology and geology.

Humboldt’s wider perspective inspired him to map the world using isotherms (lines connecting points with the same mean temperature) and identify climate zones from the equatorial Torrid Region, to the Frozen Regions.

“Humboldt was one of the last people to hold essentially all scientific knowledge in one head,” write researchers in a special birthday issue of the Journal of Biogeography.

By necessity today’s scientists are specialised, but some of the greatest challenges would benefit from a Humboldtian approach, and by working together scientists can make the kind of connections that Humboldt’s one single polymath brain was able to make.
International Humboldt Day 2020

The International Biogeography Society is launching – **International Humboldt Day** – an annual celebration of Humboldt’s legacy and the breadth of research that was prompted by his pioneering work in botanical geography.
Humboldt defined not only the distribution zones of vegetation in relation to altitude, temperature and humidity, but crucially also compared these distributions to other mountain ranges of the world — **implying a global connection between the biotic and abiotic realms.**

Humboldt’s idea of a **holistic web of connections** presented a dramatically different vision to the dominant scientific ideas of the time, which focused on organisms at the level of the individual, with humans set apart — ideas influenced largely by Carl Linnaeus.

Humboldt anticipated Charles Darwin’s famous idea of an **entangled bank of connections in the web of life**, and also recognized that organisms have a reciprocal effect on their environment — for example, in the shade provided by trees, or the stabilizing effects of vegetation on soil.
Latin America also proved an excellent place to satisfy Humboldt’s obsession with volcanoes.

Little was known about the formation of volcanic mountains outside of the few active ones in Europe, and in a short trip Humboldt would climb dozens.

Taking data on altitude, pressure, geology and magnetic compass bearings led Humboldt to discover that the Earth’s geomagnetic equator was some 500 miles farther south than its geographic one.

Later in life, he established the first coordinated network of geomagnetic monitoring stations across the world, pre-empting the era of big data, international collaborative science and distributed experiments.
Alexander von Humboldt played an important role in establishing the science of geomagnetism. He described the systematic change of magnetic field strength with distance from the equator, and he initiated synchronized magnetic field observations worldwide.
After he saw the disastrous environmental effects of colonial plantations in Venezuela in 1800, Humboldt became the first scientist to talk about harmful human-induced climate change.

Deforestation made the land barren, he said, and with the disappearance of brushwood, torrential rains washed away the soils, while water levels of lakes were falling.

Everything,” Humboldt later said, “is interaction and reciprocal.”

Towards the end of his life, he even prophetically warned about deleterious gas emissions at industrial centers.

There were moments when he was so pessimistic that he painted a bleak future of voyages into space, when humans would spread their lethal mix of vice and greed even across other planets.
Darwin’s voyage was undoubtedly inspired by Humboldt’s adventures, and later in life the two met and exchanged letters about their overlapping ideas on the transformation of species.

No other person has had as many species, places or geographic features named after them than Alexander von Humboldt — yet, among these species are those threatened by the very dangers that he identified during his travels.
The Humboldt Current is named after **him**. He reported measurements of the cold-water current in his book *Cosmos*. 
The presence of the Humboldt Current and its associated wind shear makes for conditions that inhibit the formation of tropical cyclones. (Worldwide tropical cyclone tracks, 1945–2006.)
Humboldt recognized that wetland draining and forest clearance by colonists for agricultural production:

- left indelible scars on the landscape
- reduced, the cover provided by natural vegetation,
- left the land arid and unproductive.

He was the first to highlight the effects of human-induced land-use and climate change on the natural world.
In the nineteenth century Alexander von Humboldt was acclaimed as "the second Columbus" and "the scientific discoverer of America."

His prestige and fame were such that on 14 September 1869, the hundredth anniversary of his birth, a grand celebration was held with parades, speeches, concerts, and the unveiling of memorials in cities across the country.

Humboldt's popularity in the United States endured for the remainder of the nineteenth century, but he dropped from public consciousness in the twentieth century.

Why?

✓ a shift in the character of scientific endeavor

✓ the quality of Humboldt's written work

✓ and the rise of anti-German sentiment with a concurrent rush to "de-Germanize" the United States in the early twentieth century.
“When you have eliminated the impossible, whatever remains, however improbable, must be the truth?”
Instead of "climate change" the preferred terms are "climate emergency, crisis or breakdown" and "global heating" is favoured over "global warming," although the original terms are not banned.
Human-induced climate effects

Human
Anthropomorphic

Induced
Effect, Cause
Be Responsible For

Climate
Not Anecdotal
Weather

Effects
Hot, Cold, Wet Dry
Calm, Stormy, .....
HICCE research falls into nine independently studied, but physically related, lines of evidence:

1. **Simple chemistry** burning carbon-based materials, (CO2) is emitted
2. **Basic accounting** of what we burn, and therefore how much CO2 we emit
3. **Measuring CO2** and other greenhouse gases in the atmosphere and trapped in ice to find levels higher than anything we've seen in nearly 1,000,000yrs.
4. **Chemical analysis** CO2 increase is coming from burning fossil fuels
5. **Basic physics** that shows us that CO2 absorbs heat
6. **Monitoring climate conditions** to find that the air, sea and land is warming, ice is melting and sea level is rising
7. **Ruling out natural factors** that influence climate like the sun and ocean cycles.
8. **Employing computer models** of natural versus human-influenced simulations of Earth
9. **Consensus among scientists** who consider all previous lines of evidence and make their own conclusions.
The evidence for rapid climate change is compelling:

- **Global Temperature Rise**
  The planet's average surface temperature has risen about 2.05 degrees Fahrenheit since the late 19th century,

- **Warming Ocean**
  The ocean has absorbed much of this increased heat, with the top 328 feet of ocean showing warming of more than 0.6 degrees Fahrenheit. Earth stores 90% of the extra energy in the ocean.

- **Shrinking Ice Sheets**
  The Greenland and Antarctic ice sheets have decreased in mass. Greenland lost an average of 279 billion tons of ice per year between 1993 and 2019, while Antarctica lost about 148 billion tons of ice per year.

- **Glacial Retreat**
  Glaciers are retreating almost everywhere around the world — including in the Alps, Himalayas, Andes, Rockies, Alaska, and Africa.
NOW THIS IS REAL CLIMATE CHANGE!!
(It did “Happen Before”)

[Diagram showing Phanerozoic Climate Change with eras marked as Cm, O, S, D, C, P, Tr, J, K, Pg, N, and eras labeled as Cm, O, S, D, C, P, Tr, J, K, Pg, N, and years marked as 542, 500, 450, 400, 350, 300, 250, 200, 150, 100, 50, 0. The diagram includes a line labeled Short-Term Average and Long-Term Average, with peaks and troughs indicating hot and cold periods.]
ATMOSPHERIC CH₄:CO₂:°C
420,000 years BP – present time

Nebraska
Kansas
Illinois
Wisconsin
10 SIMPLE GRAPHS THAT SAY IT ALL

Climate Graphs
1. AIR TEMPERATURES OVER LAND ARE INCREASING.
2. AIR TEMPERATURES OVER OCEANS ARE INCREASING
3. Arctic sea ice is decreasing
4. GLACIERS ARE MELTING.
5. Sea levels are rising.
6. HUMIDITY (EVERYONE’S FAVORITE) IS INCREASING
7. Ocean heat content is increasing.
8. Sea surface temperature is increasing.
Northern Hemisphere (March-April) Snow Cover

9. Snow is decreasing.
10. Earth’s lower atmosphere temperature is increasing.
1. Earth is now losing 1.2 trillion tons of ice each year. And it’s going to get worse.
2. Ice is melting faster worldwide, with greater sea-level rise anticipated, studies show.
This map shows extremes in past and possible future changes in sea level.

A rise of one meter by the end of this century won’t be nearly this extreme.
Map of Greenland showing the number of melting days in 2012 with respect to the 1980 – 1999 average (e.g.,).

Red color indicates areas where melting lasted up to 50 days above the 1980 – 1999 mean.
University of Colorado scientists released this chart of sea level rise earlier in 2012. It is based on data collected since 1993 via satellite radar altimeters, with the measurements
There are just four critical global warming accelerating tipping points and deadlines to never forget:

1. The 2025 carbon 425-450 ppm tipping point, (the Climate Cliff)

2. The 2042-2067 or earlier, extinction-accelerating, runaway global ice melting tipping point level,

3. The 2063-2072 or earlier, extinction-accelerating, massive methane release tipping point level.

4. The post-2072, runaway rising global warming temperature tipping point level.
1. THIS IS THE COLDEST WINTER WE’VE HAD IN YEARS! SO MUCH FOR GLOBAL WARMING.

2. CLIMATE CHANGE IS NATURAL AND NORMAL

3. IT’S HAPPENED AT OTHER POINTS IN HISTORY.

4. THERE’S NO CONSENSUS AMONG SCIENTISTS THAT CLIMATE CHANGE IS REAL

5. PLANTS AND ANIMALS CAN ADAPT.

6. ANTARCTIC ICE IS INCREASING, NOT MELTING.

7. CLIMATE CHANGE IS GOOD FOR US.

8. CLIMATE TEMPERATURES HAVE BEEN HIGH IN THE PAST. THE CURRENT TEMPERATURE INCREASE IS NOTHING NEW OR UNIQUE, BUT JUST NATURAL VARIATION.
WHAT ARE THE CONSEQUENCES OF HICE?
Research shows the Earth lost a sheet of ice 100 meters thick roughly equivalent to the size of the U.K. in recent decade.

From Antarctica to the Arctic, the world’s ice is melting faster than ever, according to a new global satellite survey that calculated the amount of ice lost from a generation of rising temperatures.

Ice plays a crucial role in regulating the global climate, and losses will increase the frequency of extreme weather events such as flooding, fires, storm surges and heat waves.”
Peer Review Process

1. Author submits article

2. Author submits revised manuscript

3. Article assessed by editor

4. Revisions required

5. Sent to reviewers

6. Reviews assessed by editor

7. Further review needed?

8. Rejected

9. Accepted

10. Production

11. Publication
5 CHARACTERISTICS OF SCIENCE DENIAL

F: Fake Experts
   Magnified Minority

L: Logical Fallacies
   Red Herring

I: Impossible Expectations
   Misrepresentation

C: Cherry Picking
   Jumping to Conclusions

C: Conspiracy Theories
   False Dichotomy
That’s 588 MILLION in less than a second

That’s 7.414 BILLION in a tad over a second

Technology enables the spread of misinformation in a way that wasn't possible before!
From 1997 to 2017, the Kochs funneled $127,006,756 to 92 organizations that advance the Kochs' attacks on climate change science while presenting themselves as experts. These organizations are listed below:

<table>
<thead>
<tr>
<th>Acton Institute for the Study of Religion and Liberty</th>
<th>American Council for Capital Formation (ACCF)</th>
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<tbody>
<tr>
<td>American Council on Science and Health (ACSH)</td>
<td>American Enterprise Institute (AEI)</td>
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<tr>
<td>American Legislative Exchange Council (ALEC)</td>
<td>American Spectator Foundation</td>
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<tr>
<td>Americans for Prosperity Foundation (AFP)</td>
<td>Americans for Tax Reform (ATR)</td>
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<tr>
<td>Atlas Network</td>
<td>Ayn Rand Institute (ARI)</td>
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<tr>
<td>Capital Research Center (CRC)</td>
<td>Cato Institute</td>
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<td>Center for Freedom &amp; Prosperity Foundation</td>
<td>Center for Independent Thought: Stossel in the Classroom</td>
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<tr>
<td>Center for the Study of Carbon Dioxide and Global Change (CO2 Science)</td>
<td>Center for the Study of Market Processes</td>
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<tr>
<td>Citizens for a Sound Economy (disbanded – now FreedomWorks)</td>
<td>CO2 Coalition (formerly George C. Marshall Institute)</td>
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<tr>
<td>Collegians For A Constructive Tomorrow (CFACT Campus)</td>
<td>Commonwealth Foundation for Public Policy Alternatives</td>
</tr>
<tr>
<td>Competitive Enterprise Institute (CEI)</td>
<td>Council for National Policy</td>
</tr>
<tr>
<td>Environmental Literacy Council (disbanded)</td>
<td>Federalist Society for Law and Public Policy Studies</td>
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<tr>
<td>Foundation for Economic Education (FEE)</td>
<td>Foundation for Research on Economics and the Environment (FREE)</td>
</tr>
<tr>
<td>Fraser Institute</td>
<td>Frontiers of Freedom</td>
</tr>
<tr>
<td>Goldwater Institute</td>
<td>Heartland Institute</td>
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<tr>
<td>The Heritage Foundation</td>
<td>Independence Institute</td>
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<tr>
<td>Independent Institute</td>
<td>Independent Women’s Forum (IWF)</td>
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Here is a summary of global warming and climate change myths, sorted by recent popularity vs what science says. Click the response for a more detailed response. You can also view them sorted by taxonomy, by popularity, in a print-friendly version, with short URLs or with fixed numbers you can use for permanent references.

https://skepticalscience.com/argument.php
<table>
<thead>
<tr>
<th>Climate Myth</th>
<th>vs</th>
<th>What the Science Says</th>
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<tbody>
<tr>
<td>&quot;Climate's changed before&quot;</td>
<td>Climate reacts to whatever forces it to change at the time; humans are now the dominant forcing.</td>
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<td>10</td>
<td>&quot;Antarctica is gaining ice&quot;</td>
<td>Satellites measure Antarctica losing land ice at an accelerating rate.</td>
</tr>
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</table>
1934 was one of the hottest years in the US, not globally.
Science denial

- This is the type of denial we are all familiar with: that the science of climate change is not settled.
  - Deniers suggest climate change is just part of the natural cycle.
  - Or that climate models are unreliable and too sensitive to carbon dioxide.
- Some even suggest that CO₂ is such a small part of the atmosphere it cannot have a large heating affect.
- Or that climate scientists are fixing the data to show the climate is changing.

Techniques of Science Denial

- Fake Experts
- Logical Fallacies
- Impossible Expectations
- Cherry Picking
- Conspiracy Theories
Political denial

- Climate change deniers argue we cannot take action because other countries are not taking action.
- But not all countries are equally guilty of causing current climate change.
- For example, 25\% of the human-produced CO₂ in the atmosphere is generated by the US, another 22\% is produced by the EU. Africa produces just under 5\%.
Humanitarian denial

- Climate change deniers also argue that climate change is good for us.
- They suggest longer, warmer summers in the temperate zone will make farming more productive.
- These gains, however, are often offset by the drier summers and increased frequency of heatwaves in those same areas.
- For example, the 2010 “Moscow” heatwave killed 11,000 people, devastated the Russian wheat harvest and increased global food prices.
Crisis denial

- Deniers argue that climate change is not as bad as scientists make out.
- We will be much richer in the future and better able to fix climate change.
- They also play on our emotions as many of us don’t like change and can feel we are living in the best of times – especially if we are richer or in power.
Decades of Science Denial Related to Climate Change Has Led to Denial of the Coronavirus Pandemic.

- Gretchen Goldman, research director of the Union of Concerned Scientists’ Center for Science and Democracy says:
  - I’m skeptical that this situation is enough to change people’s minds on climate change.
  - There will never be an event that you can point to and say that it’s climate.
  - You won’t have a ‘gotcha moment’ as you would with this virus because you have a more definite link to deaths when you have a virus.
  - If coronavirus changes people’s science denial ways here, I wouldn’t put money on it changing their views on other scientific issues.
Parallels between the coronavirus and the climate crisis

- You could just as easily replace the words ‘climate change’ with ‘COVID-19’; it is truly the tale of two pandemics deferred, denied, and distorted.

- Just as in today’s pandemic, progress has been halted by
  - finger-pointing
  - denial
  - replacing real science with junk science
  - misinformation
  - flat-out lies
  - elevating political hacks instead of scientists and experts
  - refusal to work with allies and even adversaries
  - leaving states and cities to fend for themselves

- Sound familiar?
  - It’s no coincidence that the same person who called COVID-19 a “Democratic hoax” referred to climate change as a “hoax invented by the Chinese.”
Covid-19 Denials

- If you look at the number of COVID-19 deaths compared with the U.S. population, it's a very small percentage, not enough to worry about.
- The virus is going to do what it is going to do. We cannot stop it; we cannot slow it. It's just going to have to run its course..
- Hospitals are inflating COVID-19 death numbers to get more money.
- Most people who die of COVID-19 are older; younger people don't have to worry. Numbers of COVID-19 cases are inflated because of repeat testing.
- Do you know how many people die of Swine Flu each year?
- Dr. Fauci is making millions off the vaccine development.
How Identity—Not Ignorance—Leads to Science Denial

- Changing the minds of Covid-19/Climate deniers may require a lot more than sound reasoning.
- The people who deny science are often trying to uphold membership in something that they find meaningful.
- Once a community absorbs an idea into its collective viewpoint, rejecting that idea becomes akin to rejecting the whole community.
- An individual alone can seldom fulfill the basic psychological needs of another.
- That fulfillment comes from a larger community and identifying with them and being a part of them.
President Biden has named former secretary of state John Kerry as international climate envoy and former EPA administrator Gina McCarthy as national climate adviser.

The climate Cabinet is much larger than just the nominal climate team, because almost every Cabinet job is actually a climate job.

Most departments—from Interior to Transportation—can help reduce U.S. greenhouse gas emissions and improve climate resilience.

And with gridlock likely to continue in the closely divided Congress, rulemaking in the executive branch may be the only way to make a difference.

HOW ABOUT A LITTLE GOOD NEWS
Many companies have committed to going 100% renewable energy to power their businesses:

- Apple
- Levi Strauss & Co
- Bank of America
- Bloomberg
- Citi
- Clif Bar
- eBay
- General Motors
- JPMorgan Chase
- Nike
- Wells Fargo
- Xylem

What we need is more of this.
The war on climate denial has been won. 
And that’s not the only good news. 

*By David Wallace-Wells*

- A decade ago, capitalists deemed decarbonization too expensive.
- Suddenly, it appears too good a deal to pass up.
- The IEA, a notoriously conservative forecaster, recently called solar power "the cheapest electricity in history" and projected that India will build 86% less new coal power capacity than it thought just one year ago.
- It would appear that the age of climate denial is over, thanks to extreme weather and the march of science and the historic labor of activists — climate strikers, *Sunrise*, *Extinction Rebellion* — whose success in raising alarm may have been so sudden that they brought an end to the age of climate Jeremiahs as well.
The Uninhabitable Earth

Life After Warming

David Wallace-Wells
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Excerpt from *Lines Written in Early Spring*

*BY WILLIAM WORDSWORTH*

*To her fair works did Nature link*
*The human soul that through me ran;*
*And much it grieved my heart to think*
No man is an island entire of itself;
every man is a piece of the continent, a part of the main;
if a clod be washed away by the sea, Europe is the less,
as well as if a promontory were,
as well as any manor of thy friends or of thine own were;
any man's death diminishes me,
because I am involved in mankind.
And therefore never send to know for whom the bell tolls;

it tolls for thee.
That's all folks!
A polymath is an individual whose knowledge spans a substantial number of subjects.

Polymaths include the great scholars and thinkers of the Islamic Golden Age, Renaissance and the Enlightenment, who excelled at several fields in science, technology, engineering, mathematics, and the arts.
Why one can’t be a Polymath anymore
Homework Assignment
Speculate on the scenario that would result if this particular event had taken place:

Covid-19 pandemic had occurred in 1950.

What to consider:

1. The state of knowledge about DNA, RNA
2. Communications of the times, e.g. lack of internet
3. Much smaller amount of mass travel
4. Public divisiveness or cohesion
5. Polio
Decades of Science Denial Related to Climate Change Has Led to Denial of the Coronavirus Pandemic

- After the fossil fuel industry spent hundreds of millions of dollars attacking climate scientists it isn’t hard to understand how pandemic denial happened.
- Climate deniers have long attacked climate scientists, and Covid-19 deniers recently launched a smear campaign against Dr. Anthony Fauci, in part because he corrected the President’s inaccurate statements about the pandemic.
- Between 2003 and 2010, 91 climate denialist groups received more than half a billion dollars.
- A 2016 survey by the Pew Research Center found that fewer than 30 percent of Americans understood that the vast majority of climate scientists and peer-reviewed studies support the conclusion that climate change is a human created threat.
- Human activities, particularly the combustion of fossil fuels, are altering the climate system.
- Human-driven changes in land use and land cover:
  - urbanization,
  - deforestation
  - shifts in vegetation patterns that, resulting in changes to the reflectivity of the Earth surface (albedo)
  - emissions from burning forests
  - urban heat island effects and
  - changes in the natural water cycle.