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LaRouche's Fourth Law



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LaRouche's Fourth Law

EDITORIAL

A Campaign Unlike Any Other

by Harley Schlanger

Aug. 7—As we, as a people, move through the month of August 2020, with a Presidential election now only three months away, the question is posed to each of us: Do we have the moral fitness to survive? We are not outside observers of these events, nor is it our job to “report on” or make commentaries about what is transpiring. The issue before us is, as Abraham Lincoln posed it: *Will government of the people, by the people, and for the people—the greatest experiment in the freedom to do good and foster human creativity in history—survive and prosper into the future?* The responsibility to ensure that this occurs lies within each of us, and the decisions we make and actions we take over the next 12 weeks will determine the outcome.

The election of Donald Trump in November 2016 delivered a profound shock to an establishment which assumed that Hillary Clinton’s election would ensure continuity in strategic and economic/financial policy. Decades of post-industrial wreckage had transformed America from an industrial powerhouse to a nation dependent on cheap goods imported from poor nations. At the same time, the destructive effect of non-stop wars and military adventures destroyed thousands of the nation’s young people and wasted trillions of dollars in actions that made the country less secure. These developments triggered a restless anger among the people, but the nation’s political leaders and pundits were blind to this, and the pollsters missed it entirely.

Trump’s insurgent campaign decimated the old guard of the Republican Party on the way to his nomination, then repeated this in the general election. While Hillary Clinton arrogantly assumed she would be the inevitable victor, voters in states between the two coasts

rejected her intent to continue the devolution of the Obama presidency. Trump’s campaign rallied support by calling for an end to the wars of the George W. Bush and Obama years; overturning the trade deals worked out by corporate cartels, through which they profited obscenely at the expense of America’s productive work force; and providing an optimism that America’s best days were ahead,—in contrast to the pessimism imposed by the anti-growth, fake science of “man-made climate change,” and Green ideology.

Most significant among the challenges that Trump posed was the idea that a strong national economy and defense capability opened the door to peaceful cooperation with those nations designated by previous administrations as dangerous adversaries. In particular, he ridiculed the mainstream geopolitical dogma which asserts that Russia, under President Putin, is again an enemy, and should be confronted. For example, in Syria, where Clinton was willing to risk a war by imposing a “no-fly zone” to oppose Russian intervention to defend the government there from CIA-armed and trained terrorists, disguised as “moderate rebels.” It was Trump’s oft-stated desire to establish friendly, cooperative relations with Russia, which triggered the fraudulent narrative, fabricated by imperial forces in British intelligence and their allied War Hawks in both U.S. parties tied to the military-industrial complex, that Russia had “rigged” the 2016 election, and/or that Trump was a Russian puppet.

The Overdue Demise of Russiagate

A series of events sponsored by LaRouche PAC in the last week have thoroughly shredded the narrative of Russiagate, exposing it as a fabrication of deeply entrenched operatives in the permanent bureaucracy, di-

rected by leaders of the UK's MI6 and City of London financial interests, in coordination with leading figures of the intelligence community under Obama. Presentations by long-time Trump ally Roger Stone and former Technical Director of the National Security Agency Bill Binney provided conclusive evidence that there was no "Russian meddling" in the 2016 election, and that the fabric of lies woven by the investigation of special counsel Robert Mueller was intended to prevent the Trump administration from pursuing peaceful collaboration with Russia and China.¹

The continuous chanting of the mantra of the War Hawks of "Russia, Russia, Russia," followed by the equally fraudulent war drive against China, are expressions of the desperation of those savage forces to keep the era of endless wars alive. This has been typified by bipartisan Congressional opposition to Trump's efforts to remove U.S. forces from Syria and Afghanistan and reach a peaceful resolution with North Korea.

In his comments, Stone—whose prison sentence from a corrupt conviction in a federal courtroom was commuted by Trump—reminded viewers that Trump's attacks on the strategic and economic policies of the entrenched establishment were what provoked the enmity reflected in the continuous campaign against him. Stone said that he foresaw this destructive behavior as early as the 1980s, with the attacks against Lyndon LaRouche. He emphasized that the key to Trump's reelection is to return to the theme of peaceful cooperation, centered on ending the endless wars, and restoring the optimism of a pro-growth economic policy, oriented toward reviving U.S. industry through fair trade, and investment in infrastructure.

Binney, in addition to elaborating his forensic investigation—which decisively proved that there was no Russian hacking of the Clinton and Democratic National Committee computers in 2016—presented a compelling case against the "weaponization" of intelligence gathering. It was this process, accelerated over Binney's objections after the 9/11 attacks on the U.S., which made possible the illegal spying on the Trump campaign, as well as the collection of data on every American, in the name of security. Binney described the present crisis as the most threatening to the constitutional republic since the Civil War.

1. The most significant of these events are an August 1, 2020 LaRouche PAC [conference](#), and an exclusive [interview](#) Stone gave to this author.

Biden and the Old Regime

As the election nears, leaders of the British and Anglophile American establishments are becoming hysterically desperate to prevent a second Trump term. Every conceivable effort is being made to demoralize Trump supporters and to portray a Biden victory as the likely outcome, this coming from the mainstream media that hates Trump and takes its orders from the Bush/Obama apparatus. The same polling companies that predicted a Hillary Clinton victory as a certainty, are now deployed to brainwash Americans into believing that Biden is "way ahead."

This is all psychological warfare and part of the ongoing coup attempt. There is nothing objective or true about any of this "news." The demoralization and despair resulting from the COVID-19 pandemic and the accelerated collapse of the economy associated with the lockdowns, is being weaponized politically to bash Trump. Add to this the deployment of violent extremists who are burning American cities while proclaiming that Trump is a racist, and the latest attacks against Trump personally by the Manhattan District Attorney, who leaked that he is looking into "criminal" financial practices by Trump's real estate companies. Meanwhile a major initiative is underway to allow nationwide voting by mail, which will create the basis for massive vote fraud. All of this is designed to spread despair among Trump supporters.

Apparently, the cognitively challenged Joe Biden and his advisors believe there is a yearning for the days of the Obama presidency. But do they truly believe Americans want to continue the endless wars? Go back to trade agreements that destroyed the goods-producing capacity of America's work force? Reject scientific and technological advance in energy production and space exploration, in favor of the false promises of a fascist Green New Deal?

A lot of the Biden message is mere PR fluff, which no one takes seriously. As his handlers well know, there is no love for Biden among voters. Given his inability to formulate coherent policy ideas—as his appearances often demonstrate signs of extreme mental deterioration—he has spent most of the campaign in his basement, emerging only for short, highly-scripted statements to selected media accomplices. Thus, the plan will be to keep Biden as invisible and silent as possible, while escalating the incessant smears and slanders of Trump in the mainstream media.

The unraveling of the lies of Russiagate, which has been spearheaded by Bill Binney, has the potential to blow up this entire fragile scenario. The outcome in November will be determined by the ability to mobilize voters around a program that can accomplish what Trump promised to do in his 2016 campaign—to reverse the disastrous plunge towards war and bankruptcy, which is the legacy of Bush and Obama, and to rebuild the scientific and productive capabilities within the U.S. economy. To that end, LaRouche PAC is circulating a battle plan, its “2020 Terms of Battle,” which defines a positive direction for the nation, in the tradition of the American System policies that Trump enunciated before the all-out war to remove him from office.²

It is in the Artemis program—to return to the Moon and go on to Mars—that we find the best expression of

2. LaRouchePAC’s “[2020 Terms of Battle](#): Secure the American Revolution, Crush the British Empire.”

cultural optimism and the basis for mobilizing the American people. That optimism—as elaborated in LaRouche PAC’s Terms of Battle—defines the basis for Trump’s reelection and a successful second term.

As Roger Stone has suggested, this is the ultimate reason for Russiagate, for the entirety of the coup attempt,—the recognition by the corrupt and bankrupt establishment that the prophetic ideas of Lyndon LaRouche could be implemented by the “outsider” Donald Trump. It is now up to each of us to take these Terms of Battle and deploy with it, to rebuild and mobilize the coalition that led to Trump’s 2016 victory. This is not only a winning strategy, but the means whereby an unprecedented rebirth of the productive U.S. economy might be realized.

If we act in this way, we will make this campaign unlike any in recent memory, one in which voters reject the mass media manipulation and act to become the deciding factor in directing the future of the American constitutional republic.

Cover
This Week

Louis Pasteur (1822-1895). Of LaRouche's *Four Economic Laws*, the fourth points to the requirement for science driver programs for true economic growth.



Painting by Albert Edelfelt, 1885

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I. LaRouche's Fourth Law

THE AMERICAN SYSTEM AT ITS BEST

Science Driver Medicine: RNA Vaccine Technology Expands Into Broader Disease Treatment

by Ned Rosinsky, M.D.

Aug. 7—COVID-19 has created a worldwide disaster of unprecedented proportions. If the onslaught of the epidemic is not checked, it may affect most the world's population, and cause tens of millions of deaths.

Yet, as frightening as this COVID-19 prospect is, there is a breathtaking worldwide surge of research currently underway to develop preventive vaccines, as well as treatments for active cases. This response to the epidemic has also been unprecedented.

Some efforts are using traditional methods of extracting viral proteins and using them in a vaccine to stimulate an immune response. Some are using more advanced techniques such as taking a SARS-CoV-2 (the virus that causes COVID-19 illness) gene for a specific virus component, such as the spike protein, putting it into a harmless live virus, and using the virus to get the gene into the cells of the person. (The spike protein, on the surface of the virus, binds the virus to a receptor on the host cell.) The inserted gene is then used by the cells to make the coronavirus protein without the presence of the intact coronavirus, and this protein then stimulates an immune reaction that protects against the actual virus. And there are other advanced techniques in various stages of human testing, which I will describe below.

In the face of a general opposition to technological advance and basic science, begun with the environmental movement and accompanying anti-science Malthu-



Argonne National Laboratory

Ultra-high-vacuum scanning-probe microscopies, including scanning tunneling microscopy, tunneling spectroscopy, and atomic and molecular manipulation are used in the investigation of nanoscale phenomena. Here, a researcher at the Center for Nanoscale Materials at Argonne National Laboratory operates a synchrotron x-ray scanning tunneling microscope.

sianism in the 1960s, the medical research community is healthy and thriving in its response to the COVID-19 epidemic. Why are we apparently strong in medical research and so weak in other areas? It is fortunately due to a vital aspect of basic human nature. At this point in our development as a species, we all, each of us, will someday die. Our children will die. For those of us with living parents, we know that they will die.

Yet every year we read about progress in medical research. Sometimes it is agonizingly slow, sometimes it is surprisingly rapid. Currently we are going through a major transition in cancer treatment, using immune modulator mediations that improve the ability of the immune system to recognize cancer cells and attack

them, or medications that decrease the ability of the cancer cells to turn off the immune cell activity, or medications that decrease the ability of cancer cells to stimulate the growth of new blood vessels that feed the cancer, and so on. We now have hope for some tumors that previously were death sentences, such as melanoma, multiple myeloma, even lung cancer, and the field is exploding with potential new treatments.

We have not solved all the problems of cancer, heart disease, stroke, dementia, or the aging of body tissues generally, but there is a profound hope and expectation within the population that treatments, cures, and preventions for these major disorders is only a matter of time. After all, we have already seen a remarkable increase in life span in the U.S. over the past one hundred years.

This stubborn optimism is a thorn in the side of the oligarchs. They have tried to kill this optimism repeatedly, with HMO's making decisions for physicians on the basis of maximizing profits, with the right-to-die movement attempting to force through the idea that people who have a hopeless condition should be allowed to die, ravaging the medical ethic idea that every life is precious. And now we have the use of non-physicians practicing medicine independently, so potentially family practice physicians will no longer be needed.

Yet the optimism in the population continues, virtually unabated, and in the past several years it has been increasing to an unprecedented level, as the basic sciences of biochemistry, genetics, and physiology have ripened to the point that minor retooling of an established disease treatment may soon be all that is needed to produce a cure for even rare diseases, quickly and efficiently.

Yet the other problems in the economy persist, the destructive investments into derivatives, the trashing of the NASA and fusion budgets, the miserable state of our infrastructure, and the lack of a Hamiltonian type of national bank as a source of very long-term investments.

I propose that the COVID-19 epidemic and the astonishingly rapid vaccine and treatment research effort be used to spearhead a massive science driver for the economy. I propose that our weakened economy be returned to the American tradition of industrial and infrastructure development, new technology, Glass-Steagall

banking regulation, and a long-term investment perspective of a Hamiltonian national bank.

These four measures will not function individually, but they are interdependent and must be accomplished simultaneously. Keep in mind, if our economy is robust, we can roll with the punches of future unexpected disasters such as COVID-19 without suffering the way we are now. This stubborn belief in the idea of progress is the characteristic feature of the anti-entropic nature of the human species, the idea that human creativity is the driver of universal progress. This idea is enshrined in our Declaration of Independence and Constitution, that we have inalienable rights, that government exists to promote the general welfare. Now is the time to bring



The Chinese made people immune to smallpox by exposing them to small amounts of the scabs that arise over the smallpox pustules on the skin. This practice apparently goes back to the second century BCE.

these ideas to full fruition, to defeat the oligarchy once and for all, to finish what was started with the American Revolution against the British Empire.

Past Vaccines

Every human culture in recorded history has made attempts to prevent and treat human disease. Historical measures range from religious supplication, exorcising demons, and herbal remedies, to basic public health measures such as personal hygiene, clean water, a healthy diet, and safe working conditions. Among these efforts, the idea of providing immunity to a specific illness by exposure to a mild form of the illness dates back at least to the second century BCE.

There are indications that at that time, the Chinese were making people immune to smallpox by exposing them to small amounts of the scabs that arise over the smallpox pustules on the skin. The scabs are specific to the disease, with characteristic raised edges. The scabs were ground into a powder and inhaled through the nose. Alternatively, the material from a smallpox pus-

tule may have been taken and used for inoculation by scratching it into a person's skin. Either way would produce a smallpox infection, but it would be milder than the usual smallpox infection. Smallpox acquired naturally has a mortality of 10-30%, while smallpox acquired by exposure to the ground scabs or pustule material by skin scratch has a mortality in the range of 2%.

The Chinese Emperor K'ang, whose reign started in 1661 after he lost his father to smallpox, documented his own experience of supporting this vaccine treatment. The term "vaccine" generally refers to biological entities that produce active immunity against a particular infectious disease.

Reports of the Chinese use of smallpox inoculation were received by the Royal Society in London in 1700, one from an employee of the British East India Company. The smallpox vaccine approach was further advocated in England by Lady Mary Montagu, daughter of an English duke, who lost two brothers to the disease and then contracted smallpox herself in early adulthood, but survived. Later in her life, while travelling with her husband in Turkey where he was British Ambassador, she happened upon a group of old women who annually inoculated large segments of the local population with smallpox pustule material either by scratching it into the arm, or making a hole in a vein with a needle and forcing the material into the vein.

Lady Montagu also noted that smallpox infection was almost unknown in that area of Turkey, and she documented her findings in a letter dated 1717. Soon afterward, her husband was recalled to England where smallpox was common,



The smallpox vaccine approach used in China was further advocated in England by Mary Wortley Montagu, after she saw how effective it was in Turkey in 1717. Here she is portrayed by Jean-Baptiste van Mour.

and she decided to have her 5-year-old son inoculated in Turkey. During a smallpox epidemic in London she had her second child inoculated, and she invited the king's physician to observe the procedure. The child recovered from the vaccination well and did not subsequently develop smallpox from the epidemic.

Lady Montagu discussed the vaccine procedure with the Princess of Wales, whose children were possible heirs to the throne. The Princess of Wales then asked King George I to have her children inoculated. The king agreed to the procedure for her female children but not the males, fearing that these possible future heirs to the throne might die from the vaccine. The inoculation procedure subsequently became widespread in England, and also in the American colonies.

Benjamin Franklin learned of the smallpox inoculation procedure and advocated the inoculation starting in 1730. Franklin suggested that his friend William Haberden, who was an English physician, write a pamphlet describing the procedure. The pamphlet was produced, although it was not signed by Haberden. It was distributed extensively in the American colonies as well as in England.

The pamphlet provides a short list of the steps required to do the inoculation. Franklin was concerned that the vaccine was not being used widely enough, and he wrote a preface to the pamphlet in 1759, urging its use.



Benjamin Franklin, in a 1762 painting by Mason Chamberlin, an early promoter of smallpox inoculation.

Franklin on Smallpox

The pamphlet is titled, *Some Account of the Success of Inoculation for the Small-Pox in England and America. Together with Plain Instructions, By which any person may be enabled to perform the Opera-*

tion, and conduct the Patient through the Distemper.
The pamphlet then notes,

Since at least 1730, Franklin has advocated inoculation for smallpox as “a safe and beneficial Practice.” His suggestion for Dr. William Heberden’s pamphlet and his own preface to it may be regarded as further efforts to persuade the people to use “a discovery God in his mercy has been pleased to bless mankind with.”

Franklin’s preface follows.

The Preface of Benjamin Franklin

Having been desired by my greatly esteemed friend Dr. William Heberden, F.R.S., one of the principal Physicians of this city, to communicate what account I had of the success of Inoculation in Boston, New-England, I some time since wrote and sent to him the following paper, viz.

About 1753 or 54, the Small-pox made its appearance in Boston, New-England. It had not spread in the town for many years, so that there were a great number of inhabitants to have it. At first endeavors were used to prevent its spreading, by removing the sick, or guarding the houses in which they were; and with the same view Inoculation was forbidden; but when it was found that these endeavors were fruitless, the distemper breaking out in different quarters of the town, and increasing, Inoculation was then permitted.

Upon this, all that inclined to Inoculation for themselves or families hurried to it precipitately, fearing the infection otherwise be taken in the common way; the infection inoculated in every neighborhood spread the infection likewise more speedily among those who did not choose Inoculation; so that in a few months, the distemper went thro’ the town, and was extinct; and the trade of the town suffered only a short interruption, compar’d with what had been usual in former times, the country people during the seasons of that sickness fearing all intercourse with the town.

As the practice of Inoculation always divided people into parties, some contending warmly for it, and others as strongly against it; the latter asserting that the advantages pretended were imaginary, and that the Surgeons, from views of interest, conceal’d or

diminish’d the true number of deaths occasioned by Inoculation, and magnify’d the number of those who died of the Small-pox in the common way; It was resolved by the Magistrates of the town, to cause a strict and impartial enquiry to be made by the Constables of each ward, who were to give in their returns upon oath; and that the enquire might be made more strictly and impartially, some of the partisans for and against the practice were join’d as assistants to the officers, and accompanied them in their progress through the wards from house to house. Their several returns being received, and summ’d up together, the numbers turned out as follows,

Had the Small-pox in the common way		Of these died		Received the distemper by Inoculation		Of these died	
Whites	Blacks	Whites	Blacks	Whites	Blacks	Whites	Blacks
5059	485	452	62	1974	139	23	7

It appeared by this account that the deaths of the persons inoculated, were more in proportion at this time than had been formerly observed, being something more than one in a hundred. The favorers of Inoculation however would not allow that this was owing to any error in their former accounts, but rather to the Inoculation at this time [of] many unfit subjects, partly through the impatience of people who would not wait the necessary preparation, lest they should take it in the common way; and partly from the importunity of parents prevailing with the Surgeons against their judgment and advise to inoculate weak children, laboring under other disorders; because the parents could not immediately remove them out of the way of the distemper, and thought they would at least stand a better chance by being inoculated, than in taking the infection, as they would probably do, in the common way. The Surgeons and Physicians were also suddenly oppress’d with the great hurry of business, which so hasty and general an inoculation and spreading of the distemper in the common way must occasion, and probably could not so particularly attend to the circumstances of the patients offered for Inoculation.

Inoculation was first practiced in Boston by Dr. Boylston in 1720. It was not used before in any part of America, and not in Philadelphia until 1730. Some years since, an enquiry was made in Philadelphia of the several Surgeons and Physicians who had practis’d Inoculation, what numbers had been by each inoculated, and what was the success. The result of this enquiry

was, that upwards of 800, (I forget the exact number) had been inoculated at different times, and that only four of them had died. If this account was true, as I believe it was, the reason of greater success there than had been found in Boston, where the general loss by Inoculation used to be estimated at about one in 100, may probably be from this circumstance; that in Boston they always keep the distemper out as long as they can, so that when it comes, it finds a greater number of adult subjects than in Philadelphia, where since 1730 it has gone through the town once in four or five years, so that the greatest number of subjects for Inoculation must be under that age.

Notwithstanding the now uncontroverted success of inoculation, it does not seem to make that progress among the common people of America, which at first was expected. *Scruples of conscience* weigh with many, concerning the *lawfulness* of the practice: And if one parent or near relation is against it, the other does not choose to inoculate the child without the consent of all parties, lest in case of a disastrous event, perpetual blame should follow. These *scruples* a *sensible Clergy* may in time remove. The *expense* of having the operation perform'd by a Surgeon, weighs with others, for that has been pretty high in some parts of America; and where a common tradesman or artificer has a number of his family to have the distemper, it amounts to more money than he can well spare. Many of these, rather than own the *true motive* for declining Inoculation, join with the scrupulous in the cry *against it*, and influence others. A small Pamphlet wrote in plain language by some skillful Physician, and publish'd, directing what preparations of the body should be used before the Inoculation of children, what precautions to avoid giving the infection at the same time in the common way, and how the operation is to be performed, the incision dress'd, the patient treated, and on the appearance of what symptoms a Physician is to be called, &c. might by encouraging parents to inoculate their own children, be a means of removing that objection of the expense, render the practice much more general, and thereby save the lives of thousands.

The Doctor, after perusing and considering the above, humanely took the trouble (tho' his extensive practice affords him scarce any time to spare) of writing the following PLAIN INSTRUCTIONS, and generously, at his own private expense, printed a very

large impression of them, which was put into my hands to be distributed *gratis* in America. Not aiming at the praise which however is justly due to such disinterested benevolence, he has omitted his name; but as I thought the advice of a nameless Physician might possibly on that account be less regarded, I have without his knowledge here divulg'd it. And I have prefixed to his small but valuable work these pages, containing the facts that gave rise to it; because *facts* generally have, as indeed they ought to have, great weight in persuading to the practice they favour. To these I may add an account I have been favoured with by Dr. Archer, physician to the Small-pox Hospital here, viz.

There have been inoculated in this Hospital since its first institution to this day, Dec. 31, 1758, 1601

Of which number died, 6

Persons who had the Small-pox in the common way in the Hospital, to the same day, 3856

Of which number have died, 1002

By this account it appears, that in the way of Inoculation there had died but one patient in 267, whereas in the common way there had died *one* in *four*. The mortality indeed in the latter case appears to have been greater than usual, (one in seven, when the distemper is not very favorable, being reckon'd the common loss in towns by the Small-pox, all ages and ranks taken together) but these patients were mostly adults, and were received, it is said, into the Hospital, after great irregularities had been committed. By the Boston account it appears, that, Whites and Blacks taken together, but about one in eleven died in the common way, and the distemper was therefore reckon'd uncommonly favorable. I have also obtained from the Foundling Hospital, (where all the children admitted, that have not had the Small-pox, are inoculated at the age of five years) an account to this time of the success of that practice there, which stands thus, viz.

Inoculated, boys 162, girls 176, in all 338.

Of these died in Inoculation, only 2.

And the death of one of those was occasioned by a worm fever.

On the whole, if the chance were only as *two* to *one* [i.e., twice as many deaths from naturally acquired smallpox compared to the number of deaths from the vaccination—ed.] in favour of the practice among children, would it not be sufficient to induce a tender parent

to lay hold of the advantage? But when it is so much greater, as it appears to be by these accounts (in some even as thirty to one) surely parents will no longer refuse to accept and thankfully use a discovery God in his mercy has been pleased to bless mankind with; whereby some check may now be put to the ravages that cruel disease has been accustomed to make, and the human species be suffered to increase as it did before the Small-pox made its appearance. This increase has been more obstructed by that distemper than is usually imagin'd: For the loss of one in ten thereby is not merely the loss of so many persons, but the accumulated loss of all the children and children's children the deceased might have had, multiplied by successive generations.

B. Franklin,
of Philadelphia.

There are several aspects of this Franklin preface that are startlingly modern.

First, he gives the actual numbers generated by the studies, the cases of inoculation versus naturally acquired smallpox, and the outcomes, so the likelihood of effectiveness and adverse effects can be calculated.

Second, the numbers he accesses are in the hundreds to thousands, large enough to provide a reasonable determination of the strength of his conclusions.

Third, the gathering of the evidence of vaccination and outcomes in the initial Boston study was verified by municipal workers assigned to go door-to-door and interview patients and their families, an important attempt to eliminate bias in the reporting. They even recruited pro- and anti-vaccine citizens to accompany the municipal workers as they gathered the data.

Fourth, he contrasts the findings in Boston, where there was a major epidemic during the inoculations, and Philadelphia, where there was a less severe epidemic at the time. Both locations showed a strong effect of vaccination and a low number of deaths from the vaccine, but the results were more pronounced in Philadelphia. Franklin attempts to explain this discrepancy by pointing out that the urgency of the situation in Boston may have decreased the quality of patient evaluations prior to inoculation, as well as the quality of follow up after inoculation. Franklin thus analyzes potential weaknesses in the initial Boston study.

And fifth, by including the statistics on blacks as

well as whites in the Boston study, Franklin, the political and philosophical father of the United States, more than 250 years ago demonstrated his concern for the lives, safety, and wellbeing of blacks as well as whites.

Franklin's focus on a potential weakness in his study, the discrepancy between the numbers in Boston versus Philadelphia, is a lesson sorely needed today, given the recent flurry of reports of vaccines and treatments for COVID-19 that are hailed as miraculous, prior to the completion of, or even attempt to do, competent, controlled double-blind studies. A double-blind study, considered the gold standard in modern research, involves providing the test treatment to some patients and an alternative treatment or "sugar-pill" to other patients, in which neither the patients nor researchers know who gets the treatment or the alternative until the study is over and the data is analyzed. This is done in an attempt to eliminate conscious and unconscious bias in doing the study.

A potential weakness in the study is that the overall risk of not getting the vaccine is not addressed. This risk would be related to the likelihood of getting smallpox naturally during the individual's entire lifespan.

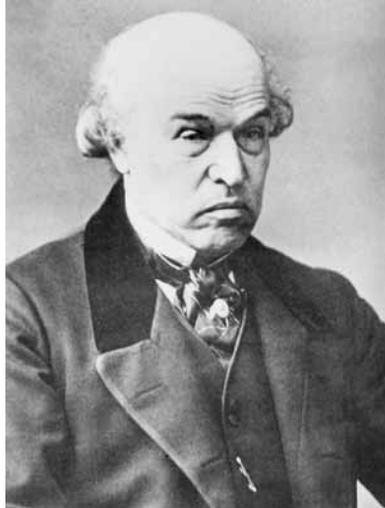
If smallpox were rare, then even if the chance of dying from the vaccine were much lower than dying from naturally occurring smallpox, that is, if they were both rare, that would have decreased the motivation for getting immunized. Franklin gets close to this point when he remarks that in Philadelphia, most of the naturally occurring cases were in children, because most of the adults were immune from frequent past epidemics. In contrast, in Boston the attempts to keep the disease out resulted in less frequent epidemics but the epidemics hit a larger proportion of the population when they did occur, due to decreased immunity in the population. The Philadelphia case indicates that the likelihood of getting smallpox naturally over one's lifespan is high, considerably over 50%.

Another way to approach this problem is to look at the total populations of Boston and Philadelphia during the time of the study.

Data recorded in the Johnson Cyclopeda from individual census studies, as well as estimates from the number of dwellings, put Boston at 17,000 in 1740; 15,731 in 1750; and 15,756 in 1760. The significant drop from 1740 to 1750 is discussed in the Johnson Cyclopeda, and is ascribed to smallpox and war. Philadelphia, in contrast, goes from 13,400 in 1750 to 18,758 in



Alchethron



Public domain, c. 1860

English physicians John Fewster (left) and Sir William Jenner were friends and professional colleagues.

1760, with no data from 1740. Now compare these total population figures to the total of naturally occurring cases in the Franklin tables. Boston had a total of 5,544 cases, Philadelphia a total of 3,856. Both of these numbers are a significant proportion of the total population, and they occurred during a single epidemic cycle. If naturally acquired smallpox is not rare, then Franklin's conclusions are valid.

Continuing Vaccine Efforts

The next step in the development of the smallpox vaccine came in 1768, when an English physician, John Fewster, was in the process of inoculating people with material from active smallpox cases. People who had survived an earlier smallpox infection were screened out and not inoculated, since they had acquired immunity. He expected that people who were inoculated would get the milder form of smallpox, and then would be immune to the disease.

On one occasion he inoculated a farmer, who did not have any response to the smallpox inoculation exposure. While discussing this with the farmer, the farmer said that he had in the past a severe case of cowpox. Fewster then questioned several other people who had no response to the inoculation, and he found that they all had a history of past illness with cowpox. The cowpox illness resembles smallpox, with skin abscesses and fever, but is very rarely fatal. Fewster then tried inoculating people with cowpox abscess material. He found that it was effective for causing immunity to

smallpox, and was much safer than using smallpox material to do the inoculation.

This practice of using cowpox material spread rapidly in England and the American colonies. It is amusing that the English physician William Jenner, in 1798, published an article discussing the use of cowpox inoculation in a small number of patients, without reviewing any of the history of this practice in his article. When he died shortly after this publication, his biographer fabricated a story that Jenner had heard of the possibility of using cowpox from a milkmaid when he was 13, and that he got around to trying it out in 1798.

However, it is documented that Jenner had learned the practice of medicine from two physicians who were outspoken advocates of using cowpox to immunize against smallpox, so he would have been aware of the use of cowpox from his early training. Jenner was subsequently given credit for discovering the cowpox inoculation, and Fewster was forgotten, until the history was clarified several years ago.

Such was the state of documentation and communication of medical knowledge in those days. Physicians kept each other informed of advances in knowledge at informal meetings in taverns. Franklin's beautiful study of the effectiveness and safety of cowpox inoculation would have been published today in a peer-reviewed medical journal, and the peer-reviewer would likely have raised the issue of the total population of the cities under consideration. Franklin, probably thinking that the total population numbers were well known at the time and not needing documentation when he wrote the pamphlet preface, would likely have complied with the peer-reviewer's comments and added the information, so that the conclusions would make sense wherever and whenever the article was read.

Of all the diseases affecting the human species, why would smallpox have been so early a focus for vaccine treatment? There are several issues that stand out in the case of smallpox.

First, it has a high mortality, and before widespread vaccination it was responsible for more deaths than any other infectious disease including the black plague.

Second, if an affected person survives the illness, he or she will never again contract the disease. Third, the distinct skin pustules and scabs are useful for identifying the disease, unlike diseases characterized by more general symptoms such as fever, cough, body pain, diarrhea, or more non-specific rash. Some diseases with non-specific symptoms may confer immunity, but since a similar-appearing disease may subsequently occur, the immunity to the first disease may go unnoticed.

Fourth, the skin pustules or scabs can be easily sampled, and therefore very small amounts can be given to healthy people in attempts to cause a milder illness which confers future immunity. Also, the samples can be manipulated, such as by drying, which may further weaken the smallpox severity with vaccination.

Pasteur

Louis Pasteur (1822-1895) initiated the next major developments in vaccine development. He was an artist as a child, pre-occupied with sketching. His father urged him to enter a profession that would provide support for a family, and after some difficulties with early studies he became interested in chemistry. At age 24 he worked on the chemistry of tartaric acid, a naturally occurring substance found to be produced in the process of fermentation.

In 1815 the chemist Jean-Baptiste Biot had discovered that polarized light could undergo rotation when passing through organic substances. Biot did not draw any conclusions regarding chemical structure from these findings.

In his work with tartaric acid, Pasteur noted that tartaric acid from fermentation rotated polarized light, but tartaric acid produced from simpler substances in the chemistry lab did not rotate light. While examining crystals made from the lab-produced tartaric acid, Pasteur noticed that they were not all identical, but occurred in two forms. These two crystal forms were

mirror images of each other—analogue to the difference between the right hand and the left hand—due to the angles of their characteristic facets. He separated the two groups of crystals, and he found that the two forms polarized light in opposite directions.

From this finding he developed his hypothesis that there were two chemical forms of tartaric acid, which were mirror-images of each other. Today, the property of a molecule occurring in two mirror-image forms is termed chirality. And in addition, he con-

cluded that the tartaric acid produced in fermentation was only of one of the forms. He thus came across evidence that tartaric acid had a geometric structure which was of a form that it could demonstrate chirality, and this was before any specific knowledge regarding that form was known.

Keep in mind that at that time little was known about the geometry and structure of chemical compounds. There was no evidence that electricity is a flow of electron particles, and there was no understanding of molecular bonds between atoms.

It would have taken a visual artist such as Pasteur to appreciate and to be fascinated by this finding, someone with a strong,

creative geometric imagination. This chirality may also have indicated to him that living processes were qualitatively different from non-living processes, which would play a role in his later arguments against spontaneous generation, as well as in his subsequent formulation of the germ theory of disease.

Informed by his impression of the potential complexity of living metabolism, derived from his extensive work on the chemistry of substances derived from living processes such as fermentation, Pasteur became opposed to the generally accepted idea of spontaneous generation of bacteria in rotting material. It was known that bacteria would not form in closed jars of material that were initially heated to kill any bacteria present at the start. The supporters of spontaneous generation held that the exposure to air was sufficient to generate



Louis Pasteur, as photographed by Paul Tournachon in 1878.

microscopic life, which was why the jars had to be open to promote bacterial occurrence.

To test this air-exposure hypothesis, Pasteur devised a flask containing heat-sterilized broth with a long, narrow S-shaped neck open at the end. He found that mold and other living microorganisms would not subsequently appear in the broth, even though it was exposed to the air through the long, twisted flask neck, likely due to any dust carrying microorganisms that entered the flask opening settling within the twisted neck and not traveling to the broth. This one experiment demolished the notion of spontaneous generation. Pasteur was the first to think of creating this experimental apparatus in the long history of the debate regarding spontaneous generation, and possibly it was his creative geometrical imagination that suggested using the long S-shaped flask neck.

Pasteur continued to study bacteria, in the context of an explosion of interest in microscopic life in the latter part of the nineteenth century. Pasteur became interested in the problem of the souring of wine and milk. He documented that the souring was due to microorganism growth, and he found that heating wine and milk, followed by keeping these liquids in air-tight containers, would prevent souring. This process, termed Pasteurization, became widespread throughout Europe.

Enlarging on his experience with microorganisms souring wine and milk, Pasteur developed an interest in the role of microorganisms in human and animal disease. In particular, he became interested in vaccine development. He studied the chicken cholera bacterial disease. He grew chicken cholera bacteria cultures in chicken broth, and he used these cultures to sicken chickens and study their reaction, which was usually fatal.



Süddeutsche Zeitung

Dr. Robert Koch, the German bacteriologist and physician, in his laboratory, 1871.

While Pasteur was on a month-long vacation, he assigned a research associate to continue the chicken inoculation, but the associate did not follow the instructions and went on vacation himself. When the associate returned, he used the old cultures to inoculate chickens, which caused disease but was not fatal.

When Pasteur returned, he used these recovered, healthy chickens to study inoculation from viable cultures, and he found that they were resistant to the disease. He reasoned that the failed cultures had weakened the bacteria to the point that they could not cause fatal disease, but they could still confer immunity on the host.

This was the first use of deliberately weakened microorganisms to confer im-

munity without causing disease. Unlike smallpox inoculation with scabs or pustule material, the chicken cholera inoculation did not cause a potentially life-threatening disease. And unlike the use of cowpox for smallpox inoculation, it was not necessary to find a similar, naturally occurring but less harmful microorganism to use for the vaccine. Pasteur presented these findings to the French Academy of Sciences in 1880.

This case of serendipity, the chance discovery that the spoiled cultures of chicken cholera would confer immunity without harming the chickens, illustrates a point that Pasteur made earlier in his career in 1854. On that occasion he had been appointed dean at the University of Lille, the site where he would be doing studies on the chemistry of fermentation. During the appointment ceremony Pasteur stated, “In the field of observation, chance only favors the prepared spirits.”

Pasteur subsequently collaborated with bacteriologist and physician Robert Koch in studying anthrax, which was killing large numbers of sheep in Europe at

that time, and occasionally infecting humans. Koch identified the bacterium involved, and he gave samples to Pasteur. Pasteur weakened the anthrax bacteria with the chemical potassium dichromate, and he used the weakened bacteria to do a large experiment on sheep. He inoculated half the sheep with his vaccine, and then exposed all the sheep to anthrax. All the non-vaccinated sheep died, and none of the vaccinated sheep died. This experiment was widely publicized, and it was important for establishing Pasteur's credibility against his vociferous critics. Koch meanwhile became famous for discovering the bacteria that cause tuberculosis and cholera. He also developed techniques for pure cultures, using agar.

In a major advance, Pasteur then developed a vaccine against rabies. The causative agent is a virus, and not visible using the microscopes of that time. Pasteur modified his culture technique, using live rabbits to grow the virus, and then drying the affected rabbit nerve tissue to weaken the virus. The initial trials were controversial, but in 1886 Pasteur was able to do a trial on 350 people who had been exposed to rabies, and only one developed rabies. The success of this effort led to financial support for the creation of the Pasteur Institute, with the initial task of large-scale production of rabies vaccine.

In line with his broad experience with microorganisms causing disease, and using his personal credibility, Pasteur advocated public health measures to reduce bacterial contamination. He advised surgeons to wash their hands prior to performing surgery and between examining patients, measures that were accepted due to Pasteur's immense reputation. These measures greatly reduced surgical infections, and they also reduced puerperal fever, which can be fatal, in maternity wards.

Into the 20th Century

In the twentieth century, whole-organism vaccines continued to be developed, using either weakened or dead microorganisms. These vaccines were effective against measles, mumps, German measles, and diphtheria. The polio vaccine was developed in the 1950s, and an effective worldwide smallpox vaccine program eradicated this disease in the 1970s. The weakened live vaccines have the advantage that they can induce responses from several segments of the immune system: the host's white blood cells termed killer T-cells and helper T-cells, and the protein antibodies. The dead

vaccines do not stimulate T-cell response, but do stimulate antibodies, so they are at times less effective than live vaccines. The problem with weakened live vaccines is that they may cause significant disease in people who are immune-compromised, such as people with AIDS or cancer.

To address these concerns, attempts have been made to use specific components of the offending bacteria or viruses, such as toxins or constituent proteins, which can generate a helper T-cell response as well as antibodies. These vaccines are termed second-generation.

It is important to keep in mind the progress of physics, chemistry, biology, and medical science generally, as the context for vaccine production, particularly in the nineteenth and twentieth centuries. There is also the political and philosophical climate, and the state of the cultural level. While the enormous extent of this historical field is beyond the scope of the present article, some highlights should be pointed out.

In addition to vaccines used to prevent infections, treatments for active disease using antibiotics were initiated in the twentieth century, including penicillin, found serendipitously in 1928, and tetracycline, discovered in 1957.

Before the development of antibiotics, there were no effective treatments for most bacterial infections, and bacterial infection was a major cause of infant mortality. Most combatant deaths in the Civil War were from wound infections, not from the wounds themselves. The great composers Schubert, Chopin and likely Mozart died early from infections which would today be eminently treatable—Schubert at 31, Chopin at 39, and Mozart at 35. The *Annals of Internal Medicine* published a study in August 2009 reviewing the historical data, including statements made by Mozart's contemporary family that he had a high fever and body swelling prior to death; the study concluded that he died of a Strep infection. And what a chunk of unwritten music died with him.

During the twentieth century, the physiology of many human diseases became increasingly understood, such as the discovery of insulin in 1921 and its first use in diabetes in 1922. Prior to the discovery of insulin, most childhood diabetics died in the first two years after the onset of the disease. We provide here a primer providing basic information regarding chemicals, catalysts and nucleic acids.

Continued on page 21

Chemical Reactions, Catalysts and Nucleic Acids

Chemicals are composed of atoms, and chemical reactions are changes in chemical composition. These changes may involve two chemicals combining to form one; a chemical breaking into two parts; or a part of one chemical transferring to another chemical. These chemical changes usually involve an intermediate state that has a temporary high energy level.

Think of playing catch with a football. Initially, one person holds the ball; this state is a stable low-energy state. That person then throws the ball, and while the ball is travelling through the air, the overall energy state is elevated. Then someone catches the ball, and the energy state returns to a stable low energy. Furthermore, if the thrower is standing at a higher elevation than the catcher, then the final energy state is lower than the initial state. The chemical reaction equivalent to the ball travelling in the air, is the activated intermediate state, a state of higher energy.

Now think of playing catch, where the passer and receiver are on opposite sides of a house that is located between them, and the passer and receiver cannot see each other. The passer has to throw the ball over the house, has to impart a significant energy to get the ball over the house, and has to do it in such a way that the ball ends up travelling in the correct direction, towards the receiver. If the house is more than 4 or 5 stories high, the game of catch may become impossible. This is where a catalyst comes into the picture. A catalyst lowers the required activation energy, lowers the height of the house.

In chemical reactions involving chemical changes in metabolism, an activation energy is frequently required, because the intermediate state has an imbalance in charge, a buildup of positive or negative charge, as in the process of transferring electrons between chemicals. The energy involved in this localization of charge can be lowered if, for example, the electro-negativity or electro-positivity can be dispersed over a larger area, so it is not so concentrated. Metals make good catalysts in industrial chemical processes because some of the electrons in a metal can move relatively freely, which is why metals conduct electricity easily. If a metal is in the presence of a chemical reaction, the buildup of charge in the reaction intermediate state can delocalize into the metal, so the reaction can go to completion more easily.

A related issue is that in the metabolism of living organisms, the geometries of the reactants can be quite complex, and the chemical changes are likewise geo-

metrically complex. Using the football catch game analogy, if a set of goal posts is planted in the roof of the house, and the passer is required to throw the ball between the goal posts, then the receiver has an idea of where to expect the ball even though he cannot see the passer on the other side of the house, so the geometry is simplified. And just as in an actual football game, energy and geometry are both crucial in making a successful pass. Geometry includes orientation of the reactants, and also the shape and bulk of the reactants. In the football analogy, the position and mobility of the defense must be taken into account when the offense makes a pass.

In living organisms, the catalytic role is played by enzymes, which are generally large, specialized proteins. The proteins may have extended molecular electron orbitals that can diffuse the buildup of charge in chemical intermediates during the chemical reaction, and the proteins have specialized geometries that can fit like a hand-glove to choose the correct reactant chemicals from the biological environment, and then orient and hold the reactant chemicals in the correct positions for the reaction to occur.

The biological chemical reaction pathways function in the metabolism of the organism to utilize nutrients to extract energy, create the chemical building blocks used by the organism to grow and reproduce, and are involved in numerous other functions. The primary chemicals involved in metabolism are carbohydrates (such as sugars, starch, glycogen, and cellulose), lipids (fats and fat-soluble substances such as cholesterol), proteins, and nucleic acids. The primary elements composing these chemicals are carbon, hydrogen, oxygen, and nitrogen.

Dr. Robert J. Moon, the American physicist, chemist and engineer created a [model](#) of atomic nuclei in the 1980s using geometric symmetries based on the Platonic solids. These symmetries imply resonances that function to stabilize the physical entity. Similar geometric resonances appear to occur on the level of the atom and in chemical compounds.

The genetic material is made of DNA (deoxyribonucleic acid) both in the most primitive living organisms, the bacteria (prokariotes); and in the more advanced organisms, those with a nucleus in the cell (eukariotes). DNA is a polymer, a long molecule composed of subunits, termed monomers, which are nucleotides. A short gene may contain approximately 15 of these subunits, while a large gene may have 100 or more

subunits. Each nucleotide monomer subunit consists of one of four possible nitrogen-containing bases (think of the basic quality of the related ammonia, NH_3), a deoxyribose sugar molecule (a 5-carbon sugar), and a phosphate group (think of the acidic quality of the related phosphoric acid). The four possible nitrogen-containing bases are adenine, cytosine, guanine, and thymine.

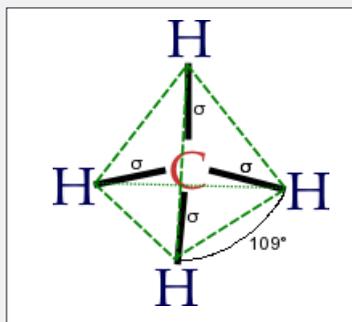
The backbone of each DNA strand is held together by chemical bonds between the phosphate and sugar components, and the two strands are held together in the double helix by comparatively weaker hydrogen bond interactions between the pairs of bases, adenine from one strand matching with thymine from the other strand, and cytosine matching with guanine.

The specificity of the gene is determined by the sequence of the 4 possible bases in the DNA polymer. DNA usually exists as a double helix of two strands of nucleic acid. The human genome consists of 3 billion pairs of bases, arranged in 23 pairs of chromosomes which are located within the cell nucleus. The DNA of bacteria ranges in size from 130,000 base pairs to over 14 million base pairs. For example, the genome of *E. coli* consists of 4.6 million base pairs arranged in a single closed loop chromosome. Most of the DNA in bacteria codes for genes, the rest being utilized for control of genetic expression.

In advanced organisms, the great majority of the DNA does not code for genes, but is involved in regulating the activity and timing of the expression of the genes. In the human, only 2% of the DNA codes for genes; the rest of the DNA is involved in gene control and expression.

Each cell in the body has a complete set of genes, and in each particular cell only the genes that are needed for that cell type are active. You do not want fingernail

Methane, CH_4 , Tetrahedral Geometry



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A carbon atom forms 4 chemical bonds at the tetrahedral angle; hydrogen forms 1 bond.

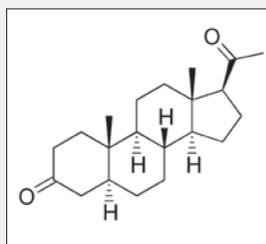
genes active in your retina cells, unless you want to give someone the evil eye.

RNA (ribonucleic acid) is usually a single-strand polymer. RNA differs from DNA in several respects, with thymine replaced by another base, uracil; and deoxyribose replaced by another sugar, ribose. There is evidence that electrical currents may move along the strands of both DNA and RNA, which may have implications for enzymatic activity of these molecules, and these electrical currents may also support an antenna-like function for the molecules.

Although DNA is the genetic material in most organisms, RNA is also present in these organisms. The DNA genes, when activated, are used to create analogous copies of RNA, termed messenger RNA (mRNA). The sequence of bases in the DNA is mirrored by the base sequence in the messenger RNA. In eukaryotes this occurs in the nucleus. The mRNA then moves out of the nucleus to the cytoplasm of the cell, and it is utilized by structures in the cytoplasm, the ribosomes, to determine the production of proteins. The ribosomes are themselves composed of ribosomal RNA (rRNA) and proteins. The ribosome has an active site for the linking of protein building blocks, amino acids, to produce proteins. This active site has been shown to be portions of the rRNA itself.

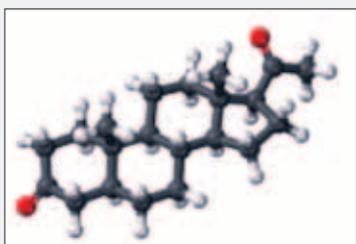
Therefore, these portions of rRNA are functioning

Three Visual Representations of the Same Chemical



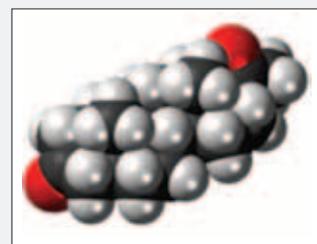
Wikipedia/Jynto

Line Angle Representation



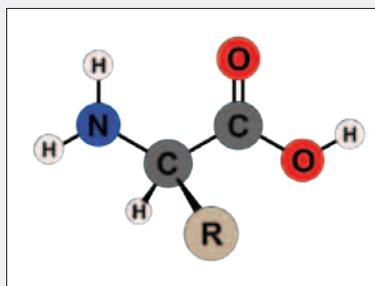
Wikipedia/Jynto

Ball and Stick Representation



Wikipedia/Jynto

Spatial Extent of Atoms



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The Amino Acid Structure in Its Un-Ionized Form

The word amine refers to the NH_2 group attached to the left carbon. The acid arises from the loosely held H on the OH group attached to the right carbon. Nitrogen forms 3 bonds, oxygen forms 2 bonds. Carbon and oxygen may form a double bond, illustrated by a double straight line connecting them, which changes the tetrahedral 4-atoms bonded to carbon geometry to a flat 3-atoms bonded to carbon. The R represents the side chain, which is specific and different in each of the 21 amino acids that are the components of protein.

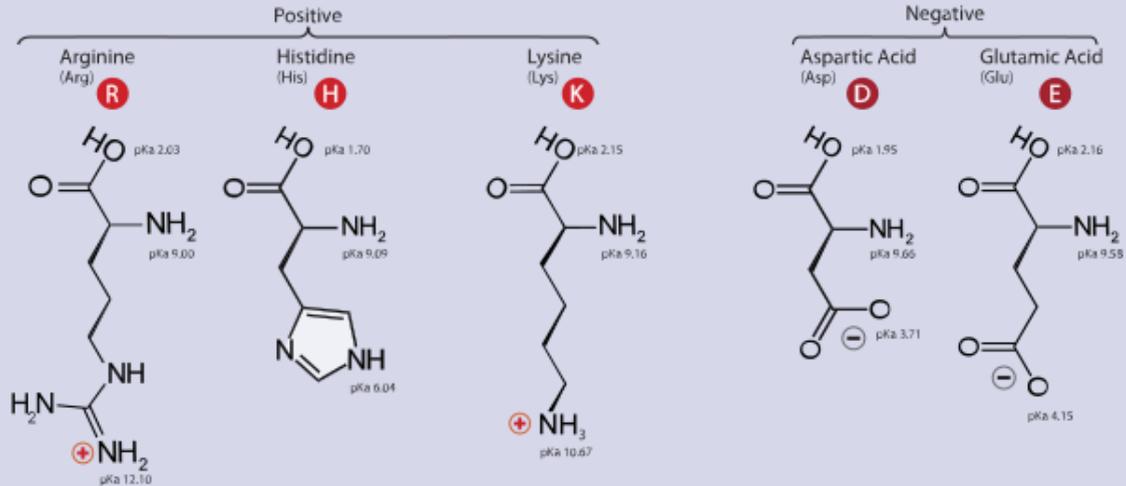
Twenty-One Amino Acids

⊕ Positive

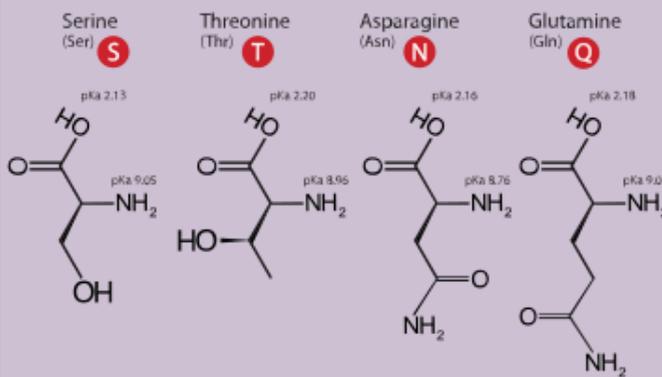
⊖ Negative

• Side chain charge at physiological pH 7.4

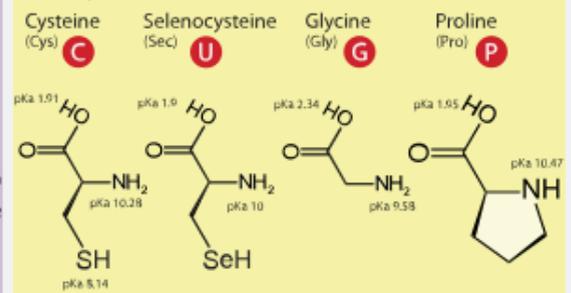
A. Amino Acids with Electrically Charged Side Chains



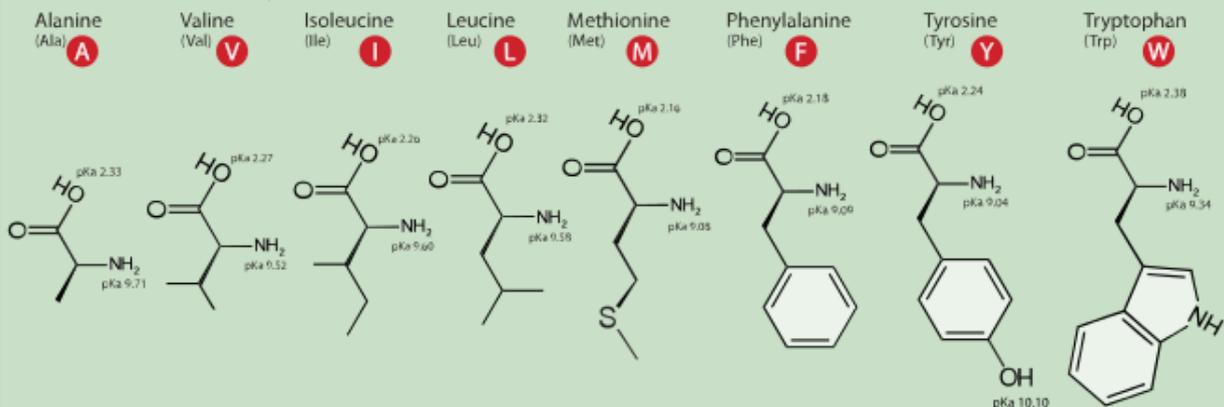
B. Amino Acids with Polar Uncharged Side Chains



C. Special Cases



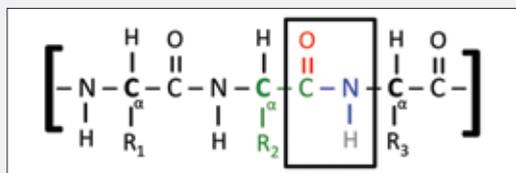
D. Amino Acids with Hydrophobic Side Chain



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The 21 different amino acids found in organisms that have a nucleus in their cells (eucaryotes). These molecule diagrams use the line-angle representation. At the upper end of each molecule is the line-angle representation of the amino acid group. The R portion is the rest of the molecule, and the wide variations of the R portion are evident. Here the 21 amino acids are arranged in four groups according to the R portion chemical characteristics. These characteristics include acidity (pH), the tendency to expel a hydrogen nucleus (a proton); imbalance in charges carried (negative or positive); special cases such as cysteine that contains sulfur which can form a sulfur-ulfur bond with another cysteine in another part of the protein resulting in loops of the amino acid chain; and hydrophobic side chains which are electrically neutral over the broad extent of the R portion, so they are oil soluble but not water soluble.

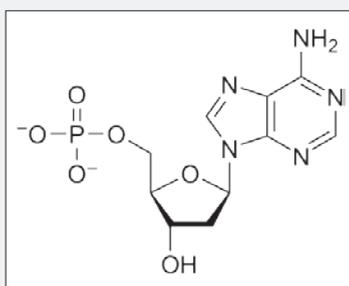
Chemical Structure of the Peptide Bond



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The amino portion of one amino acid attaches to the acid portion of another amino acid, and in the process an oxygen and two hydrogens are separated off.

Chemical Structure of a Nucleotide



CCO/Hbf878

Nucleotides, the building blocks of DNA, have three subunit molecules: the phosphate group (at the left), which tends to liberate hydrogen nuclei into the surrounding environment and is therefore acidic; the deoxyribose sugar (in the middle) which forms a ring structure; and the nitrogen-containing base ring structure (at the right), which tends to grab hydrogen nuclei from the environment and is therefore basic.

in the role of enzymes in the production of proteins. In this case, there may be electrical currents in the rRNA that are lowering the required activation energy for the chemical reactions linking the amino acid building blocks in the formation of proteins. Again, this is similar to the use of metal surfaces in the industrial production of chemicals.

As indicated, proteins are polymers of amino acids. There are 20 different amino acids that are used as monomers in the production of proteins. In the sequence of bases in mRNA, each set of 3 bases codes for a specific amino acid. Since there are 4 possible bases, there are $4 \times 4 \times 4$, or 64 possible sequences of 3 bases.

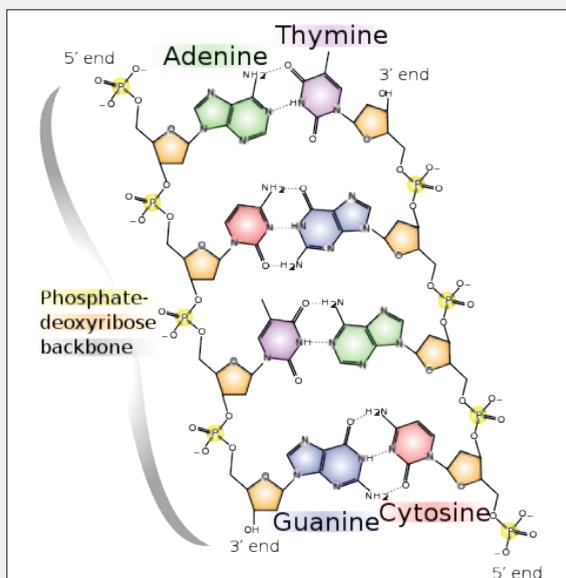
To implement this code, there is another type of RNA, called transfer-RNA or tRNA, which is present in the cytoplasm. Each type of tRNA has a region of the molecule that is specific for a triplet base sequence in the mRNA, and another region that is specific for a particular amino acid. Because there are more possible base triplets (64) than there are amino acids (20), some amino acids are coded for by more than one base triplet, and therefore have more than one tRNA associated with them. The tRNAs recognize specific amino acids in the cytoplasm and bring them to the ribosome. At the ribosome, the amino acids are arranged in a sequence that mirrors the base

sequence code, and are linked together in chains to form proteins.

The proteins generated by the ribosomes function in numerous capacities, for example as enzymes, as structural components, as contractile components in muscle, as hormones, as antibodies in the immune system, and as immune modulators.

The amino acids are linked at the amino-acid-group end of the molecule, and the rest of the amino acid molecule projects outward from the polymer as branches

Chemical Structure of DNA



CCO/Madeleine Price Ball

Each of the two main strands is composed of nucleotides. The nucleotides are held together by bonds between the phosphate group of one attached to the ribose of the next. The genetic code is represented by the sequence of bases. The two strands are held together by weak hydrogen bonds that link a base from one strand with a base from the other strand, shown as dotted lines. The bases can be single-ring or double-ring. There are two possible double-ring bases, adenine and guanine; and two possible single ring bases, cytosine and thymine. Due to the geometries of these bases, adenine pairs up only with thymine, and cytosine pairs up only with guanine.

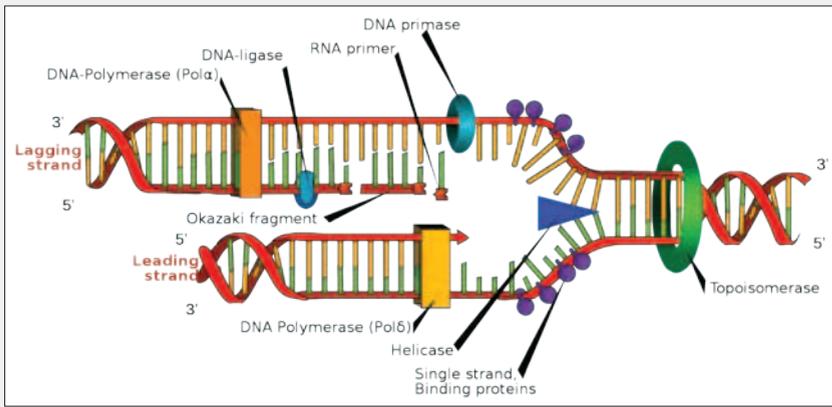
A Section of Double-Stranded DNA



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This shows the overall double helical structure.

Two DNA Strands Separating



Public Domain/ Mariana Ruiz

In the replication of DNA, the two DNA strands separate for short lengths to allow replication of the DNA, or to allow the production of mRNA for the purpose of protein production outside the nucleus on the ribosome. When the strands are separated, they are used to define the sequence of nucleotides that are brought in to form new DNA strands in DNA replication. The separated strands can also be used to define the sequence of nucleotides to form single-stranded RNA, which will be transported to the cytoplasm and used to guide the formation of proteins. RNA uses ribose as the sugar component, while DNA uses deoxyribose as the sugar component. The DNA base thymine is replaced by uracil in RNA.

from a central tree trunk. These 20 different types of molecular branches, termed side chains, have a variety of chemical characteristics. Some are acids, some bases; some are water-soluble, some are fat-soluble; some are large and bulky, some small; some are able to complex with metal ions, such as the iron in hemoglobin. One of the amino acids, cysteine, has a side chain that contains sulphur, and these cysteine side chains can form chemical bonds with each other, linking one part of the protein with another part, which changes the topology of the protein.

Each side chain has a specific geometric configuration. While being produced, and after being produced, the protein polymer chain undergoes further modification in the cytoplasm environment such as folding, forming helices, forming sheets, and complexing with other proteins, to assume the final geometrical functional form.

RNA is also involved in genetic regulation. It has also been found to complex with the genetic DNA to modulate the activity of the DNA genes in the nucleus.

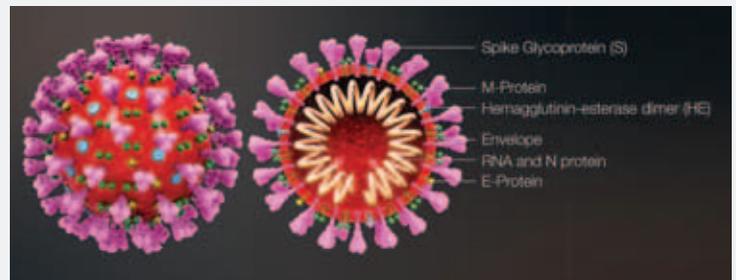
There is some justification to hypothesize that in the early stages of the origin of life, RNA functioned as both the genes of the organisms, and as the catalysts used by the organisms for the chemical reactions involved in metabolism. The switch

to DNA genes may have occurred due to the DNA being more stable in the presence of cosmic rays.

Cells contain within the cytoplasm, membrane-bound organelles. There are two important organelles within the eukaryotic cell that are relevant here—the mitochondria, which are the site of energy extraction from nutrients, and the chloroplasts, which use the energy from light to produce carbohydrates in plants by combining carbon dioxide (CO₂) and water. Both of these organelles have many characteristics of independently-living prokaryotes, including the presence of their own DNA genetic material. These organelles use RNA in their own genetic expression. This is therefore yet another function of RNA in the eukaryotic cell. It appears likely that the eukaryotes started as interdependent, mutually collaborative arrangements of prokaryotes,

a form of interaction which has persisted up to and including functioning in the cells of the human species.

Outside and Cross-Section Structural Views of a Coronavirus



CC BY-SA 4.0/scientificanimations

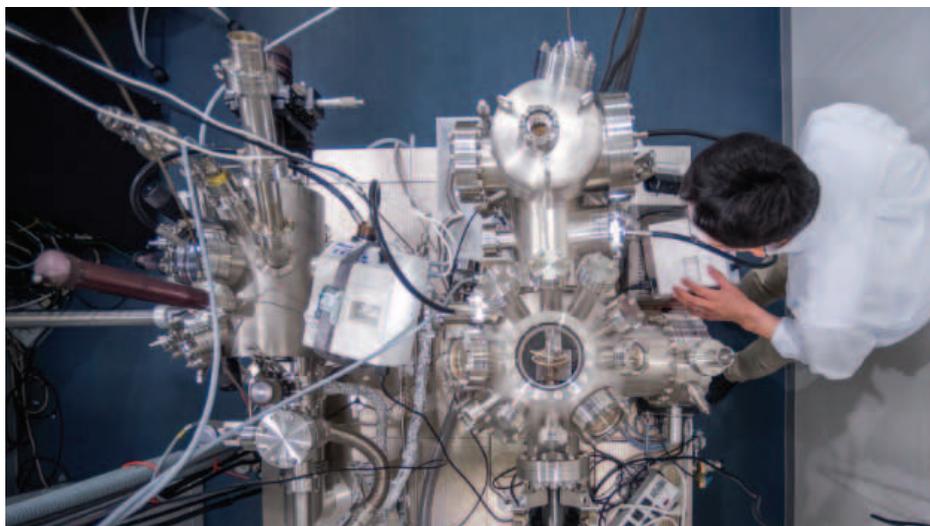
The spike proteins are labeled as spike glycoproteins because they are attached to oligosaccharides, which are short chains of sugar molecules. Other surface proteins identified are the E-protein and M-protein. The virus has an envelope, and within the envelope is the spiral representation of the viral RNA, which contains the viral genes. The spike proteins are involved in attaching the virus to the host target cell, and facilitating the entry of the virus into the cell. The spike protein forms an attachment to the lung cell at the site of the lung cell surface ACE enzyme (angiotensinogen converting enzyme). The spike protein can be used in vaccines, to trigger an antibody response to the protein, which then protects against an actual infection. The spike protein can be taken from killed whole viruses; it can be harvested from killed viruses; it can be produced in the host cells by inserting the virus gene that makes the spike protein into another virus such as an adenovirus and then infecting the host with the adenovirus to bring the gene into the host cells; or it can be produced within the host cell by inserting into the host cells lab-produced mRNA that codes for the spike protein.

Continued from page 15

DNA was demonstrated to be the genetic material in the 1950s, and the correspondence between a DNA's base sequence and the associated protein's amino acid sequence was worked out in the 1960s. Technologies for rapidly determining the sequence of bases in DNA and RNA, as well as for rapidly synthesizing DNA and RNA in the laboratory according to a specific required sequence, were developed and successively improved over the years 1960 to 1990. The human genome project, the sequencing of the entire human genome, was accomplished in an international effort from 1990 to 2003.

The scanning tunneling microscope—enabling the visualization of individual atoms as well as the atomic structure of proteins and DNA—was invented in 1980. The scanning tunneling microscope is based on the quantum mechanics theory worked out in the early twentieth century, heralded by Einstein's paper on the photoelectric effect, which indicated that light has momentum despite not having mass, as well as Einstein's recognition that the energy in light occurs only in distinct amounts, termed quanta. Einstein's physics was heavily influenced by the work of nineteenth century mathematician Bernhard Riemann, who developed the concept of singularities, sources of input and sinks of output, determining fluid and potential flows in higher-level geometries.

Superconductivity, the flow of electricity with zero resistance, was discovered to occur in ultra-low temperature materials in 1911 by Dutch physicist Heike Kamerlingh Onnes, and has been used widely to produce the powerful

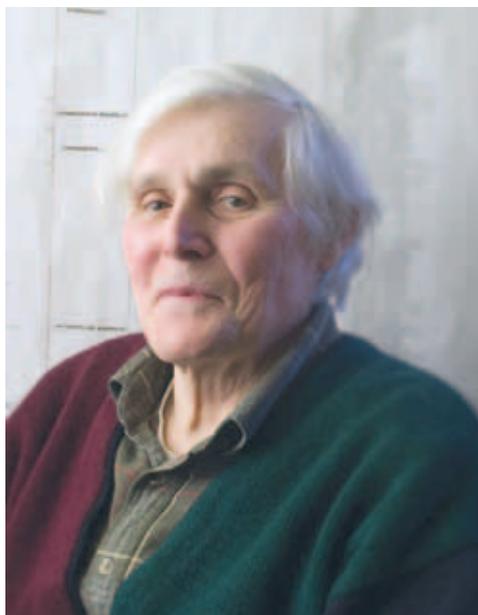


Argonne National Laboratory

At the Argonne National Laboratory Center for Nanoscale Materials, the Quantum and Energy Materials group paves the way for breakthroughs in new energy conversion and power-efficient energy technologies. Shown is a variable-temperature scanning tunneling microscope with atomic force microscopy capabilities.

electromagnets needed for MRI imaging, particle accelerators, beam spectroscopy, and magnetic confinement in the Tokamak and other experimental fusion energy machines. In 1924 Einstein collaborated with Satyendra Nath Bose to formulate a theory indicating that certain gases could condense at low temperatures to form a superconducting state. The first demonstration of this Bose-Einstein superconducting condensate took place in 1995.

In the later 1990s, Carl Woese, a geneticist with an interest in the origin of life, used the results of the genetic mapping of bacteria that had become available from the DNA sequencing technology, and the results of the Bose-Einstein superconductivity demonstration, to formulate a theory of rapid initial origin of life based on the concepts of gene sharing among numerous species of primitive bacteria-like organisms. The gene-sharing is modeled as a strongly collective effect in the early ecology, an effect that bears some resemblance to the collective effect in superconductivity. For example, if one species of



CC/Don Hamerman, 2004

Carl R. Woese (1928-2012) formulated a theory of rapid initial origin of life based on the concepts of gene sharing among numerous species of primitive bacteria-like organisms.

bacteria developed a gene that can perform photosynthesis efficiently, that gene could be transferred to other species rapidly, so the entire ecology would benefit, resulting in rapid collective evolution.

Recent, Current and Future Vaccines

Since 1997, DNA and RNA techniques have been developing that use the genes of the offending microorganisms in the vaccines. When used to produce immune responses, these are termed third-generation vaccines.

Furthermore, because RNA plays numerous roles in the normal functioning of cells, these genetic techniques provide opportunities to develop treatments for a wide variety of genetic-related disorders. Keep in mind that some cancers, heart diseases, and even longevity tend to run in families, indicating that there may be genetic factors involved.

There are three major types of RNA interventions. RNA may be given to inhibit specific DNA genes. RNA may be used to inhibit specific proteins. And RNA may be used to produce proteins directly by taking the role of messenger RNA (mRNA) on the ribosome.

There are two main types of genetic intervention that inhibit specific nucleic acids. The first is single-strand, short DNA, which is complementary to the targeted gene, termed antisense oligonucleotides (ASOs), consisting of 15 to 25 nucleotides (the units that make up DNA and RNA). The second is double-stranded RNA that interferes with DNA expression, and it is termed interference RNA or iRNA.

The ASO can stop naturally produced mRNA from being translated into protein by inhibiting the mRNA at the ribosome, or by causing the mRNA to degrade. In 2018 an ASO, inotersen, was approved by the U.S. Food and Drug Administration (FDA) for treatment of hereditary ATTR amyloidosis (familial amyloid polyneuropathy), a human disease characterized by the buildup of abnormal proteins in the nervous system, heart and other organs, which is progressive and may be fatal.

ASOs also operate by affecting splicing, which is the process by which an mRNA is changed to its final functional form. In 2016 two treatments of this type were approved by the FDA—nusinersen, which treats spinal muscular atrophy, a lethal inherited condition; and eteplirsen, used for treating Duchenne muscular dystrophy (remember the Jerry Lewis telethons of the 1950s-1960s). Eteplirsen blocks only a portion of the



CDC

A 26-year-old with Duchenne Muscular Dystrophy, a genetic disorder that causes muscle wasting. Children with DMD usually die of cardio-respiratory failure, but with stem cell therapy, this young man has not lost muscle power for five years and his heart and lung muscles and the upper half of his body are working well.

mRNA, which allows the production and normal activity of a part of the protein, but it blocks the production of the pathological portion. Eteplirsen is termed a morpholino oligomer due to modifications of the ribose sugar component in the RNA, which improves targeting and inhibits the cell's nuclease enzyme from degrading the medication. There are ASO medications in early clinical trials for the treatment of numerous other conditions, including Alzheimer's Disease, Huntington's Disease, and Amyotrophic Lateral Sclerosis (ALS).

The iRNA involves double-strand RNA, which causes the degradation of the target pathological mRNA before it can be used to code for a protein. The iRNA complexes into a hybrid with the target mRNA, and activates an enzyme present in the cytoplasm, RNase H, which recognizes DNA/RNA hybrids in the cytoplasm and degrades the RNA. The iRNA is more difficult than single-stranded RNA to get into the target cell, but techniques involving packaging it in small membrane-bound vesicles have been effective. Another treatment for hereditary ATTR amyloidosis that was approved in 2016, patisiran, is of this type.

There are RNA treatments that use an RNA to target specific proteins. These RNAs are termed RNA aptimers. A treatment for age-related macular degeneration,

pegaptanib, uses this technique to decrease the activity of vascular endothelial growth factor (VEGF), a protein that stimulates the growth of blood vessels in the eye. Overactivity of VEGF causes blindness by the abnormally increased growth of blood vessels that interfere with retinal activity.

In the area of vaccines and cancer treatments, RNA therapies are used as mRNA to enter cells, engage the ribosomes, and produce specific proteins. This is a vast area of development over the past 10 years. RNA treatments of this type appear promising for the treatment of melanoma and other cancers.

Vaccines made from mRNA produce the antigens required for the stimulation of immunity indirectly, within the cells and utilizing the ribosomes in the cells. This process increases the speed of vaccine production because there is no need to grow the live microorganisms on cell cultures or fermentation processes, and then harvest the antigen from the virus, which requires extensive purification steps. The use of mRNA also offers increased reliability and scalability. The production platform is standardized, and all that is required for a change to another vaccine is the amino acid sequence of the new target antigen. This sequence is then used to produce the required mRNA, which is used for the vaccine. This eliminates the need for antigen-specific production facilities.

Other advantages of mRNA vaccines include post-translation natural modifications of the antigen in the cytoplasm, which mimic the situation in actual viral replication and increase the effectiveness of the antigen; and the use of multiple mRNAs in the vaccine for the production of multiple viral proteins that may be involved in multiplexing or consolidating into a single multi-protein antigen which is closer to the actual viral infection effect, and is therefore more effective as an antigen.

A COVID-19 Vaccine

There are currently three leading companies involved in clinical trials of SARS-CoV-2 vaccines using mRNA: Moderna in Cambridge, Massachusetts; BioNTech in Mainz, Germany in collaboration with Pfizer; and CureVac, in Tübingen, Germany. Moderna is in the lead, and it is now in Phase 3 testing, with possible final FDA approval for use by as early as November/December. BioNTech started an initial trial of its mRNA COVID-19 vaccine in April in Germany, and in May in the U.S. CureVac plans to begin Phase 1 in August.

Since the start of its COVID-19 vaccine program, Moderna has been working directly with staff at the Institute of Allergy and Infectious Diseases (NIAID) at the National Institutes of Health (NIH).

Moderna has taken the lead by rapidly reformulating work that it used earlier on other viral diseases, which demonstrates the efficiency and flexibility of this approach. Moderna is now in Phase 3 testing of its vaccine, to evaluate safety, reactogenicity, and immunogenicity. Moderna's Phase 3 is placebo-controlled, and it will involve 30,000 participants. The endpoints of Phase 3 are the prevention of SARS-CoV-2 infection, the prevention of symptomatic COVID-19, and the prevention of hospitalization from COVID-19. Based on the Phase 1 and 2 trials, the dose of vaccine chosen to maximize effect and minimize adverse reactions is 100 micrograms (mcg), with a schedule of 2 doses given 28 days apart. Phase 3 participants will receive either two doses of 100 mcg, or two doses of a placebo.

Moderna has produced the required vaccine supply for Phase 3. With the 100 mcg dose, Moderna is on track to produce 500 million doses of the vaccine per year, and possibly 1 billion doses per year from its U.S. plant, in collaboration with the Swiss pharmaceutical company Lonza Group. Lonza has started manufacturing the vaccine.

The FDA requires 3 phases of testing to qualify for its approval of a new medical treatment.

The FDA defines Phase 1 as, "Researchers test an experimental drug or treatment in a small group of people for the first time. The researchers evaluate the treatment's safety, determine a safe dosage range, and identify side effects."

In Phase 2, "The experimental drug is given to a larger group of people to see if it is effective, and to further evaluate its safety."

In Phase 3, "The experimental study drug or treatment is given to large groups of people. Researchers confirm its effectiveness, monitor side effects, compare it to commonly used treatments, and collect information that will allow the experimental drug or treatment to be used safely."

The plan for each phase must be approved by the FDA prior to initiation. After the completion of Phase 3, the experimental data is presented to the FDA for final consideration of approval for use. The FDA may approve the use, delay decision and request additional data, or deny the request.

Funding for the Moderna COVID-19 vaccine devel-

opment includes support from the Biomedical Advanced Research and Development Authority (BARDA), a division of the Office of the Assistant Secretary for Preparedness and Response (ASPR) within the U.S. Department of Health and Human Services.

The Moderna COVID-19 vaccine utilizes mRNA-1273, which is an mRNA coding for a perfusion-stabilized form of the SARS-Cov-2 spike protein. This target antigen was selected by Moderna in collaboration with the Vaccine Research Center (VRC) at NIAID. The initial batch of mRNA was funded by the Coalition for Epidemic Preparedness Innovations, and it was produced on February 7, 2020. After analytic testing, it was sent to NIH on February 24, 2020, which was just 42 days after selecting the antigen. The Phase 1 testing started on March 13, 2020, which was 63 days after selecting the antigen.

Moderna currently has 9 viral vaccines under development. There are 6 vaccines for respiratory infections: respiratory syncytial virus (RSV) vaccine for older adults (mRNA-1777 and mRNA-1172 or V172 with Merck); RSV vaccine for young children (mRNA-1345); human metapneumovirus (hMPV) and parainfluenza virus type 3 (PIV3) vaccine (mRNA-1653); COVID-19 vaccine (mRNA-1273); and influenza H7N9 (mRNA-1851). There are 2 vaccines for infections transmitted from mother to baby: cytomegalovirus (CMV) vaccine (mRNA-1647); and Zika vaccine (mRNA-1893 with BARDA). There is 1 vaccine against a highly prevalent viral infection: Epstein-Barr virus (EBV) vaccine (mRNA-1189).

The current status of Moderna's vaccines in process are as follows: Phase 1 has shown positive results in 7 vaccines (H10N8, H7N9, RSV, chikungunya virus, hMPV/PIV3, CMV, and Zika). The CMV vaccine is currently in Phase 2 dose-confirmation study. The Zika vaccine, currently in Phase 1, was granted FDA Fast Track status in August of 2019.

In the area of cancer treatment, Moderna has the following studies in place. A cancer vaccine for melanoma is in Phase 2 (mRNA-4157), and this same mRNA is in Phase 1 in combination with pembrolizumab for inoperable solid tumors. For advanced solid tumors or lymphoma, Moderna has a Phase 1 with mRNA-2416, and for relapsed or refractory solid tumors, Phase 1 with mRNA-2752.

Moderna points out that there are 7,000 rare diseases affecting more than 300 million people worldwide, including 30 million people in the U.S. How-

ever, there are approved treatments for only 5 percent of the rare diseases. Many of the rare diseases are caused by defects or deficits of specific proteins produced by liver cells. Due to the low incidence of each of these rare diseases, there is insufficient research to address each of these conditions. The technique of mRNA greatly improves the efficiency of treatment, by providing the liver with the mRNA to produce the needed protein.

For example, for the treatment of the disease methylmalonic acidemia, which involves a missing normal enzyme, Moderna has a Phase 1-2 ongoing with mRNA-3704 and mRNA-3927 to produce the missing normal enzyme. Work is being done to produce other missing enzymes in the diseases propionic acidemia, phenylketonuria (PKU), and Fabry disease.

Moderna was founded in 2010 by Harvard scientist Derrick Rossi, who had an interest in stem cells and using mRNA to cause dedifferentiation of cells, followed by differentiation into various types of cells. Initial attempts to produce mRNA for chronic diseases in collaboration with major pharmaceutical companies were not successful, due to adverse effects of the mRNA and difficulties in getting mRNA into target cells.

In 2014, Moderna changed its focus to vaccine production. By 2018, the initial hurdles were largely overcome, and the current COVID vaccine development has passed NIH safety requirements for human trials. In December 2018, Moderna raised \$600 million in an IPO for 8% of its stock, implying an overall valuation of \$7.5 billion. In April 2020, BARDA allocated \$483 million to support Moderna's COVID-19 vaccine program. In May 2020, Moderna board member Dr. Moncef Slaoui left the company and became the Chief Scientist for Operation Warp Speed, the Trump administration's leading effort to rapidly develop a COVID vaccine. If Moderna's COVID vaccine is successful, it will be Moderna's first finalized product to be approved for human use.

There are other COVID-19 vaccines that are in advanced states of development. The University of Oxford is working with AstraZeneca on a vaccine that uses a weakened adenovirus, which is a common cold virus. The researchers have put genes from the SARS-CoV-2 that code for the spike protein into the adenovirus. The adenovirus is modified so that it cannot replicate. The aim of the vaccine is to have the adenovirus bring the spike protein genes into the cells of the person vaccinated; the spike genes then produce spike protein, and

the spike protein initiates an immune response that is protective. President Trump has provided \$1.2 billion to AstraZeneca to support this vaccine effort, through Operation Warp Speed. This development is now in Phase 2.

Johnson & Johnson is also working on a vaccine using an adenovirus to bring the SARS-CoV-2 spike protein genes into the host cell and produce the antigen that is intended to provoke an immune response. J&J has started Phase 1-2 testing in humans, and it anticipates starting Phase 3 in September. The testing involves subjects in the U.S. and Belgium, and it is being funded by Warp Speed.

Novavax and Sanofi/GlaxoSmithKline (Sanofi/GSK) are both using insect cells to manufacture spike protein by placing spike protein genes in the insect cells. The produced spike protein is then harvested, and it is then used directly in the vaccine to produce an immune response. Sanofi/GSK is adding an adjuvant to increase the immune response. Warp Speed has awarded Novavax \$1.6 billion for late-stage trials and vaccine production. Operation Warp Speed has awarded Sanofi/GSK \$2.1 billion for vaccine development and manufacturing.

Merck has started efforts to produce a vaccine using a weakened measles virus to transfer virus parts into the host cells. Merck has acquired Themis for this effort. Themis is a company in Vienna that was created from staff at the Pasteur Institute, and has previously used this technology to develop a vaccine against Chikungunya, a virus carried by mosquitoes. Merck says that this type of vaccine requires only one dose, which is more manageable than the spaced 2-dose regimen required by the mRNA vaccines and most of the other COVID-19 vaccines under development. The managing of 2-dose regimens is particularly difficult in areas with low living standards and marginal public health systems. The 2-dose vaccines are effective after a total of 6 weeks, while the single-dose vaccines are effective after 2 weeks.

Inovio uses DNA that codes for the spike protein. The DNA is incorporated into plasmids, which are microscopic, membrane-bound packets of DNA. The vaccine is given in the muscle or skin, and after it is given, a brief electrical pulse is administered to the area of the vaccination with a handheld device called Celectra. The electrical pulse induces the cells in the area to open small pores, allowing the plasmids to enter the cells. The opening of the pores is reversible. Once inside the

cell, the DNA is used to produce the spike protein, which stimulates the immune system against the SARS-CoV-2 virus.

Warp Speed recently funded the efforts of Regeneron, a company that produces an antibody to SARS-CoV-2 using the spike protein gene placed in mice. The mice produce large amounts of the antibody, which is harvested, purified, and administered to ill patients as a treatment. It is also planned for administration to people who have been exposed to COVID-19 but are not yet symptomatic or are mildly symptomatic, to prevent the development of major disease. Thus, it can be used for health care workers who have been exposed to COVID-19, as a preventive measure. This preventive use is similar to a vaccine, but it is immediately effective, though the effect is short-lived, approximately 1-3 months, due to the usual rate of breakdown of antibodies. BARDA announced funding of \$450 million for Regeneron on July 7, 2020.

Chinese and Russian Efforts

A vaccine study conducted by the Jiangsu Provincial Center for Disease Control and Prevention and collaborators in Wuhan, China, is investigating the use of a weakened adenovirus to deliver genetic material that codes for the spike protein into host cells.

The host cells then produce the spike protein, which stimulates a host immune response, which is anticipated to protect against an actual SARS-CoV-2 infection. The results of the Phase 2 trial using this vaccine candidate were published in the journal *The Lancet* on July 20, 2020. The Phase 2 was randomized, controlled, and double-blind. It involved 508 healthy adult subjects, with 253 getting a high dose of vaccine, 129 getting a low dose, and 128 getting a placebo. Participants receiving the high and low dose vaccine had significant responses in antibody production, and in T-cell responses. None of the subjects getting the placebo showed an immune response. The test subjects were followed for 28 days after the test doses.

It is expected that the trial will soon move to Phase 3. Funding was provided by the National Key R&D Programs of China, National Science and Technology Major Project, and CanSino Biologics.

The Chinese have two other vaccines in development, both using inactivated SARS-CoV-2 viruses, and both are in Phase 3 testing. One is sponsored by the Chinese pharmaceutical company Sinopharm. Phases 1 and 2 were double blind and placebo controlled, and

completed in Jiaozuo, Henan Province. Phase 3 will be starting in Abu Dhabi, UAE, in collaboration with the Abu Dhabi government, and the Abu Dhabi-based artificial intelligence company G42 Healthcare. G42 noted that Sinopharm chose UAE for the Phase 3 trial because the nation houses more than 200 nationalities. The Abu Dhabi government plans the trial to involve 15,000 subjects.

The second Chinese trial of an inactivated SARS-CoV-2 vaccine, called CoronaVac, is being sponsored by the Chinese company Sinovac. The study has completed Phase 2 in China, and plans Phase 3 to occur in Brazil, at the Clinical Hospital of São Paulo. The trial is being done in collaboration with the Butantan Institute, a Brazilian public health research facility. The news release announcing the Phase 3 trial notes that Brazil has the second highest number of COVID-19 cases in the world, with 2.1 million confirmed cases, and 80,000 deaths as of July 20, 2020. It is also noted that AstraZeneca is collaborating with Brazil regarding a Phase 3 trial of another vaccine.

Russian scientists at Sechenov University in Moscow, the top medical university in Russia, announced on July 15, 2020 that they have completed a Phase 1 study of a COVID-19 vaccine. The vaccine is described in the press release as using two types of adenovirus. The virus carries the gene for the spike protein into the host cell, which then produces the antigen in the host cell to stimulate the immune response. Phase 2 is planned for August.

The World Health Organization states that there are currently 25 vaccine programs worldwide that are in the stage of human testing. There are 139 vaccine programs in earlier stages of development, including additional programs at Sanofi and GSK.

Operation Warp Speed

The Trump administration initiated Operation Warp Speed in April 2020 to support and coordinate the research, production and use of vaccines, treatments, and tests for COVID-19. The program was announced pub-



White House/Sheilagh Craighead

President Donald Trump formally announced Operation Warp Speed on May 15, 2020 in the White House Rose Garden.

licly in May 2020. Operation Warp Speed is a public-private partnership. The federal agencies involved include DHHS, NIH, CDC, FDA, BARDA, DOD, Department of Agriculture, DOE, and the Department of Veteran Affairs. BARDA coordinates these agencies with private companies.

BARDA, the Biomedical Advanced Research and Development Authority, is a federal agency under DHHS, which develops medical defenses for the civilian population against attacks on the U.S. from chemical, biological, radiological and nuclear weapons (CBRN), and against other emergencies such as epidemics and toxic chemical spills. The DOD has parallel agencies to protect the armed forces. BARDA works with the Public Health Emergency Medical Countermeasures Enterprise, which coordinates responses to CBRN threats. BARDA provides funding to the private sector to support R&D for treatments, vaccines, and tests. As of January 2020, BARDA has facilitated FDA approval successfully for over 50 related submissions. BARDA oversees Project BioShield to fund R&D for treatments and vaccines that would defend against CBRN attacks. BARDA was created in 2006 by the Pandemic and All-Hazards Preparedness Act.

The U.S. Congress has authorized \$10 billion for Operation Warp Speed this year, including \$6.5 billion through BARDA for COVID-19 response measures, and \$3.5 billion for NIH research.

To summarize, Operation Warp Speed is currently funding nine pharmaceutical companies engaged in COVID-19 vaccine development: Moderna, AstraZeneca/Oxford, Novavax, Johnson & Johnson, Pfizer/BioNTech, Sanofi/GlaxoSmithKline, Merck, Inovio, and Vaxart. Funding thus far includes \$954 million for Moderna, \$1.2 billion for AstraZeneca/Oxford, \$1.6 billion for Novavax, \$2 billion for Pfizer/BioNTech, \$2.1 billion for Sanofi/GSK, \$456 million for J&J, and \$38 million for Merck.

Operation Warp Speed has been pushing for rapid vaccine development. The funding levels are high, there is a variety of vaccine approaches, and there is useful redundancy in several approaches, in which two companies pursue similar lines of research.

Merck is using the oldest and most successfully tried approach. The use of adenovirus as a carrier of the spike protein is a newer approach that has shown promise in the past, and it is being used by several companies.

There are two firms using the most advanced approach of mRNA, which has shown promise in Phase 1 and Phase 2 trials so far, but this technology has not been used in the past for a finalized, successful vaccine. Keep in mind that it has only been two years since Moderna solved the problems of getting the mRNA into the cells.

National Institute of Allergy and Infectious Diseases (NIAID) Director Anthony Fauci has remarked that Trump became enthusiastic about funding Moderna after he attended a presentation of their work. A member of the board of directors of Moderna was subsequently appointed to be the chief science advisor to Operation Warp Speed.

Trump appears to have been looking at the long term as well as short term regarding Moderna, since the mRNA, as indicated above, has much broader implication for disease treatment than just vaccines. This perspective is consistent with Trump's support of the Moon-Mars space colonization program. The creation of a Hamiltonian national bank would institutionalize this orientation more broadly, to cover fusion, maglev, and collaborative beam weapon defense for Mutually Assured Survival.

Another source of federal funding involved in therapeutics for infectious disease is from DARPA, the De-

fense Advanced Research Projects Agency.

DARPA was created in 1958 by the Eisenhower Administration in response to Sputnik. DARPA has invested heavily in military surveillance technology for anti-submarine warfare, for example. In the 1980s, DARPA was heavily involved in Strategic Defense Initiative technologies, including space-based surveillance systems and space-based high-energy laser beam weapons. DARPA has focused on both immediate military needs, and on basic science that may be useful at some time in the future.

In 2013, DARPA provided \$25 million to Moderna to develop an mRNA platform that would be able to create antibodies quickly against novel biological warfare agents. Unlike vaccines, which stimulate the body to produce its own antibodies, the use of lab-produced antibodies would confer immediate immunity, and it could also be used to treat active disease. This early funding and subsequent support helped propel Moderna into the use of mRNA for infectious disease therapeutics, and that lead translated into it being the first to enter a Phase 3 study for a SARS-CoV-2 vaccine, which occurred in late July 2020.

A True Science Driver

It is important to locate the vaccine development efforts within the activity of science drivers more generally, as spinoffs. Going back to the beginning of the U.S. manned space program that got started after Sputnik, manned space flight required light-weight, small computers, not the bulky high-energy-consuming computers in use in the 1950s.

For this purpose, semiconductor technology was developed for computers in space flight, including landing a man on the Moon. This technology subsequently became the microchips that run the personal PCs that became widespread starting in the 1980s. The continued development of micro-circuits laid the basis for the inexpensive, powerful computer power that has been required for numerous scientific and other uses, such as the above-mentioned human genome project.

A more recent example of spinoff from the space program is a significant number of experiments on disease-causing bacteria that have been done in the conditions of microgravity on the orbiting Space Station.

It has been found that Salmonella and Multi-drug Resistant *Staph aureus* (MRSA) become more virulent, more harmful, in microgravity conditions. Keep in

mind that Salmonella is the third leading cause of childhood deaths in the underdeveloped countries, and MRSA is a leading cause of treatment-resistant, hospital-acquired infections. This increase in virulence under microgravity conditions is useful for understanding the genetics of virulence. Scientists have been able to identify unusually high expression of specific mRNAs in the high virulence state of these bacteria. The scientists can then identify the corresponding DNA in the bacterial genome, and specifically disable or knock out that DNA gene or genes, producing a harmless or minimally harmful variant of the bacteria. The resulting bacteria can then be used for vaccine production in its live form, or if preferred, in the dead form.

Looking back at the long history of vaccine development, we can see an approximately exponential rate of acceleration of progress.

The initial period of smallpox vaccine using small amounts of actual smallpox material stretches from the time frame of 200 BCE in China, to Dr. Fewster's cowpox finding in 1768, approximately a 2,000-year span.

From Fewster to the vaccines of Pasteur and Koch near the end of the 1800s is approximately 120 years. From Pasteur to the widening of vaccine use in numerous diseases brings us to the 1950-1960 time period, a 50- to 60-year jump, leading to the eradication of smallpox worldwide in the 1970s.

By 2003, we have the full human genome sequenced and mapped, and the stage is set for a vast explosion of research into the long-term chronic diseases that have up to now put a finite limit on human life expectancy: cancer, heart disease, stroke, dementia, and the aging of tissues more generally.

In the past twenty years, enormous technical advances in rapidly sequencing and reproducing nucleic acids has paved the way for not only the proliferation of vaccines, but also the wider use of genetic material such as mRNA in cancer and a large spectrum of rare genetic disorders.

The exponential rate of development entered a phase-change in the past ten years, as the various uses of mRNA and DNA in treating numerous diseases have taken off. This broad expansion of lines of research, emanating from the breakthroughs in basic sciences, is an example of a Riemann singularity operating in the realm of the human expansion of knowledge and associated increase in power over the universe. The singularity is a source, analogous to the source in a fluid flow

or potential flow. It is not a point source in a Riemann mapping, but a state-of-existence source, a singularity in the state of the science.

We lived through the potential of such a source with the manned Moon landing under President John Kennedy, but it was thwarted by the international oligarchy using assassination and the crushing of the NASA budget.

We again lived through the potential of such a source in the development of the SDI and President Reagan's promotion of Mutually Assured Survival, but it was again thwarted by the oligarchy. Newly-anointed General Secretary Andropov turned the Soviet Union sharply against the Strategic Defense Initiative, which it had earlier been willing to discuss, at the time presumably due to his fear that the U.S. would make better use of spinoffs and leave the USSR in the dust. But Reagan offered to help the USSR with spinoff integration in the summer of 1983 and it was still refused, making it clear that a much fouler process was affecting the USSR, a process that was bent on maintaining divide and rule, was getting in the way.

Now we have the opportunity to use the magnificent singularity of the science pouring out of the vaccine research to treat and prevent many chronic genetic diseases, including possibly the aging process itself, and the oligarchy is stumped. They cannot stop this one, except by starting World War III in desperation and annihilating the planet.

With all these scientific efforts, it is highly likely that we will have a COVID-19 vaccine within a year, and very possibly by the last months of 2020.

Let us use the die-hard optimism of the population that expects progress in medical science, to revive the optimism that we have had in the past for other major science-drivers of the economy such as space exploration, and let us use this energy of optimism—to rid ourselves of the parasitical derivatives market with Glass-Steagall, to revamp our infrastructure, and to form a Hamiltonian national bank. The Golden Renaissance followed on the heels of the devastating bubonic plague. We can create another renaissance on the heels of the COVID-19 disaster. We only need to follow what we have done in the past, such as what President Franklin Roosevelt did to get us out of the Great Depression, with his programs such as initiating Glass-Steagall banking regulation, and massive infrastructure developments such as the Tennessee Valley Authority hydroelectric project.

‘I Say to Congress: Look at What We Have Done’

Leaders of America’s return to space spoke to the nation and its elected officials about America’s future in space, on August 2. NASA Administrator James Bridenstine and SpaceX CEO Elon Musk addressed a press conference at the Houston Space Center only hours after astronauts Bob Behnken and Doug Hurley had splashed down in the Gulf of Mexico, returning from a 64-day mission to the International Space Station. The astronauts both briefly conveyed their thanks to all NASA and SpaceX teams on the flight, before Bridenstine and Musk spoke. It was the first mission of American astronauts on an American rocket and capsule, since the retirement of the Space Shuttles nine years ago. We publish here the remarks of the NASA and SpaceX chiefs.

James Bridenstine: I’m going to take my mask off for just a few seconds here, and just say thank you to everybody who participated in this. You know, we just saw Bob and Doug; and I think the rest of us are going to have memories now for the rest of our lives, [of] when they launched. In fact, we’ll have memories of the day they didn’t launch, and then, three days later, coming back and doing the whole thing again—not knowing whether or not they were going to go. “50-50” on the weather. And then, sure enough, the skies opened up and we were able to launch Bob and Doug.

I want to say a few words about what champions they are; beyond just being the first crew to fly on Dragon [the SpaceX Crew Dragon capsule—ed.], it goes beyond that. They knew that when they were doing this, it was a test flight. They also knew, that they were going to be responsible for conducting a lot of operations on the International Space Station for a period of months—to include what ended up being four space walks; spending that extended period of time on the International Space Station; and then flying back. And amazingly, coming off the jet right now after being weightless for the last 63 days; coming off the jet, sitting down, and doing a public event.

And I gotta tell you, I’ve never flown into space, but from my,— that’s not normally done. It’s very difficult. But they wanted to take that opportunity to connect

with the American people on this momentous occasion. And you just can’t put into words, just how important this was for our country, to have access to space again from our own soil.

So, again, congratulations to Bob and Doug and their families. What an amazing day for the United States of America.



NASA/Bill Ingalls

America’s return to space returns to Earth. The Crew Dragon capsule touches the surface of the Gulf of Mexico on Aug. 2 after an apparently perfect undocking and return from the International Space Station.

‘We Want To Be Flying to the Moon’

I would also say, that what we just saw is the beginning of what will be a whole lot more activity in the future. Right now, when we talk about “commercial crew,” we’re going to go—for the Dragon—we’re going to go from development to operations. Of course we’re always going to learn, and we’re always going to modify, but making that transition from development to operations is going to be a challenge. But the NASA

team is up for it. But it goes beyond that, because we still have [Boeing's crew capsule—ed.] Starliner, and we need to get Starliner flying. And then we've got to get [NASA's space capsule] Orion flying. And we've got to get Starship [SpaceX's very large-capacity crewed rocket] flying—[comment from Musk off-mike]—a lot of stars, absolutely.

So, look, there is a lot to do in front of us. But here's what we know. We know that when members of Congress come together in a bipartisan way, and they fund NASA, amazing things can happen. Right now, we have before the House and the Senate, the biggest budget request in NASA's history, in nominal dollars. By the way, right now we have the biggest budget NASA has ever had, in nominal dollars. Now if you look at real dollars, Apollo might have us beat by a little bit. But we're heading in the right direction.

And next year—if we get the budget request that is before us right now, next year we're going to go up an order of magnitude. And that is necessary. Because today we're flying into low Earth orbit. And in a few short years, we want to be flying to the Moon. And not just go once or twice. We want to go sustainably, with a purpose.

We're going to the Moon sustainably. We're going to learn how to live and work on another world, for long periods of time. We're going to use the resources of the Moon in order to live and work [there]. And we're going to take all of that knowledge on to Mars. That's what we're able to accomplish because of the bipartisan support we've had, in the House and in the Senate, for the budget that we have right now.

And what I'm asking for our Members of Congress to do is, look at what we've done with what we have; and if you fund us at our budget request level, we will be on the Moon. And we will be successfully on the Moon with our commercial partners, and with our international partners.



NASA/Bill Ingalls

Astronaut Doug Hurley reclines on a stretcher on the recovery ship after exiting the capsule, which shows the scorch marks from 3,000@dg C temperatures during descent through the atmosphere. After months of weightlessness in space, human beings are unable to walk any distance or stand for any length of time.

So today was an amazing day. It was a historic day. It's been nine years since America launched and landed from its own soil. And yet here we are. But the next step is, we're going on to the Moon and then on to Mars. This is about momentum. It starts today, and it finishes when we put an American flag on Mars.

All right: I've got the honor to introduce somebody whom we are very grateful for, to help us accomplish this mission. I've said it before and I'll say it again: NASA seeks to be one customer of many customers in a very robust commercial marketplace in low Earth orbit. And we want to have numerous providers that compete, on cost and innovation and safety. And I will tell you, there was a moment—maybe not even a year ago—... when we had some significant challenges. We might have had a few disagreements on parachutes. We might have had a disagreement on—maybe we need to change the titanium, because of its reactivity with nitrogen tetroxide ...

I sent a tweet, Elon, and I know you remember this. And since we've had a number of dialogues: I sent a tweet, and I said "It's time to deliver." And I tweeted it at Elon Musk. And I want to tell you, Elon, you responded absolutely magnificently. And you have, in fact, delivered. You have delivered beyond anything

any of us would have expected. And I will also say that all of the reports I'm getting from all of the teams on commercial crew, is that this mission went as good as we could have hoped. And we are so grateful for the team at SpaceX; and the great team in NASA's commercial crew program; and all of the operators that helped us get to this point.

So I just want to say "Thank you." Elon Musk, the time is yours.

'Let's Make Human Life Multiplanetary'

Elon Musk: [Lets out a whoop.] Thanks, Jim. After these great words that were spoken, I'm not sure I have much to add to Bob and Doug, Jim. But I do think, what this heralds, really, is fundamentally a new era in space-flight; a new era in space exploration. We're going to go to the Moon; we're going to have a base on the Moon; we're going to send people to Mars; and make life multiplanetary. And I think this day heralds a new age of space exploration. That's what it's all about.

And this is the result of an incredible amount of work. From people at SpaceX, people at NASA—Hey, Kathy! [Kathryn Lueders, NASA Commercial Crew Program Manager]—so much! Eighteen years. This

has been 18 years to finally fly people to orbit and back, and I mean, I really came here because I wanted to see Bob and Doug, to be totally frank. Thank goodness!

[Long pause, and laughing] I think my entire adrenalin just dumped. Thank God! You know, I'm not very religious, but I prayed for this one.

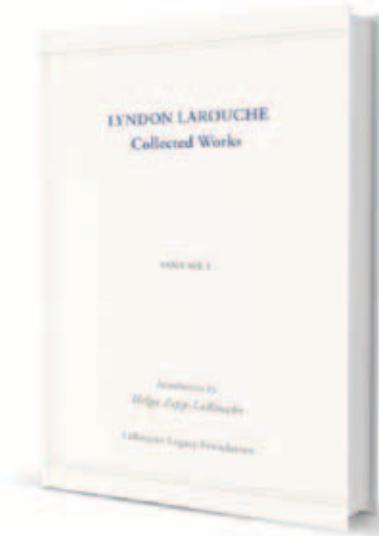
So, just once again, thanks everyone—SpaceX, NASA, everyone, Air Force, our key suppliers, that incredible work. Thanks again.

And this is something that the whole world can take some pleasure in, and can really look at this as an achievement of humanity. And these are difficult times, when, you know, there's not that much good news. And I think this is one of those things that is universally good, no matter where you are on planet Earth. This is a good thing, and I hope it brightens your day. Thank you.

Mark Geyer, Houston Space Center Director: Thank you, Jim and Elon, for those inspiring words. You know, all of us are here because we believe in this country, and [in] exploring space. We believe in humanity's destiny to explore the Solar System. And as was said, this is a milestone moment, and it's an honor to be here. So thanks again for coming. Thanks for everything you do for the mission of NASA and the work that we do.

LYNDON LAROUCHE Collected Works, Volume I

This first volume of the Lyndon LaRouche Collected Works contains four of LaRouche's most important and influential works on the subject of physical economy:



- *So, You Wish to Learn All About Economics?*
- *There Are No Limits to Growth*
- *The Science of Christian Economy*
- *The Dialogue of Eurasian Civilizations: Earth's Next Fifty Years*

So, You Wish to Learn All About Economics? was first published in 1984 and has become the single most translated of LaRouche's books.

There Are No Limits to Growth first appeared in 1983 as a direct response to the Club of Rome's *The Limits to Growth*, thoroughly refuting the latter's unscientific Malthusian argument, which underlies the "green" environmentalist movement today.

The Science of Christian Economy (1991) is a groundbreaking study written by Mr. LaRouche during the five-year period he was unjustly incarcerated as a political prisoner in significant measure for the arguments he sets forth in this book.

The Dialogue of Eurasian Civilizations: Earth's Next Fifty Years (2004) follows in the footsteps of Cardinal Nicholas of Cusa to establish the scientific, cultural, and theological basis for a true dialogue of civilizations, in order to successfully address the existential crises facing humanity today.

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II. Our Mission

LAROCHE PAC'S 2020 TERMS OF BATTLE

Secure the American Revolution, Crush the British Empire!

This statement, edited for publication in EIR, was released by LaRouche PAC on August 4.

In this momentous year of 2020, Americans must finally fully win the American Revolution, casting off the enemy that we have been fighting for more than 200 years.

We will organize to bring citizens to fight with us on these terms of battle:

1. End the coup against the President and prosecute its perpetrators.

2. Implement Lyndon LaRouche's Four Laws for Economic Recovery of the United States, to unleash the productive power of our economy, freeing the nation from the grip of the global financiers.

3. Work with Russia, China, India, and other sovereign nations to establish a New Bretton Woods monetary system, freeing the world from the globalist system itself.

This battle has been joined. It is going on now. It is not a time for anyone who cares about this Republic or its future to sit on the sidelines.

Our nation, and indeed, all of civilization, is under attack. Our founder, Lyndon LaRouche, demanded that we name the name of our enemy, and not be diverted by satraps, agents, and false flags. The enemy is the British Empire, against which we fought a revolution. Today it is represented by the financiers of Wall Street and the City of London and other criminal elites, but it is the historical heir to earlier empires, operating through the same mechanisms, central banking, enforced usury, slavery (physical and mental), raw materials looting, and endless, manipulated wars.

Today, those elites would risk plunging the world into war, rather than allow the emergence of a New

Bretton Woods system.

They recognize that COVID-19 has revealed the bankruptcy of their system, as it has killed the poor, the dispossessed, and the elderly even in the world's most advanced economies because of financialized healthcare systems and poverty. Elsewhere, entire swaths of this Earth have no real healthcare or sanitation systems whatsoever, because of their deliberate Malthusian policies.



EIRNS/Eli Santiago

LaRouche PAC organizers at work for LaRouche's Four Laws, New York City, June 28, 2018.

Even prior to COVID-19, their speculative bubble, built on the ruins of 2008-2009, teetered on the edge of collapse. Now, the world's economies have been brought to a screeching halt. They have no intention of launching the necessary national mission to build our way out of this. Instead they are focused on whipping up the dangerous myth that China and Russia are our enemies, that our suffering is due to them. They hope to keep "the little men and women" pacified or impotently enraged with dope, identity politics, video games and entertainment,



Portrait by Daniel Huntington, 1865

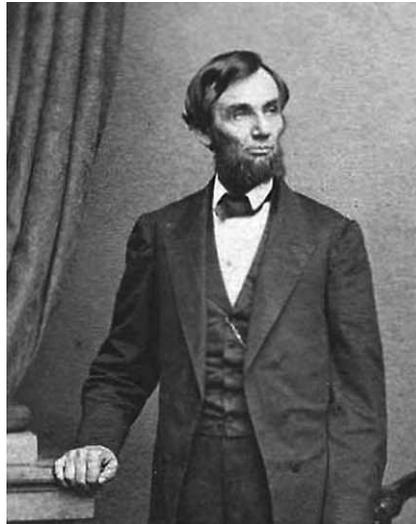


Photo by Thomas Le Mere, 1863



Photo by Oscar White

Defeating the British Empire will involve Americans making the delightful discovery of the American System of Alexander Hamilton, Abraham Lincoln, and Franklin Roosevelt.

and, when necessary, the corrupting influence of lots of money, while they “cull the herd” through disease, famine, and war, in order to preserve their system.

The British elite have publicly declared their political intentions. In an official 2018 report, the House of Lords warned that their empire would not survive a second Trump Administration. Their plan is to elect Obama 2.0, a Joe Biden Administration, which will put the United States under a genocidal Green New Deal, drown it in chaos, and pit it against those nations that refuse to submit to a global dictatorship of central bankers and technocrats.

In 2016, Lyndon LaRouche located the Trump victory as part of an international revolt against those imperial policies. Trump’s presidency has been attacked from every quarter, preventing him from acting fully on that mandate. That mandate must be fulfilled, and Donald Trump must be reelected, or the United States will again become an appendage of the British Empire. But we need action now, long before November, to redefine the terms of battle, overturning the enemy’s plans for global conflict, civil strife, and genocide.

Defeating them will involve Americans making the delightful discovery of the fundamental difference between the American System of Alexander Hamilton, Abraham Lincoln, and Franklin Roosevelt, and that of the British System, built on the myths of free trade and worship of an unfettered and heathen “market” which has, since 1971, taken over and looted the United States and the world.

In the 1850s, as the United States was being driven toward a civil war by the British Empire, as it is today,

Henry C. Carey, who would later become Abraham Lincoln’s economic adviser, wrote of that difference:

Two systems are before the world.... One looks to pauperism, ignorance, depopulation, and barbarism; the other in increasing wealth, comfort, intelligence, combination of action, and civilization. One looks towards universal war; the other towards universal peace. One is the English system; the other we may be proud to call the American system, for it is the only one ever devised the tendency of which was that of elevating while equalizing the condition of man throughout the world.

During his 2016 campaign and in the early months of his Presidency, Donald Trump called for a return to the American System of political economy, to rebuild the economy and “end the carnage” of the Bush Administrations and that of Barack Obama.

LaRouche PAC’s Call to Arms

I.

Defeating the Coup

Since Donald Trump’s election, we have been subjected to an ongoing coup against his presidency, which is leading, dangerously, to a new Civil War. It has been directed by the British and the Tory advocates of their system within our government, the news media, and both political parties. It has been financed by Wall Street and Silicon Valley with ample help from foreign oligarchs. But at each stage of this process, as this Presi-

dent has courageously stood his ground, more of this apparatus has been exposed as never before. The leaders of this apparatus must be prosecuted, and the surveillance state they erected, beginning right after September 11, 2001 must be dismantled. This will only happen if the citizens of this country demand it and fight for it with the highest intellectual and educated passions.

II. The Constitution, LaRouche's Four Laws, and the American System

Lyndon LaRouche identified the essential principles of the preamble of our Constitution, the mission statement for our nation, as follows: (1) The sovereignty of the nation-state republic; (2) That no government rules legitimately under natural law, unless it is committed to efficiently promoting the general welfare of all of the people; and (3) The commitment to act in ways that effectively plan to ensure progress in the general welfare of posterity, rather than letting the future be consumed by the appetites of the present moment.

LaRouche makes clear the economic implications of the Preamble's principles:

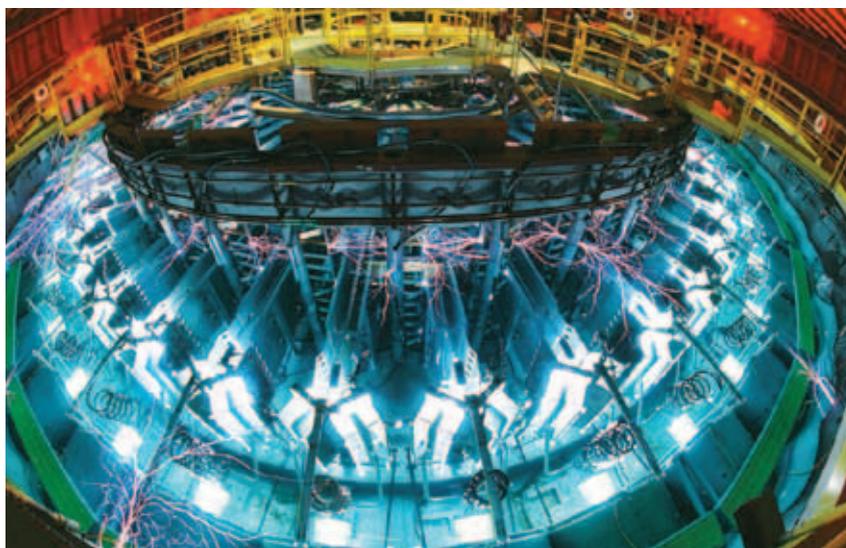
The function of the proper political design of a republic, is to create the combined social and physical pre-conditions, under which the development of the creative powers of every individual (as Plato, Leibniz, and Gauss defined "powers") is fostered, and in which those with developed such sovereign creative powers of the individual mind, from whatever prior station in life, are steered into opportunities to supply society as a whole with the performance of those functions which the creative scientist, entrepreneur, and workman bring to the social-economic process.

There is no way to calculate arithmetically the value of such persons and their work; we must rely on producing such persons, and affording them the circumstances to do their work. We measure economic growth, not in simple arithmetic magnitudes, but in powers. Each such power is expressed in the form of a discovery of a universal physical principle.... It is the accumu-

lation of the combined, transmitted, and new discovery of such principles, as powers, which defines human progress scientifically. Therefore, the most profitable form of national economy is known to be the type of science-driver program which U.S. President Kennedy motivated.

Our economy was intended to be developed as an instrument through which to bring the creative powers of the sovereign human individual into play, as the reigning feature of our medium- to long-range policy decisions. This is the intention of LaRouche's Four Laws, based on the principles of the American System:

1. Reinstate Franklin Roosevelt's Glass-Steagall banking separation act, thereby quarantining the Wall



Sandia Labs/Randy Montoya

LaRouche's Fourth Law calls for a science driver. Shown is Sandia National Laboratory's Saturn, a pulsed-power, high-frequency electromagnetic wave generator, designed to test materials at extreme temperatures and pressures—important to developing fusion power machines.

Street/City of London speculative bubble before it collapses.

2. Return to national banking, as defined by Alexander Hamilton, and reflected in Lincoln's Greenback policy and FDR's Reconstruction Finance Corporation to provide directed credit to the physical economy.

3. Direct trillions of dollars of federal credit toward high-productivity and high-technology investment in 21st Century infrastructure, manufacturing, and technology.

4. Prioritize a crash program to develop fusion power, and space exploration, as embodied in President Trump's Artemis program.

III.

New Bretton Woods

LaRouche long asserted that it would take an alliance of the United States, Russia, China, and India, to come together, to put the existing Wall Street/City of London-run global financial system into bankruptcy reorganization and to replace it with a New Bretton Woods, modeled on the intention of Franklin Roosevelt's policies for an anti-imperial post-war world. This system would provide long-term, low-interest credit for development of the world, based on relations among sovereign nation states, ending the casino economy in which whole sections of the world remain impoverished and enslaved while a decadent elite flourishes.

Russian President Putin has proposed a "P5" summit of the permanent members of the UN Security Council for September 2020. The U.S., Russia, and China would be joined by France and by Britain, whose Conservative Prime Minister Boris Johnson just upset the monetarists' fiscal austerity apple cart by proposing to "build, build, build" his nation's way out of the economic crisis with an FDR-style New Deal. In the current environment of British escalations of dangerous tensions between the superpowers, this summit is urgent and should become the first step in a path to LaRouche's New Bretton Woods. And, because of the global nature of this pandemic, the United States must work with other major nations, most especially the other major economy in the world, China, to ensure that every nation will have the necessary health infrastructure to defeat this virus.

Step Onto the Stage of History

To understand the danger and the promise of the days ahead, reflect on what Abraham Lincoln accomplished, by not only preserving the Union, but by reestablishing the American System—during a Civil War!—and unleashing a mighty industrial revolution that became the paradigm for the world. By the onset of the 20th Century,



EIRNS
LaRouche PAC organizes support for LaRouche's call for a Four-Power Summit, the first step toward a New Bretton Woods monetary system. New York, November 14, 2018.

several nations, including Russia, Germany, and Japan, had modeled their economic policies on the American System ... by name! Sun Yat-sen, inspirer of the 1911 Chinese republican revolution, was also dedicated to the American System, by name!

The response of the British Empire to the possibility of a world of sovereign nations, cooperating with each other for the economic advance of mankind, has been assassinations, coups, fascist insurrections, and perpetual wars. The 20th Century and the opening decades of the 21st Century have been dominated by endless Empire-provoked wars, unleashed to prevent such a new paradigm for mankind.

Imagine instead, the nations of the world joining forces in exploring and developing our solar system. The summer of 2020 has seen American rockets return Americans to the International Space Station to join their Russian counterparts, and has seen multiple missions to Mars launched by the United States, China, and the United Arab Emirates. Pushing the frontiers of human knowledge and extending our dominion over nature is the essence of LaRouche's Fourth Law, and provides the basis for mobilizing our economy, our population, and especially our youth to create the actual wealth and the cultural optimism that foster further human discovery and creativity. International cooperation in space lays the basis for securing genuine peace, based on the common aims of mankind.

This is our 2020 mission. We are asking you to take these demands to the nation's constituency leaders and to your fellow citizens and, like the Committees of Correspondence, which communicated the profound ideas of the American Revolution, to help us create the historical and scientific literacy in the population to save the nation. If we succeed, the actions taken now, and the decisions made this year, will complete the mission of our founding fathers, and finally crush the British Empire.

JUNE 5, 1996

LETTER TO A SECONDARY STUDENT

Return to Classical Education

by Lyndon H. LaRouche, Jr.

With what miserable quality of public education the student is confronted today, how has this come about; and, how do we change it?

To begin a competent discussion of U.S. educational policy today, one must focus on many crucial facts, demonstrating, in total, that, perhaps an average of one recent high-school graduate among 1,000, or fewer, has been provided any significant knowledge of the history of modern civilization, even of the actual history of the U.S.A. To the degree that the young citizen, or future citizen of today, relies upon “mass culture,” as a substitute for, or supplement to public education, today’s recent secondary-school graduate is saturated with popularized, but pervasively false, media mythologies, which, like today’s popular textbooks at their best, have almost no truthful relevance to the past or current realities of either modern European civilization, or today’s world at large. Tests which assess a student’s familiarity with today’s secondary-school curricula, are almost irrelevant, for reasons I shall indicate briefly, each at the appropriate location, below.

Not unusual among not unintelligent, but poorly educated graduates of today’s secondary schools, are opinions such as: “Addis Ababa is the neighboring country of Africa,” or bewilderment when confronted with the fact, that the contiguous 48 states span four, (predominantly) astronomically determined time-zones [not to mention the “international date line”]. Both secondary and higher education in the U.S.A., today, are a

Editor’s Note: This letter by Mr. LaRouche was previously posted on the LaRouchePub.com website, but never published in *EIR*.



clipart.com

Tests of what knowledge a student has obtained from current school curricula, are almost irrelevant in the real world.

disaster, even as compared with the already flawed standard of 25-30 years earlier.

What Went Wrong?

To address the survey’s questions directly, we must first define the context within which the response is to be situated. (Just as, to define the meaning of observed events, one must first define the special, Riemannian type of physical space-time geometry, to which those events belong.) So, I now add a concluding set of prefatory, historical observations, respecting the several, successive strata of changes which have occurred within general educational practice, in both the U.S.A. and western continental Europe, during the recent seventy-odd years.

It was my good fortune, to have recognized, by no later than mid-first grade in Rochester, New Hampshire, in 1928, that my parents, my peers, and school officials “lied most of the time.” [I have a specific recol-

lection of that thought, from that time, although I believe that that, or a similar thought, had occurred to me earlier.]

Comparing what was discussed privately, with my peers, with what they said publicly, or in front of adults generally, I was shocked to realize, not only that there was no consistency with what that same person, my peer, said under other circumstances; but, that that peer's inconsistency was both conscious and intentional. Among my own, or others' parents, a common euphemism for such forms of "polite" lying, was "company manners." I learned that teachers and others, with reckless disregard for truth, prevaricated (or, simply improvised excuses for subjects they themselves either did not understand, or simply wished to evade). This usually occurred in service of "carrying out policy," or simply in the effort to assert their own personal authority in the situation.

Over the following years, in elementary and secondary education, most among my peers concurred with my judgment on that fact; but, despite that degree of agreement with my view, most among them argued (during those 1930s Depression years) to the effect: "Learn what you are told to learn, and keep your mouth shut about the rest, if you wish to get ahead." Sociologist Riesman had another name for such lying: typical American "other-directedness." For others, American "pragmatism," was the preferred euphemism.

It is fair to cite, that the central principle of Plato's dialogues coincides with Paul's *I Corinthians* 13: without love [the Greek term used by Plato, et al., is *agapē*, not *eros*] of justice, and love [*agapē*] of truth, there is nothing of value within us. Plato's policy, the self-reflexive equivalence of truth and beauty, is the subject of one among John Keats' most famous poems, *Ode on a Grecian Urn*. Education must be a program of development of the student's ability to discover and know the truth about (the historical form of expression of) the importance of each individual person, and his or her creative powers of mind, within society as a whole.

Some of the roots of today's decadent classroom, may be recognized from the experience of my childhood, adolescence, and young manhood. Then, education was organized in a way eerily suggestive of the kind of utopian, "class" distinctions described in Aldous



"Plato's policy, the self-reflexive equivalence of truth and beauty," is the subject of John Keats' poem *Ode on a Grecian Urn*, a sketch of which by Keats is shown here.

Huxley's *Brave New World*. To wit:

The highest class of students was relatively a tiny minority. These represent the very few deemed destined to occupy the elite positions of intellectual authority in society. These pupils were presumably destined to become part of that elite, which taught the ruling elite of financial and political life how to think. Only in such rare cases, was the student encouraged to develop socratic knowledge respecting the way in the axiomatic assumptions [e.g., underlying constitutional principles] of society are formed.

Below that, there was a less privileged stratum, a less well-educated minority, whose education was designed to train candidates who would obey blindly the underlying axioms, but who might expect to participate, when they become qualified as scientific workers, or other professionals, in the shaping and enforcement of the theorems, called policies, which are derived from currently prevailing, axiomatic assumptions.

Still lower, was education for the training of sundry types of technicians, from engineers on down.

Near the bottom, were those whose prescribed educational opportunities were trivialized, to such an extent as not to foster discontent with the relatively low social station the pupils on this track were deemed destined to occupy in adult life.

The reader might, therefore, recognize why I hated most of the secondary education to which I was exposed at Lynn's [Massachusetts] English High School.

By the age of 12, my concern for truth, and hatred of that “pragmatism” which I had, earlier, regarded simply as lying by my peers, parents, and others, had impelled me into an intensive reading of notable English, French, and German philosophers of the 18th and 19th centuries; by the age of 14, I had become a convinced advocate of Leibniz, in both philosophy and science, against Bacon, Hobbes, Descartes, Locke, Newton, and Hume; this extended to my subsequent years defense of Leibniz against Kant.

Lynn’s English High School, in an area in which the principal employer was the General Electric Company, provided a relatively good (i.e., useful) education for second, third, and fourth class students, for future employment by GE, or like employers, according to the “politically correct” standards of the time. The Lynn school system wasn’t intentionally mean about it, just stubborn; the effect was approximately the same.

Later, at the beginning of the 1960s, I compared my views on problems of creativity, with those of Yale psychoanalyst Lawrence Kubie’s 1958 *The Neurotic Distortion of the Creative Process*, and his 1962 Daedalus paper, “The Fostering of Creative Scientific Productivity.” I recognized the accuracy of Kubie’s clinical observations, from my own observations of secondary and university education. The impact of the lower tracks in public and higher education, from the second level, on down, is to tend to transform promising young minds into sterile pedants, and the like.

Nonetheless, with all its faults, the society which I knew from Lynn English High School days, typified the culture of the generations which fought, and won, World War II, and, under Franklin Roosevelt’s leadership, brought the United States out of the dust-bin of the 1930s Depression, to resume, more than ever before,



CC/Jaimrsilva

“By the age of 14, I had become a convinced advocate of Leibniz, in both philosophy and science.” Shown, a statue of Gottfried Leibniz at the University of Leipzig.

our position as the greatest agro-industrial power the world had ever seen.

During the two decades immediately following the war, the *per-capita* quality of average education was improved, temporarily; but, the *per-student* quality of higher education deteriorated significantly. That secular trend continued, accelerating through the present time. *On the good side:* The “levelling” effect of the post-depression World War II, as typified by the “G.I. Bill of Rights,” increased the percentile of the population entering higher education, and also fostered improvements in the per-capita education offered the “Baby Boomer” generation, especially among many of the “more affluent” bed-room communities of the 1950s and early 1960s.

On the bad side: So-called “Generation X,” with its children, has been struck by an educational disaster. During the recent quarter-century, but for

some temporary benefits of integration, both public and higher education have deteriorated, in both per-student and per-capita terms. The key factor in this spiralling degeneration of U.S. education today, is the economic and cultural impact of what the London Tavistock Institute identified, then, as the “cultural paradigm-shift” of the 1964-1972 interval: the shift from a *culturally optimistic* society, based upon the policy of scientific and technological investment (to foster improvement of both standard of living and productive powers of labor), to the prevailing *culturally pessimistic* “post-industrial” utopianism of today. This latter was ushered in by the “rock-drug-sex youth counterculture” of the middle to late 1960s, the 1960s of the Beatles, of Robert Theobald’s ‘The Triple Revolution,’ and of Aldous Huxley’s living parody, Timothy Leary.

The mid-1960s “paradigm shift” is, both directly, and indirectly, the key to the rapid deterioration in the



CC/Roy Kerwood



The culturally pessimistic, post-industrial utopianism of today was ushered in by the drug-rock-sex youth counterculture. Shown is Aldous Huxley (above) and his living parody, Timothy Leary, recording Give Peace a Chance, with John Lennon and Yoko Ono.

content of education's curricula and pedagogy, and, indirectly, the key to the collapse of the per-student budgetary, and related economic prerequisites of functioning educational institutions. The direct influence, is seen in the increasing irrationalism of the beliefs which were inculcated by the "post-industrial" shift in content of curricula, over the recent quarter-century. The indirect influence, is the interrelated social and economic impacts of "post-industrial" utopianism, upon patterns of employment, household income, and deteriorating functions of nurture within the family household.

During the immediate post-war period, the percentile of the labor-force employed in production of physical goods, was in excess of 60%. This declined somewhat into and during the 1960s, but, then, collapsed rapidly, since the 1969-1972 interval. The functions of management and operatives in agriculture, manufacturing, construction, and basic economic infrastructure, require a high degree of performance-oriented rationality, akin to that we might associate with engineering. Excepting highly skilled professions and related categories, sales and services employment tolerates large margins of irrational behavior.

Constraints of convention, rather than rationality, determine much of employee behavior in these modes of employment. What you are doing tends to be less significant, than the *style* with which one is seen to be conducting one's duties. "Style" in this instance, often verges on "socially significant basket-weaving," as opposed to function. As a reflection of this trend, much of

secondary and higher education verges on "socially significant basket-weaving." This is not confined to the "social sciences," but, has come to corrupt the science curricula, pervasively.

The former educational system was premised upon communities in which students were drawn from family households, premised then upon a presently vanishing social-economic species, called "the good provider." During the recent quarter-century, the continued, post-World War II trend of suburban sprawl, has interacted with the increased number of jobs required to sustain a household. The effect of this trend, away from the "good provider"-centered household institution, has acted virtually to destroy effective nurture within the institution of the family. This has been aggravated by the drug-like role of television and related entertainment, in suffocating intellectual life within the household. With day-care programs and other programs attached to it, public education assumes, or neglects the burden of much that was formerly family life, former family functions dumped, increasingly, into a kind of Brave New World-like, extended creche, the extended-function education system.

All of this is complicated by the corrosive impact of a twenty-five-year pattern, of worsening collapse of tax-revenue base, at each and all of the Federal, state, and local levels. Quality of teachers, quality of teacher education, loss of teacher-preparation hours, increase of class size, and overcrowded and otherwise deteriorating quality of educational facilities, are part of this



cc/Julian Tysoe

“The drug-like role of television and related entertainment has suffocated intellectual life within the household.”

pattern.

Similar disasters are seen in western Europe. There, the systematic, willful destruction of pre-1963 attempts at educational excellence, have been destroyed under the influence of a policy launched by the same Dr. Alexander King, as 1963 Director for the Paris-based OECD office, who later launched the famous Club of Rome. One example of King’s policies for destroying education, in Germany, is the effect of the repeal of the Humboldt program in education, by enactment of the so-called “Brandt reforms.” The post-1960s implementation of this “Brandt reform,” has produced a German version of “Generation X,” which exists at relatively “third world” levels of impoverished cognitive development, relative to the German “Baby Boomers” educated within the pre-Brandt-reform system, which had been dominated, axiomatically, by the Wilhelm von Humboldt reforms.

The questions in the survey symptomize, but do not address, the magnitude and severity of the past quarter-century’s worsening crisis in education. Nor, do those questions address explicitly those overriding issues of education, the issues of education which determine whether or not this nation will survive the monetary and financial crisis currently descending upon us. An education adapted to what most younger generations today would perceive as “issues relevant to current reality,” would be a disaster for all concerned. We require something much less superficial than the survey’s questions imply. The continued existence of this nation demands a sweeping reform in education, whose most dramatic

feature is, that it reverses, axiomatically, the mistakes of the past twenty-odd years’ trends.

We require, a form of education whose goal is, at a minimum, to provide each student the quality of cognitive development formerly intended only for the relative handful of future elite.

The crucial issue not referenced in the survey’s questions, is the most vital one: the issue of *knowing versus mere learning*, the issue of *cognition*, as opposed to *textbook learning* and to the travesty symptomized by multiple-choice examinations. I weave in these issues of cognition, at the appropriate locations below.

For my response to your survey taken as a whole, I change the order of queries, as follows.

What is Education (Queries 10,7)

QUERY 10: “What is the most important question a youth can ask?” As an integral part of the response to that, I include a response to QUERY 7: Is a person more than a combination of genetics and environment?” The proper response to those two, interdependent queries, identifies the principles which govern every aspect of a competent educational policy.

For the purposes of my response, I reformulate these two queries, as follows: The central question of all human knowledge, and, therefore, of all sound educational policy, is: *Does man differ from the beast? For example, is Genesis 1:26-30 just a religious teaching, or could we prove, that that statement from Genesis coincides with crucial scientific evidence? If man is set apart from the beasts in that way, “is a person more than a combination of genetics and environment?”*

In response to that combined query, under questioning by audiences of parents and others, I prefer to begin with the following, exemplary proposition: In any proper program of secondary education, every student qualified to graduate from the tenth grade would be able to perform the following task, either at the blackboard, before the class, or as the leading question of a written examination:

During the third century B.C., the famous Eratosthenes constructed an estimate for both the curvature of the planet Earth, and the length of the meridian. Given the fact, that no person saw that curvature of the Earth until the modern space-age explorations, how did Eratosthenes, more than 2,000 years before the space-age, construct the observations and measurements by

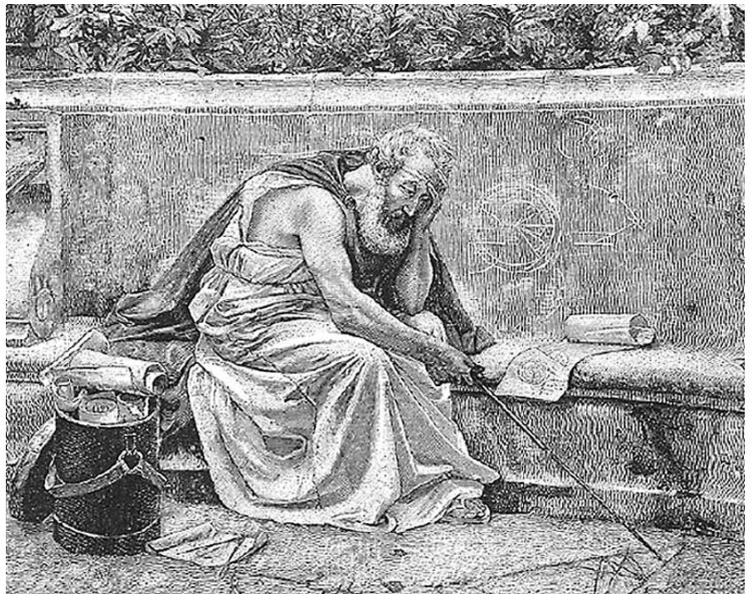
means of which he achieved an accuracy of about fifty miles error in estimating the polar diameter of the Earth? Present the crucial features of Eratosthenes' proof for his measurements. Also, show the method by which ancient Greek geometers, including Eratosthenes, estimated the distance from the Earth to the Moon.

The ancient Greeks could not see the Earth's curvature with their senses. Therefore, that curvature could be known to them only by means of the kind of scientific discovery known as a *platonian idea*. The same is true, still today, of all of the ideas associated with *microphysics*. Still today, most of the ideas we associate with *astrophysics* can not be seen by the human senses, but are principles of the type we validate by their measurable efficiency.

Mathematically, Eratosthenes' measurement of the Earth's curvature is very simple. That simplicity makes it a most convenient example to use in classrooms, for the purpose of helping students, such as those at the ninth and tenth grade levels, to reach a rational comprehension of the meaning of valid scientific discovery, or of that class of scientific ideas otherwise known to scholars as *platonian ideas*. The use of the principle of parallax for estimating the distance from Earth to Moon, and so on, follows nicely in the ninth and tenth grade curriculum.

This type of discovery represents *cognition*, as distinct from mere learning. The student who is qualified to answer the question, is a pupil who has reenacted the mental act of Eratosthenes' discovery, within the sovereign precincts of the pupil's own mental processes. Thus, that student has not merely learned to spout the right set of words, as answers to a question; that pupil has not learned the answer; that student knows the answer, because he, or she, has relived the act of validating the original discovery. A system of education which prompts pupils to relive such valid original discoveries, is providing the student with a Classical form of *education for citizenship*; a different sort of school, merely trains the student to behave as a special kind of performing animal, with a repertoire of learned tricks.

As the case of the famous Brotherhood of the Common Life illustrates the fact, the student who benefits from a Classical approach to education of the cognitive processes, is the student who stands, at



More than 2,000 years before anyone physically observed the curvature of the Earth, Eratosthenes accurately measured its polar diameter and the distance to the Sun.

worst, a decent chance of becoming a qualified original genius.

This quality of cognition, is what distinguishes man from the beasts. It is those validated discoveries of principle, discoveries made by individual minds, and transmitted among individual human minds, which have enabled the human species to increase mankind's potential population-density, from the level of a higher ape, not more than several millions poor quality of individuals, to more than three hundred millions by the 15th Century, and more than five billions today.

The object of education should be, to provide the pupil an ordered experiencing, successively, of those mental acts of reenacting crucial discoveries of principle, which represent the most important bequests of the cognition by past humanity, to the cognition of present humanity. The student who gains such an education, knows many among the most crucial discoveries of all mankind, from the earliest time, to the present. The student who has relived many of the greatest discoveries of principle, by the greatest minds of history and prehistory, is a student who has learned to use his, or her, cognitive powers.

These points are more immediately recognized, from the standpoint of the increase in productive powers of labor achieved through investment in scientific and technological progress, and in education for such progress. However, the mental processes by

which valid original discoveries of physical principle are achieved, are the same processes at work in the role of metaphor in the Classical discoveries in art by a Scopus, an Aeschylus, Raphael (Sanzio), Shakespeare, Bach, Mozart, Beethoven, Friedrich Schiller, or John Keats.

History, if taught from the vantage point of the cognitive development of entire cultures, and of the individual person within the culture, also acquires the quality of a true science. It is by valid ideas, that mankind is set above the ape, and that the majority of mankind is uplifted from the barbaric and feudal condition of virtual “human cattle.” History, in that sense, is the history of ideas, their production, their circulation, and their realization.

A Classical education, so defined, from the premise of cognition, is implicitly a moral education. To relive the noblest moments from the mental life of the greatest creative thinkers before us, is to recognize, in the proper terms of reference, our moral connection to mankind in the past, the present, and the future. Nazi existentialist philosopher Martin Heidegger, and his like, teach their dupes to regard themselves as mere, intrinsically feral, individual entities, thrown into society, as if against one’s will. Contrary to such existentialists, our conscious participation in the cognitive process, shows us our efficient interrelationship, as sovereign individuals, to all that was best in the past, and as contributors, in some degree, to the best that will be in the future. The sense that one must not dishonor those connections across the span of time, is the moral sense which a good Classical form of education in science, Classical art, and history bestirs within the child and adolescent.

On the subsumed topic, “Is a person more than a combination of genetics and environment?” By referencing a creature as being one which were essentially a combination of “genetics and environment,” we are implying any animal of the kind of “ecological” characteristics adopted by the late Julian Huxley, et al., and their followers among today’s malthusians. Mathematically,



Martin Heidegger, Nazi existentialist philosopher.

Wikipedia

the behavior (the ecological potential) of such a creature is of the form which might be described by a deductive form of theorem-lattice. That is, a network of theorems, none of which is inconsistent deductively with any among the others of the same network. Such a theorem-lattice is typified by a textbook euclidean geometry, or by the system of Descartes; we may add theorems, more or less indefinitely, but all will be consistent with a set of underlying assumptions in common: axioms, postulates, and definitions. The relationship between an “ecological” species and its environment, can be represented graphically, in terms of systems of curved surfaces, all of which curves are deductively consistent in their underlying, axiomatic quality of assumptions.

In human progress, the increase of the potential relative population-density of the human species,¹ as from the potential of a higher ape to several decimal orders of magnitude greater than that, is accomplished by axiomatic-revolutionary forms of valid discoveries of physical and other principles of nature. Through these, validated, axiomatic-revolutionary discoveries, mankind changes, willfully, the underlying, axiomatic assumptions of social and individual behavior. No reductionist’s method of ecology can represent such a process. As Genesis 1:26-30 asserts, the individual person, man and woman, are above the beasts, not subject to fixed constraints of genetics or environment. Man is a “cognitive animal,” and, thus, no animal at all. All the putative “branches” of humanity are demonstrated to be alike in this regard.

For mankind, education is the keystone of increased productivity. More immediately, a good quality of education is the precondition for that state of the individual mind, the which is the source of individual human freedom.

1. For an introduction to the notion of potential relative population-density, see my introductory textbook in physical economy, *So, You Wish To Know All About Economics?*, 2nd Edition, EIR News Service, Inc., Washington, D.C., 1995.

Sundry Other Survey Queries

QUERY 1: "How are students in poorer school districts guaranteed equal educational opportunities to those students in wealthier areas?"

There are three leading qualities which define a competent education, in the following descending order of impact: a) quality of teacher, and allowed ratio of teacher preparation-hours to classroom-room hours in the working day of that teacher; b) class size (should not exceed 15 to 18 pupils); c) cognition-relevant qualities of classroom and school facilities. In the setting of today's worsening crisis of nurture in the family household, a fourth, supplementary requirement must be added: pre-school and after-school programs.

All these elements must be judged from the functional standpoint defined by the notion of cognitive education, as I have referenced that conception, above.

It is in the vital interest of the United States, that this quality of education be provided to every child and adolescent, and that supplementary programs exist to ensure the opportunity for a higher education of a quality also determined by cognitive standards. This interest is expressed in the fundamental, all-subsuming statement of law of the U.S.A. Federal Constitution, its Preamble, i.e.: "... promote the general welfare, and secure the blessings of liberty to ourselves and our posterity,..."

Where the state or local community lacks the means to provide those indicated qualities of primary and secondary education to the children and adolescents of the community, the state and Federal governments must act in concert to fill the gap.

The 1976 Chase Econometrics study of the impact of the Kennedy space program, reported, that for each dollar expended on such aerospace research and development, fourteen dollars in income were generated within the national economy. It is that increase of the per capita productive powers of labor of the population, which fosters scientific and technological, and related progress, which is the primary source of all national wealth. A cognitive quality of education is the foundation for such growth; a cognitive education is the prerequisite for producing a young citizen who is capable of voting intelligently.

How the required education is provided, is one thing. The fact that it must be provided, to all parts of



USAF/Siuta B. Ika

"A cognitive education is the prerequisite for producing a young citizen who is capable of voting intelligently." Shown is retired Master Sergeant Carl Vetter, teaching a class in Aerospace Science at Cimarron-Memorial High School in Las Vegas, Nevada.

the population, is, in the last resort, the duty, responsibility, and authority of the Federal government.

QUERY 2: "Should minors lose rights because they are not considered full citizens?"

This question mixes, and confuses two distinct issues of morality and law. On the first issue, a minor can not be a "full citizen," because children and adolescents lack the combination of cognitive and emotional maturity to form part of the body politic. On the second issue, "rights of minors," minors do have rights as persons, under natural law, which must not be intruded upon without just due process.

To wit: In the particular case of adolescents, the typical adolescent develops behavioral traits, which, if they appeared in an adult, would be regarded as probable manifestation of mental illness. Within certain bounds, such "emotional disturbances" are to be considered as part of the process of maturity within the adolescent; it is considered "part of growing up." (When an adult shows such adolescent traits, we say that that adult has either failed "to grow up," or has reverted to a caricature of his, or her, former childishness, or infantilism.) Hence, for example, even in the extreme case, natural law prescribes that the standards of the adult criminal code must not be applied to minors, even as serious or major offenders.

There are, of course, adolescent manifestations of

outright criminality which exceed the tolerable limits of “growing up.” However, for the adolescent and other minors, a just society provides special codes applicable, in all cases, to law-breaking by minors. The minors have a moral right to protection by such special codes.

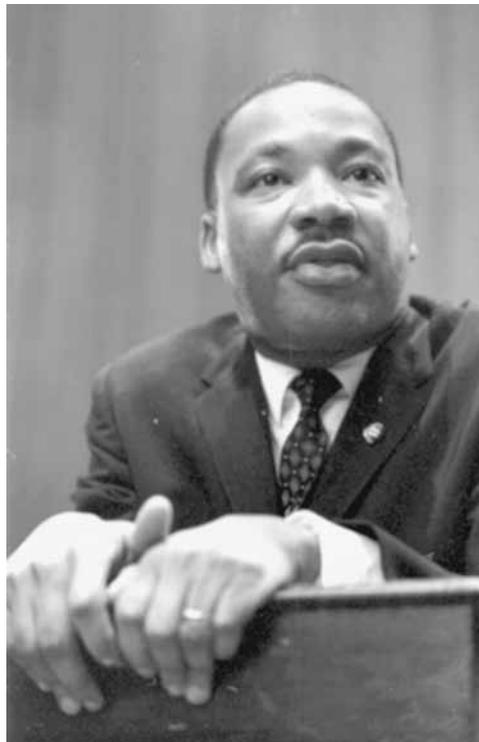
The one thing which neither a parent, nor society, should ever do to an adolescent, is to treat a child in a manner which that child, as a later adult, would rightly consider a willful injustice.

QUERY 3: “Who should young people look at as contemporary heroes?”

The only outstanding national hero of the U.S.A.’s past thirty years, is the Rev. Martin Luther King, Jr. A young, Alabama Baptist minister, called from relative obscurity, emerged during the several following years, as a moral giant. His importance was underscored by the change which came with his passing; the great Civil Rights movement, for which he had so quickly emerged as leader, shrank, and fragmented after it was deprived of his unifying, upward-leading role of personal leadership.

QUERY 4: “What does it mean to be ‘an American,’ and how does one become one?”

The creation of the United States as the foe of the British imperial power, emerged from an age-old conflict to liberate the peoples of the world from that status of virtual “human cattle,” to which more than the proverbial 95% of all persons, of all cultures, had been subjected, in every society which existed, in every part of this planet, through all human history, and pre-history, prior to the founding of the first modern nation-state, that of Louis XI’s France, in 1461-1483. The struggle to defend and develop the post-feudal European nation-state institutions, is the source of the great improvement in the demographic characteristics of humanity, taken as a whole, world wide, under the influence of the post-1461 spread of modern European civi-



LoC/U.S. News & World Report Collection/Marion S. Trikosko
“The only outstanding national hero of the U.S.A.’s past 30 years, is the Rev. Martin Luther King.”

lization throughout the planet.

When, the last fight to defend freedom was lost, in England, with the defeat of the English patriots by the so-called “Venetian Party” faction of the First Duke of Marlborough, the patriots of the United Kingdom, the Netherlands, Germany, and elsewhere looked with new interest toward the strengthening of the emerging commonwealths of North America. As the grip of the British imperial faction was consolidated in the United Kingdom, and our former ally France was corrupted into its disgusting, successive states of internal affairs, during the 1789-1871 interval, this brave little Federal constitutional republic of ours stood out as the sole “beacon of hope” for all mankind.

In our best periods, the U.S.A. showed that the constitutional principles for which we had repeatedly fought war (1776-1783,

1812-1815, 1861-1865) against our principal adversary, the British monarchy and its surrogates, provided the best form of government available to man on this planet. Whenever followed, what U.S. Treasury Secretary Alexander Hamilton named the anti-Adam Smith, “American System of political-economy,” proved, repeatedly, to be the most powerful model of economy on this planet. Under Presidents such as Washington, Adams, Monroe, John Quincy Adams, Abraham Lincoln, William McKinley, and Franklin Roosevelt, we were, as the poet’s image provides, “the cynosure of neighboring eyes,” the beloved wonder and hope of most of the oppressed peoples of this planet.

As the repeated experience was brought upon us from without, has demonstrated, there is no security for our nation, or for our citizens, until such time as the planet has been brought into a better order than has been the case up until now. We have no right to decree, to impose such an order; but, we do have the duty and responsibility, of morals and self-interest, to understand the implications of our role among the community of nations, whenever injustice or unreason might, once

again, imperil world peace and our own existence. In this respect, it were better to take a suitable role of leadership among nations, in advance, than to wait until a new war is the only remaining alternative.

Presently, we are caught, most ill-prepared, in the worst global crisis of this century, perhaps of the recent several centuries. Our United States can make a decisive difference; we have potential collaborators, among nations and others throughout this planet. We have but to summon the will and wisdom to use our power as the leading power of this planet, to bring together the forces of good will, and make the common effort which puts the presently looming peril safely behind us.

To know that, and to be part of that, is, in summary, what it is to be “an American.” To become such an American, the kind of education I have identified, provides the most efficient route.

QUERY 5: “Do you include ‘Under God’ when you say the Pledge of Allegiance?”

In my personal practice, I am not much inclined to ceremonial formalities; I would not wish to say anything which would overrate such formalities. However, I do say “Under God.”

The direct origins of the best in modern European civilization are in the Augustinian, Judeo-Christian heritage. Essentially, the passage which I have referenced from Genesis, and Plato’s principle of *agapē*, as that is represented by the Christian Gospel of John and Epistles of Paul. That all men and women are made “in the image of God,” to share “dominion,” and bound together by love of truth, love of justice, and love of God, is the source of the energy by means of which the fight to free the great majority of mankind from the status of virtual human cattle—as slaves, serfs, or worse, gave birth to the struggle for a Classical humanist education, extended to all, and, out of that struggle, the 15th-century birth of the modern nation-state.

Anyone who does not know, and honor that plain historical fact, is either an illiterate, or a fool.

QUERY 6: “How should today’s youth feel about the Vietnam War?”

He, or she, should hate that war, but honor those



Secretary of Defense Robert McNamara and Gen. William Westmoreland, Commander of U.S. military forces during the Vietnam War, speak with Gen. Tee, Corps Commander in the Danang area, August 1965.

who performed military service for their country. Our hope should be, that, by identifying the specific evil which prompted Defense Secretary Robert McNamara, National Security Advisor McGeorge Bundy, and others, to plunge us into such a monstrous, and protracted violation of all principles of justified warfare, we can reconcile both those U.S. citizens who fought the war, and those who opposed its immorality.

To understand that war, how it came about, is a long story, which but a few understand today. I have documented that long story elsewhere; it is too long to be presented to the audience, in this setting. The truth must be known, and it must be told, with precision and cognitive clarity, in every secondary school today.

QUERY 8: “What is the most prevalent slavery?”

The “conditionalities” doctrines of the United Nations Organization’s International Monetary Fund (IMF) and World Bank.

QUERY 9: “What children’s book should all parents read to their children?”

I do not feel strongly about such a choice of titles. (One might say: “Anything to keep the kiddies free of the brutish sado-masochism of TV cartoon hours.”) Perhaps Aesop’s fables, or, fairy tales, designed for children, modelled upon Aesop.

The Great Swindle of the Next Generation EU Fund

by Claudio Celani

Aug. 7—The official narrative on the results of the second longest summit of the European Council, which gathered the heads of state and government of the European Union (EU) from July 17 to 21, is that the EU finally showed its power of action, bringing EU leaders to overcome national interests. They finally agreed to an “ambitious” response to the economic consequences of the COVID-19 pandemic, with a combination of grants and loans to member countries in a spirit of solidarity. However, this is pure fiction.

The EU response, a 750 billion Euro plan pompously named “Next Generation EU” (NGEU), comes too little too late. When the pandemic broke out in Italy last February, the EU was unable to coordinate a common response, and Italy was left alone while its partners were hoarding medical equipment for themselves. Then came the lockdown and the productive shutdown, each country implemented its own program of aid to firms and families. The only good thing the EU Commission did was to lift treaty constraints on new debt—which all countries had violated anyway—in order to allow the financing of unemployment, short-work checks, and bridge loans to companies.

Since then, national economies have seen the biggest economic collapse in postwar history, with gross domestic product falling by 10.1% in Germany from April to June compared to the previous quarter, 13.8% in France, 12.4% in Italy, and 18.5% in Spain.

This is the time for a massive investment program, to put people back to work and avoid a general bankruptcy of the productive sector. This is the moment when money—mostly in the form of credit—must flow into the real economy in order to steer a recovery. But



public domain

With its “Next Generation EU” fund plan, the European Union is responding to the demands of the financial oligarchy to further dissolve the sovereignty of its member nations.

no money from this marvelous Next Generation EU plan will flow before mid-2021, when it is too late. So, what is it about?

The NGEU plan is a political scheme to lay the first brick of the European super-state. Its most important features from this standpoint are: (1) *European debt* (not debt of any nation) issued for the first time on a large scale by the European Commission or an EU agency, and (2) *European direct taxation* implemented for the first time on a large scale by the EU.

First They Cite Pandemic, then ‘Climate Change’

The plan is to issue up to 750 billion in “Euro bonds” on the financial markets, to finance grants (290 billion) and loans (360 billion) to EU member countries over a seven-year period. Those grants and loans are to be repaid starting in 2028 out of the EU budget, which will accordingly be stuffed with increased member quotas and direct taxes. On the latter, the Conclusions of the

July 17-21 summit say:

The Union will, over the coming years, work towards reforming the “own resources” system and introduce new “own resources.” As a first step, a new “own resource” based on [taxation of—ed.] non-recycled plastic waste will be introduced and apply as of 1 January 2021. As a

basis for additional “own resources,” the Commission will put forward in the first semester of 2021, proposals on a carbon border-adjustment mechanism and on a digital levy, with a view to their introduction at the latest by 1 January 2023. In the same spirit, the Commission will put forward a proposal on a revised ETS (Emissions Trading) scheme, possibly extend-

Malthus as Central Banker: The European ‘Green Deal’

In her inaugural speech to the European Parliament on July 16, 2019, newly elected European Commission President Ursula von der Leyen announced her “Green Deal” blueprint to make Europe “the first carbon-free continent by 2050.” The plan was officially presented at the European Council of heads of state and government, and is now at the core of the so-called “New Generation EU” recovery plan.

The Green Deal consists of policies to be adopted in all sectors, some of which sound like “we love our mother”—benign platitudes such as “eliminating pollution,” “the need for a cleaner construction sector,” or “clean energy.” More suspicious are the chapters in which the word “sustainability” pops up, such as, “ways to ensure more sustainable food systems,” “sustainability in EU agriculture and rural areas” or “sustainable industry.” The word “sustainability” hides Malthusian policies aimed to prevent the use of technology for the benefit of society and to make nature itself more productive.

In von der Leyen's sick view, Europe should become industrially desertified, dependent on weather conditions for production of energy, and able to sustain only a portion of the current population.

The “decarbonization” of the European continent is supposed to be accomplished in the Green Deal by



European Commission/Etienne Ansotte

Ursula von der Leyen's Green Deal to decarbonize Europe is at the core of the “New Generation EU” plan. She is President of the European Commission.

diverting financial flows from the so-called “carbon economy” to “carbon-free” investments. This will be implemented by creating “green assets”—a new financial bubble, which the psychopaths of the financial markets hope will bail out the financial system and their fortunes. Mastermind of the new “Green Finance” is former Bank of England governor Mark Carney; other former central bankers now working for BlackRock LLP call it a “regime change” in global finance. (*EIR* has published a [profile](#) of Mark Carney.

The “New Generation EU” scheme is the first step in forcing governments to submit to this economic “regime change,” by surrendering fiscal sovereignty to the Malthusian goals of the Green Deal.

ing it to aviation and maritime. Finally, the Union will, in the course of the next MFF [Multiannual Financial Framework], work towards the introduction of other “own resources,” which may include a Financial Transaction Tax. The proceeds of the new “own resources” introduced after 2021 will be used for early repayment of NGEU [New Generation fund—altogether EU1.8 trillion] borrowing.

Representative of many pro-European Union economists who welcomed the decisions of the EU Council, Commerzbank chief economist Jörg Krämer, stressed that a fundamental change has occurred in the nature of the European Union. “For the first time the EU can issue debt in the capital market on a large scale,” Krämer said. “This will not be a one-shot thing. If a new, severe recession comes, or if it is demanded by new challenges such as climate change, it is very possible that the EU will again get into debt on a large scale.”

The march of the EU toward becoming a super-state is also seen in the highly intrusive character of the conditions attached to the NGEU grants and loans. These conditions demand programs for investment reforms and structural reforms (changes in labor laws, pension provisions, etc.), which will be monitored and evaluated by the EU Commission on their merit, cost, modalities, and results. Investment projects must be coherent with the EU guidelines for “decarbonization” and are to be completed within seven years, whereas “reforms” must be completed within four years.

Furthermore, the Growth and Stability Pact, a treaty which binds member states to a balanced budget, has been suspended but not cancelled. It is to be expected that sometime next year, it will be reactivated. Then, monitoring of each nation’s finances by the European Commission will be added to the conditions just described.

All this is downplayed by the “more Europe” faction supported by the financial oligarchy. This faction emphasizes the advantages of borrowing money through the EU at the lowest possible rate on the financial markets. In the case of Italy, which was the destined recipient No. 1—as being, together with Spain, the most hard-hit country by the consequences of the pandemic—the more-Europe leaders boast that according to calculations, Italy is entitled to receive up to 209 billion euros in grants and loans. Italian Prime Minister Giuseppe Conte, for example, claims that the result of the EU summit was his personal victory.

However, Conte’s main antagonist, Dutch Prime



ECB



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Dr. Jörg Krämer, Chief Economist at Commerzbank (left), and Mark Rutte, Prime Minister of the Netherlands, both members of the “more Europe” faction, support the EU’s new power to issue debt in the capital market on a large scale.

Minister Rutte, makes the same claim. Who is right?

Main Target Country To Get ‘Peanuts’

Two prominent experts, economist Michele Geraci and Parliamentary Office of Budget Chairman Giuseppe Pisauro, made some calculations and came independently to very similar conclusions, that in reality, Italy will get “peanuts” from the EU fund.

In an article published by the financial daily *Il Sole 24 Ore*, Geraci shows that Italy’s net gain will be only EU23 billion. On paper, Italy is entitled to receive up to 20.4% of the total EU390 billion in grants. This is EU80 billion. However, Italy must pay its contribution to the “Next Generation EU,” which is EU50 billion,



Schiller Institute



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Italian economist Michele Geraci, and Giuseppe Pisauro, Chairman of Italy's Parliamentary Budget Office, have both determined that Italy will only get "peanuts" from the new "Next Generation EU" fund.

according to Italy's 12.8% capital share. Furthermore, Italy must pay part of the rebates which were given to the five countries that opposed the fund—during months of bitter wrangling over it—in order to buy their consent. Its share of those bribes is EU7 billion. According to this rough calculation, the net amount of grants remaining for Italy is EU23 billion, to be spread over 7 years (the duration of the EU budget): a mere EU3.3 billion yearly. Budget chairman Pisauro reported a slightly higher figure to the Italian Parliament's Joint Budget Committee. He put the amount of grant money assigned to Italy at EU87 billion, and said its obligation would be lower: EU41 billion. This means that the country's net gain from the grants is EU46 billion, in yearly installments of EU7 billion per year.

Whether EU3.3 billion or EU7 billion per year, this is less than what Italy has been able to borrow for itself on the capital markets *each month* in 2020, and that at a low yield.

What's more, the grant money must be advanced by the member country receiving it and will be reimbursed by the EU only if the member country complies with the constraints attached! This means that if the programs and the "reforms," either in their content or in their implementation, do not satisfy EU scrutiny, Italy will merely have given itself a grant. This goes of course

also for Spain and all EU member countries that want to apply for those funds.

Meanwhile, the group of countries that had opposed the fund got fat rebates that artificially lowered their share of contributions to the NGEU. The Netherlands, leader of the five, got a rebate of 1.9 billion, which is a 78% reduction of its current net position. The Netherlands is a net payer of EU2.46 billion to the EU budget. Similar rebates have been given to Sweden (1.069 billion), Austria (565 million), Denmark (377 million) and even Germany (3.671 billion). These funds

are bound by no conditions.

Thus, the EU is not responding to the pandemic and economic crisis at all. The amount of funds is insignificant and is going to come too late to revive the economy, build public health facilities, or any other infrastructure for recovery. Rather, the EU is responding to the long-stated demands of the financial oligarchy centered in London, that it take power away from the sovereign nations of Europe. The EU is thus acting as a super-state with its own budget, borrowing power and means to control economic investments and conditions in Europe absolutely.

This super-state is not so stingy with the megabanks and the hedge funds. Whereas EU member countries must wait until mid-2021 to receive some money from the celebrated Next Generation EU plan, the European Central Bank (ECB) is printing dozens of billions of euros every week to finance the psychopaths of the financial market. The European Central Bank has injected 715 billion Euro into the financial system in the month of July alone, both in loans to banks and in purchases of corporate and government bonds. The ECB's current rate of monetary injection is *more than a thousand times* that of the flow of funds to Italy, which is set to begin next year.

Something is certainly rotten in the super-state of Europe.

EDITORIAL

The Next Hiroshima Before November? We Need a World Order of Peace!

by Helga Zepp-LaRouche

Aug. 8—I'm sounding the alarm! Underestimated by most of our contemporaries, the U.S. campaign against China is escalating and could lead to a military conflict before the U.S. presidential election in November, Chinese analysts fear. Former Australian Prime Minister Kevin Rudd warns in an article in *Foreign Affairs* with the fateful title: "Beware the Guns of August—in Asia," with a clear reference to the outbreak of the First World War: "The once unthinkable outcome—actual armed conflict between the United States and China—now appears possible for the first time since the end of the Korean War. In other words, we are confronting the prospect of not just a new Cold War, but a hot one as well."¹

Current Australian Prime Minister Scott Morrison shares this fear that war between the U.S. and China was "previously inconceivable and not considered even possible or likely in terms of those types of outcomes" but "is not considered in those contexts anymore."

The same concern is also coming from the Russian side: On the 75th anniversary of the use of nuclear weapons in Hiroshima, Russian Foreign Minister Lavrov warns against a change in American military doctrine, which now regards nuclear weapons as "usable."

Only 75 years after the end of the Second World War, which left large parts of the world in ruins, how could the world arrive at this point of potential extinction? Because that would be the consequence of a third, thermonuclear world war. It started with the method of

Schrecklichkeit ("frightfulness"), with the demonstration of an act so terrible, that one convinces the potential opponent that only unconditional submission can save him.

Lyndon LaRouche had already condemned this use of nuclear weapons as militarily unnecessary 25 years ago, in a comment on the 50th anniversary of Hiroshima and Nagasaki. Japan had long been defeated and had explored the possibility of a surrender and an end to the war as soon as possible through negotiations between Emperor Hirohito and Cardinal Giovanni Montini, who was then secretary to Pope Pius XII and later became Pope Paul VI. These reports, which LaRouche had received through contemporary witnesses, have now been confirmed by documents available in the National Archives in Washington, and raise the question of whether it is not high time that this unprecedented act be treated and discussed as an extraordinary war crime, this act which was committed with the endorsement of Great Britain, and because of which, more than 200,000 people, mostly civilians, perished, while as a consequence countless more suffered and died.

"There was no need for a military invasion of the islands of Japan. There was no military reason for dropping those nuclear weapons on two cities, Hiroshima and Nagasaki, of a Japan which had been utterly defeated; there was only a British geopolitical motive, which had almost nothing to do with Japan as such," LaRouche wrote.²

The war was practically over. Japan was cut off from its supply lines by the American naval blockade

1. <https://www.foreignaffairs.com/articles/united-states/2020-08-03/beware-guns-august-asia>

2. <https://larouche.com/lar/1995/hiroshima.html>

and the Russian occupation of Korea and northern China. “In this situation,” emphasized Russian Foreign Minister Lavrov, “this nuclear bombing by the USA was actually just a show of force and a test of the effect of nuclear weapons on civilians.” Scott Ritter, former UN weapons inspector in Iraq, wrote in a commentary on this anniversary that Truman’s inner circle, including Secretary of State James Byrnes and Secretary of War Henry Stimson, were in favor of the deployment of nuclear weapons because they believed it would help to scare off the Soviet Union from a future war.

‘Frightfulness’ as Method

Behind this was the whole strategy that H.G. Wells had stressed repeatedly, even before the Second World War, and that Bertrand Russell published in his 1946 article, “The Atomic Bomb and the Prevention of War,” namely, to make the experience of war so terrible that every possible opponent, and especially the Soviet Union, could be forced to give up its sovereignty and submit to a world government.

Ritter also quotes General Leslie Groves, the director of the Manhattan Project that produced the two nuclear weapons, who told the scientists involved: “The purpose of the whole project was to subdue the Russians.” So it was not about saving human lives and ending the war in the Pacific in the most humane way possible, as the previous, official version about Hiroshima and Nagasaki had claimed, but as the theorist of the containment policy against the Soviet Union, George Kennan put it, it was about orchestrating the post-war era “in our image.”

In an August 5 article in the *Los Angeles Times*, Gar Alperovitz called for an “honest national conversation” on the fateful first use of nuclear weapons, which “continues to threaten our survival.”³ What is really needed is an international debate that includes the role of Churchill, who dominated Truman, and the Anglophile circles around Averell Harriman.

Correctly identifying the intention behind the initial use of nuclear weapons against a civilian population is not an academic exercise, as it appears that the current U.S. establishment has reverted to using “frightfulness” as a method of advancing its interests, not only against China.

What else can it mean, when the three U.S. Senators, Ted Cruz, Tom Cotton, and Ron Johnson, write in a letter to the management of the ports of Sassnitz and Mukran on the German island of Rügen that they either terminate cooperation with the Northstream 2 gas pipeline, or else the U.S. will take measures that will destroy the financial viability of the ports. The pipeline is already 90 percent complete and is important for the energy supply not only in Germany but also other parts of Europe, but the letter says: “The sanctions are mandatory and there is no discretion in imposing them ... If you continue providing goods, services, and support for the Nord Stream project, including by provisioning the [pipelayer vessels] *Fortuna* and *Akademik Cherskiy*, you will destroy the future financial viability of your company.”⁴

If that is the tone when speaking to the so-called “allies,” what should countries think when the U.S. has officially declared them to be “strategic adversaries” and “enemies”?

The British Terror Offensive

After Pompeo called for the creation of an international alliance against China and issued a *de facto* call for an uprising of the Chinese people against the government, the deployments of the U.S. Navy in the South China and China Seas, as well as of U.S. fighter jets along the Chinese coast, increased. Health Minister Azar’s visit to Taiwan again provoked the PRC. This is the highest-ranking visit by the U.S. since 1979 and is viewed by China as a clear violation of the “one-China policy,” which has so far been the foundation of the U.S.-China relationship. The official reaction from Beijing was that the visit endangers peace.

With Obama’s policy of a “pivot to Asia,” the expansion of military bases in the Pacific region was accelerated, which today represents a complete encirclement of China by over 400 such bases from Australia to Japan, Korea to Afghanistan and India. Various war plans by the Rand Corporation, including one entitled, “War with China: Thinking Through the Unthinkable,” conclude that the sooner it is waged, the fewer American losses there would be in such a war. The more China could expand its A2AD (anti-access area denial) capacities, the fewer the Chinese losses would be, which would reduce U.S. strike capability. Amitai Etzioni,

3. <https://www.latimes.com/opinion/story/2020-08-05/hiroshima-anniversary-japan-atomic-bombs>

4. <https://www.cruz.senate.gov/files/documents/Letters/2020.08.05%20Final%20Mukran%20Port%20Letter.pdf>

who wrote a book three years ago about avoiding war with China, expresses concern that the ongoing preparations for war could convince China that a pre-emptive strike to eliminate its nuclear weapons could be in preparation, which could present China with a terrible choice of whether to strike first, which would lead to a nuclear war.

How far we have come on this road becomes clear in an article by the editor-in-chief of *Global Times* on August 7. Under the headline, “If war breaks out between China and the U.S., which side will have the upper hand?” Hu Xijin discusses the question of what happens if Taiwan, which is one of China’s core interests, is encouraged by the U.S. to step across the red line and there is a military trial of strength.

Regardless of the fact that the overall military power of the USA is the stronger, when it comes to China’s core interests, what counts is the combination of military clout, morality, and the will to fight. Who would be stronger in a war on the coast of China? China would by no means fire the first shot, but China is well prepared to fire the second shot in response to the first. When it comes to China’s core interests, it will not back down.

The narrative that has been orchestrated by former MI6 bosses Sir Richard Dearlove and John Sawers, the Henry Jackson Society, and Niall Ferguson, that China was responsible for the worldwide spread of the coronavirus pandemic, was designed to determine the cam-

paigned themes of the current presidential election in the USA. This narrative is black propaganda intended to serve as the backdrop for the military confrontation with China.

The Summit Solution

In view of the unprecedented combination of crises mankind is currently facing, the summit of the five permanent members of this UN Security Council initiated by President Putin is possibly the last chance to deviate from the current suicidal course and to attain a new higher level of cooperation among the nuclear powers. This summit must remove the real reason for war—the bankruptcy of the transatlantic financial system—by establishing a new credit system, a New Bretton Woods System, and establishing a new platform for international cooperation in combatting the pandemic. This summit must resolve an order of peace that begins with the construction of a modern health system in every single country on Earth, and which focuses on the common goals of humanity, such as, for example, the imminent realization of nuclear fusion, and international cooperation in space travel.

Every person and every nation with an interest in human survival should actively support the success of this summit. This is nothing less than a touchstone for our moral fitness to survive.

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