



## A little science...A touch of fiction...A lot of adventure...

### News from the Den

Happy New Year Everyone - Welcome to new subscribers.

Another year is beginning and there is news in the Den. Our publisher sold the house and we will be working with a new publisher. Hopefully, all will continue seamlessly. Still waiting on news of reviews on *The Paris Contagion* - appendages remain crossed.

We feel we cannot begin a new year without reviewing the year just past. This is a bit cliché but it's a parallel to how science works. Someone has an idea and that lays a foundation and then others build upon it one stone at a time. It either is proven or it fails. From an idea to a thought-experiment to a hypothesis to a theorem to a principle, that's how science works.

As Jules Henri Poincaré stated

'Science is facts; just as houses are made of stone, so is science made of facts; but a pile of stones is not a house and a collection of facts is not necessarily science.'

So, in this issue we will change the format a bit to highlight some of the major advancements, discoveries, ideas, etc. made in 2022 which may become our foundation in 2023 and beyond.

### 2022

**Biology:** We've puzzled over the origin of life on Earth for decades. We hypothesize it began 3.8 billion years ago with the appearance of the first cells. But what formed the first replicating cells? Biochemist Nick Lane, University College London, proposed an unorthodox hypothesis in 2022: did proto-life precursor molecules evolve in a unique, energetic geologic environment? His view: 'life began when a mix of self-replicating RNA and other molecules, not fed by sunlight, but by the chemicals available at or around hydrothermal vents formed in the depths of the oceans.' This hypothesis is summarized in his new book: *Transformer, the Deep Chemistry of Life and Death*.

**Physics:** No one would argue that the James Webb Telescope and its success in the first months of observations isn't the best of all science in 2022. This amazing engineering and astronomical achievement defied all the odds, all the delays, all the threatened budget cuts and project cancellation, all human error and mechanical failure to lay the foundation for understanding the origins of the universe, the Big Bang, exoplanets and their atmospheres, and so much more. JWST will be a cornerstone of discovery for many years to come.

Others were not so lucky and we still are searching for a Standard Model for the universe - one which unites Quantum Physics with the General Theory of Relativity. But we may be one step closer with the discovery of the W Boson from a collider experiment at Fermi Labs.

What will the evolution of quantum computing give us? Secure communications, un-hackable technology, new cyphers, quantum wormholes? Qbits are our future.

**Mathematics:** My first physics professor noted 'as one continues with their studies in chemistry, physics and math, at some level they all become the same field of study'. All these disciplines merge into one, with math at its core. Problems and solutions. When a 17-year old solved one of the oldest postulates in number theory, CA feels very old. But deep learning and the evolution of AI is what we are watching in 2023. AIs that beat chess masters, can recognize speech and now are being deployed in mathematics to tackle the unsolved problems. Where does human intuition beat AI? We may find out soon.

**Geoscience:** Climate, climate, climate. Enough said. The planet is resting on a tipping point for the future. The largest source of climate uncertainty is still the human dimension. Humankind has made grand gestures at worldwide conferences to combat climate. But are we doing enough? Mega-fires, bomb cyclones, super typhoons, millennia-long droughts, extinctions at an alarming rate, and heatwaves are happening around the globe. Now, we are finding better ways to model our climate. AI and quantum computing is leading the way. Can we move models to action? One company thinks so.

Vesta, a new California company, is hoping to accelerate mineral weathering in beach sands to remove a gigaton of atmospheric CO2 per year. They project a cost of \$35 per ton. Increasing the oceans' natural ability to remove carbon from the atmosphere is less expensive than permanent CO2 removal using other methods. Fingers crossed.

Earth science is based on the theory that 'the past is the key to the future'. This maybe particularly true when it comes to the world's nuclear weaponry. The Cold War maybe over but a new one is evolving and more than 2000 nuclear warheads remain in existence. The most dangerous threat to climate would be the near-instantaneous change brought on by nuclear detonation. Nuclear climate change would include persistent winter-like weather patterns and severely impact food production. Therefore, the US is planning improvements to the International Monitoring System to watch for unauthorized nuclear testing and detonation.

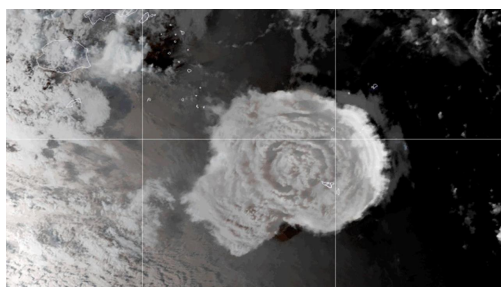
A sub-oceanic volcanic eruption on 14-15 January 2022 was one of the most powerful on record. The roar of the Hunga Tonga-Hunga Ha'apai's eruption, when it broke the ocean surface, was heard 6,000 miles away in Alaska. The volcanic cloud left the earth's atmosphere and touched space. The amount of CO2 released by the volcano equaled a whole year's emission on Earth. Humans are not the only source of greenhouse gases.

**Medicine:** The development of a scalable, rapid-response RNA sequencing platform used to create the Sars-CoV2 vaccines will have major impact on other diseases, cancers and a protection against future pandemics. CRISPR gene-editing is being expanded to address genetic diseases.

As we noted in a prior newsletter, stress and aging of our genome go hand-in-hand. Those born during the Great Depression showed signs of cellular aging throughout their life. Those born during the WWII famine years in the Netherlands showed the same cellular changes and life-long diseases. Now, we have indications that the COVID pandemic created these same stress environments. Scans of the brains of teenagers show accelerated aging, future health concerns may be present for these young people.

### Photo of the Month - Hunga Tonga-Hunga Ha'apai

Breaking the surface of the Pacific Ocean, Hunga Tonga-Hunga Ha'apai volcano created a mound of water 90m high and sent tsunamis racing across the Pacific basin. Satellite image from NASA Earth Observatory.



Hunga Tonga-Hunga Ha'apai Eruption

### In Memoriam - Walter Cunningham

Walter Cunningham, age 90, physicist, Marine pilot and Apollo 7 astronaut. His 1968, 11-day mission laid the ground work for the moon landing and NASA's success after the fatal fire and death of three astronauts the prior year. Their flawless mission of 163-Earth orbits was the first to appear on television.

### Book of the Month - *Structure of Scientific Revolutions* by Thomas S. Kuhn

The *Structure of Scientific Revolutions* by Thomas S. Kuhn, 50th Anniversary Edition. A good book may be remembered and impact how we view the world, a great book becomes part of us to the point we forget how insightful its ideas are. This seminal work by one of the great scientific philosophers of the 20th-century is as timely today as it was 50 years ago.

### Minutiae

*Quantum Time* is evolving. We had a Zoom with the new publishers. *The Paris Contagion* is slated for publication on March 15. Hardcopy, ebook and audio will be available at your favorite online source.

All the best for the New Year - Be kind.



keep being curious

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