Cognitive Economics

Cognitive capital in the 21st Century knowledge economy

Overview

An new cognitive engineering technology can deliver greater conscious awareness and cognitive abilities to a wide cross-section of humanity, beginning with the mainstream populations of industrialized Western democracies.

Genetic cognitive upgrades will enhance human-centered traits of creativity, imagination, mindfulness, and emotional intelligence.

The technology will leverage the transformative power of CRISPR to enrich human awareness and cognition.

CRISPR Revolution

“The discovery of the century.” – Bloomberg

“DNA editing will remake the world.” – Wired

“The potential is enormous.” – TIME

“This revolutionary gene editing tool could change the world.” – NBC News

“The gene-editing tool’s potential to upend science is dizzying.” – Vox

“CRISPR really will change the world forever.” – ScienceAlert

Executive Summary

This report provides civic, business and social leaders with a market intelligence analysis of economic and technology trends in the emerging field of genetic cognitive enhancement.

A genetic “smart pill” can raise conscious awareness, focus, clarity, mental acuity and creativity, supplying a lifelong cognitive boost which can elevate a person’s quality of life and ability to contribute to society.

The genes associated with cognitive capacity have been isolated, and microbiology tool sets to access and modify them have been identified.

The strategies for editing these genes are based upon new cognitive engineering principles which are conclusively proven by 25 neuroscience experiments conducted at 15 universities in 8 countries including Harvard, Yale, Columbia, MIT, Imperial College of London and the University of Vienna.

The feasibility of fabricating and manufacturing the required microbiology tools has been verified by senior executives in leading genetic engineering industry firms.

The long-range market potential for genetic cognitive enhancement is estimated at $1 trillion.

Introduction

Science and neuroscience are making landmark discoveries at a rate unknown in our lifetime or across history. A relentless parade of new scientific developments is unfolding on many fronts. The pace of advance is accelerating, and many rapidly-evolving, potentially transformative technologies are appearing on the horizon.

This report identifies revolutionary new developments which could have a massive impact on humanity's cognitive resources in the near future. It also discusses how these technical breakthroughs could change our world and recommends ways to capitalize on them.

Combining recent advances in cognitive science and genetic engineering can produce sustainable expanded states of awareness and cognitive ability. In short, it is now feasible to genetically engineer greater cognitive capacity into human DNA.

"Genomic technology has evolved from the stuff of science fiction to a tangible reality, with massive financial implications."

– Fortune

Macroeconomic Trends

• **Cognitive economics:** Artificial intelligence and robotics will displace millions of workers across a wide range of industries in the near future. As these new technologies take hold, they will also create millions of high-paying, cognitively-demanding jobs. In today's interconnected world, these new jobs will inevitably emerge in countries where the mental capacity of the workforce matches their demands. In short, we are entering an era of global cognitive economics.

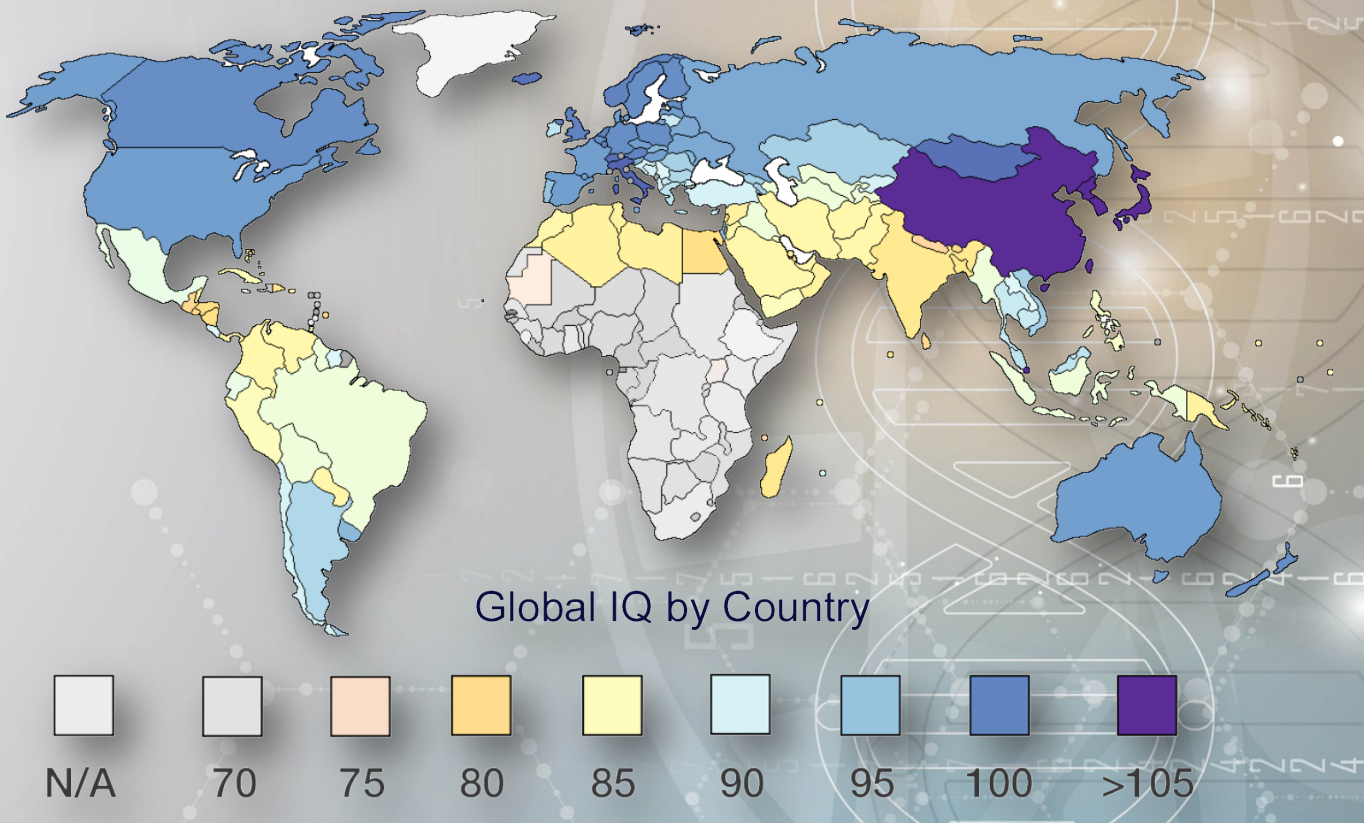
• **Cognitive geopolitics:** The new global economy is an innovation race which China is winning. The worldwide center for microelectronics has already migrated from San Francisco to Shenzhen, and software is next. Silicon Valley is microdosing to stay ahead. To thrive in this century of global competition, American business needs more innovation, more creative solutions, and more exceptional thinking.

World-renowned Oxford scholar Nayef Al-Rodhan believes that harnessing cognitive enhancement technologies can help nations engineer more productive, focused and competent workforces; thus raising the overall output of their economies. (1)

China is moving ahead aggressively in human genetic enhancement and is now the world leader. Darryl Macer of the Eubios Ethics Institute predicts China will be at the forefront of human genetic enhancement. Since Western countries have more conservative attitudes about synthetic biology, he argues that China is set to lead the world in genetic enhancement. (2) By upgrading the cognitive abilities of its population, China could become even more competitive on the global stage, while American businesses close their doors in vast numbers.

Global cognitive economics is a high-stakes game which demands bold thinking and dynamic action. China has already genetically engineered 86 people, and this is only the beginning. (3) To protect democratic free economies from an onslaught of cognitively-augmented Chinese workers, Western leaders must plan ahead and start taking action now.

Cognitive enhancement represents a lucrative investment opportunity, but it is more than that. It is an economic imperative to safeguard free world economies and uphold the values and ideals we cherish. This report describes a new technology which can address these challenges.

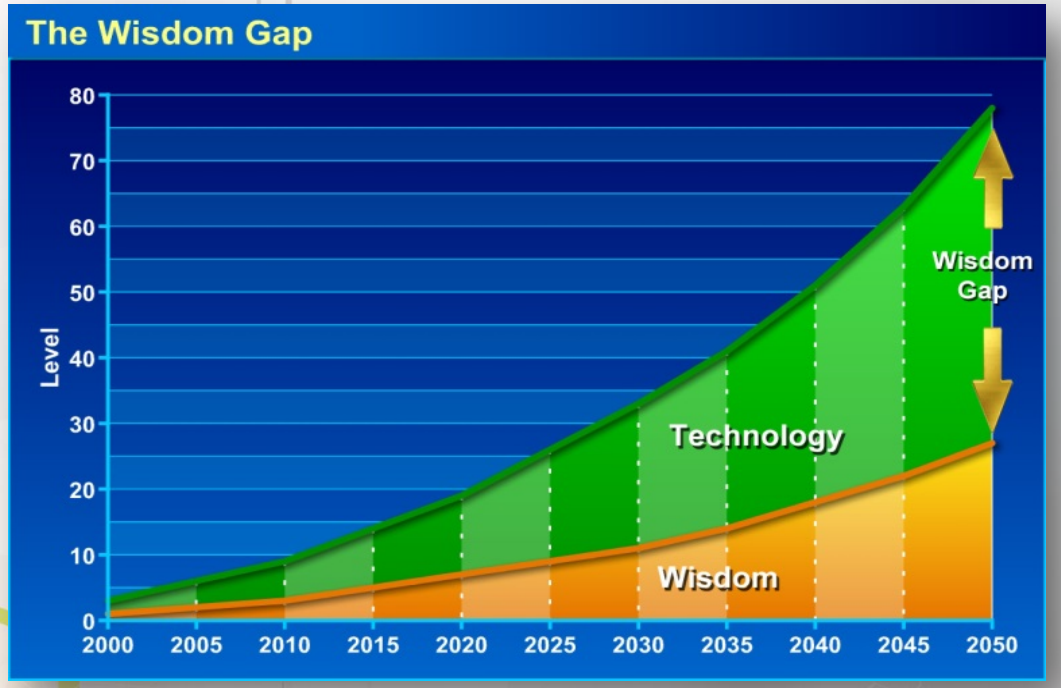


Source: IQ and Global Inequality by Richard Lynn and Tatu Vanhanen (4)
Data for Africa not available.

Safeguarding Humanity

Futurists agree the 21st Century will witness a constant onslaught of change and an ever-increasing flood of new technologies. The speed of scientific advances is multiplying exponentially, and the potential for abuse in artificial intelligence, robotics and other powerful technologies is beyond our capability to measure.

The blistering pace of advance is outstripping humanity's ability to manage progress wisely, placing potent new technologies in the hands of business leaders and policy makers who are fixated on short-term results without considering long-range impacts. This combination of scientific prowess and narrow-minded shortsightedness is creating growing risks of misusing ever-more powerful technologies.



Microprocessor power has been the driving force behind advances in science and engineering. Since there is no counterpart to Moore's Law in the humanities, the disparity between progress in the physical and human sciences is growing wider, creating a "wisdom gap."

Through a global initiative to expand its cognitive resources, humanity can raise its ability to safely manage runaway technology change.

Genetics Trends

The human race is standing at the threshold of a Genetic Age. Genetic engineering can enhance cognitive faculties such as mental acuity, awareness and intelligence, and physical attributes such as appearance, strength, and agility.

The previously-unfathomable mechanisms of gene interaction have been decoded by a revolutionary laboratory technique called CRISPR. This development is a seminal achievement in the history of biological research. Its impact on human civilization is being compared to the steam engine, which gave rise to the Industrial Revolution, and the transistor, which spawned the Information Age.

The Genetic Age dawning today will experience a power growth curve similar to the one the Information Age has enjoyed over the last six decades. Computers changed the world, and forward-thinking families who took early positions in the emerging computer industry were lifted into eminence.

Extraordinary Opportunity

“Talk to any biologist right now and you will hear a level of excitement that comes only from the emergence of something truly groundbreaking…

If the evolution from giant mainframes to personal computers forever changed technology, CRISPR promises to do something similar for genetics…

The potential is enormous…”
– TIME Magazine

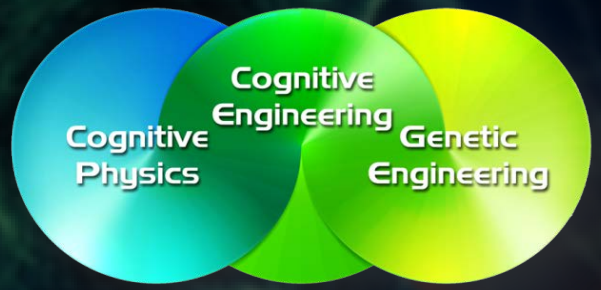
CRISPR

- Allows scientists to edit DNA like programming a computer
- Tremendous improvement in DNA editing speed, ease, cost and accuracy
- Monumental landmark in the history of biological research
- Impact on human civilization being compared to the steam engine and the transistor

Technology Trends

Visionary leaders can take advantage of new research which reveals vast reserves of human cognitive potential buried beneath layers of unconscious brainwave activity.

A revolutionary technology for unlocking this potential to generate stable expanded states of consciousness, called *cognitive engineering*, has arisen at the confluence of two new branches of science, *cognitive physics* and *genetic engineering*.



Cognitive physics reveals seminal new discoveries about the nature of awareness and its interactions with human neurology. These insights yield genetic engineering strategies for optimizing the brain's neurological substrates for cognition.

This research can be leveraged to develop genetic engineering solutions for elevating human cognitive ability to sustainable higher levels of capacity and performance.

Cognitive engineering reveals genome editing strategies for achieving lasting states of expanded awareness.

The world today is shifting into a knowledge economy where cognitive capital is the prime currency.

In the 21st Century, the ability to marshal this precious resource for creative problem solving will determine the economic mobility of individuals and the wealth of nations.

Genetic Capital

We are witnessing the emergence of a new kind of wealth – genetic capital. This new form of capital will create value in a myriad of applications across agriculture, energy, health and industry, but perhaps its greatest potential for value creation lies in *cognitive capital.*

Cognitive Capital

Defined as the measure of an individual's free, unbound conscious awareness in present time, cognitive capital is the source of all cognitive talents including creativity, focus, compassion, motivation and mental acuity.

Industry Trends

Investment in gene therapy is booming. According to The Alliance for Regenerative Medicine, public and private genetic engineering companies raised $25 billion globally in the last four years. (5)

ARK Investment Management identifies CRISPR gene editing as one of the top investable disruptive technology platforms, rating it above robotics and 3D printing. (6)

Investment advisor Jim Mellon believes we are entering the greatest era of discovery in the history of human civilization. In his book *Cracking the Code: Understand and Profit from the Biotech Revolution that will Transform Our Lives and Generate Fortunes*, he predicts synthetic biology will become one of the world's largest industries. (7)

In the same way transistors were applied across many different fields, genome editing will be used in many diverse human applications to improve human abilities:

Cognitive: Cognitive faculties such as self-awareness, mental acuity, and intelligence.

Anatomy: Physical attributes such as strength, agility, beauty, grace and stamina.

Longevity: Elements of long life including wellness, immunity and metabolism.

Talent: Mental, physical and emotional talents.

The scope of this report is limited to the first category, cognitive enhancement. An entirely new industry is emerging to leverage the power of CRISPR to transform human cognitive ability.

Vision

The opportunity to lift humanity into greater awareness and mental acuity represents a defining moment in the progress of human civilization. Such a monumental advance can empower a new generation of leaders to reach up and bend the arc of history in the direction of more freedom, greater wisdom, and more compassion.

Societies, groups and nations which embrace this disruptive new technology can harness its vast potential to drive exponential growth in cognitive capital.

Widespread application of these technologies can protect free world economies, enrich humanity's cognitive capital, and unleash a cultural and scientific bonanza which elevates quality of life around the world.

R&D Strategy

• R&D leveraging: The initial applications for genome editing are in medicine for correcting genetic defects. However, the CRISPR tools and techniques being developed for these life sciences applications can be easily re-directed to enhancing cognitive ability in healthy individuals.

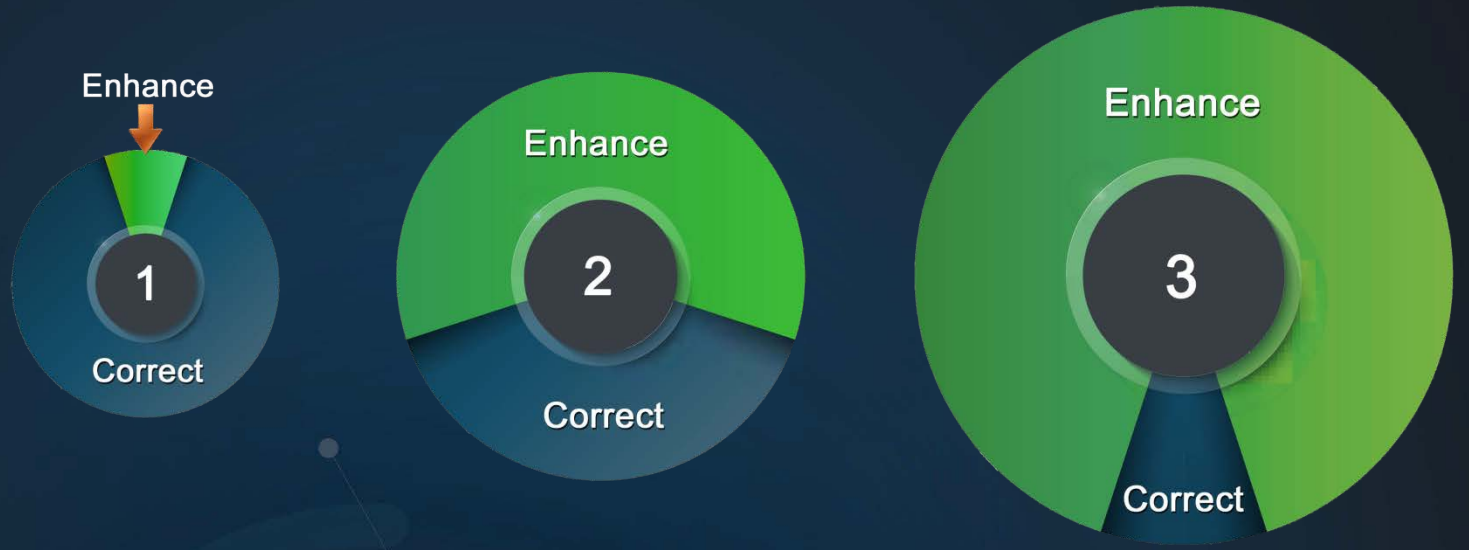
The same technology which is used to correct genetic defects can be applied to improve human abilities; it is merely a matter of which genes are edited. The genome editing tools themselves are indifferent as to which gene they are applied to.

The worldwide investment in life sciences genetic engineering projects is generating a universal set of CRISPR tools which are transferrable to innovative applications for human cognitive enhancement.

Genetic Applications Forecast

Since genetic enhancement applications for improving human ability serve the large mainstream population of healthy adults, they will outstrip the early applications for correcting genetic defects.

In Information Age parlance, medicine resembles the mainframe of genetic engineering, while enhancement is the internet.



Source: Cognitive Genetics Institute

- **Business strategy:** Cognitive genetics research programs will proceed in parallel with life sciences genetic research initiatives around the world which are perfecting the CRISPR genome editing tool set. This strategy allows cognitive genetics developers to leverage global genetic engineering R&D, while focusing their resources to create competitive advantages and achieve a dominant market position in cognitive enhancement.

"The technology's possibilities are staggering."

– Fortune

- **Conclusions:** Worldwide investment in CRISPR companies began in earnest in 2015. Today, major advances in CRISPR technology are announced almost every month.

The CRISPR tools and techniques developed initially for life sciences applications can be directly applied to enhancing human cognition. The first company to capitalize on this opportunity can achieve a leadership position in genetic cognitive enhancement.

Success in today's world requires bold decisive action based on keen insights into emerging revolutionary trends. Forward-thinking leaders can be on the winning side of change by becoming early adopters and innovators who turn potential into opportunity.

Marketing Strategy

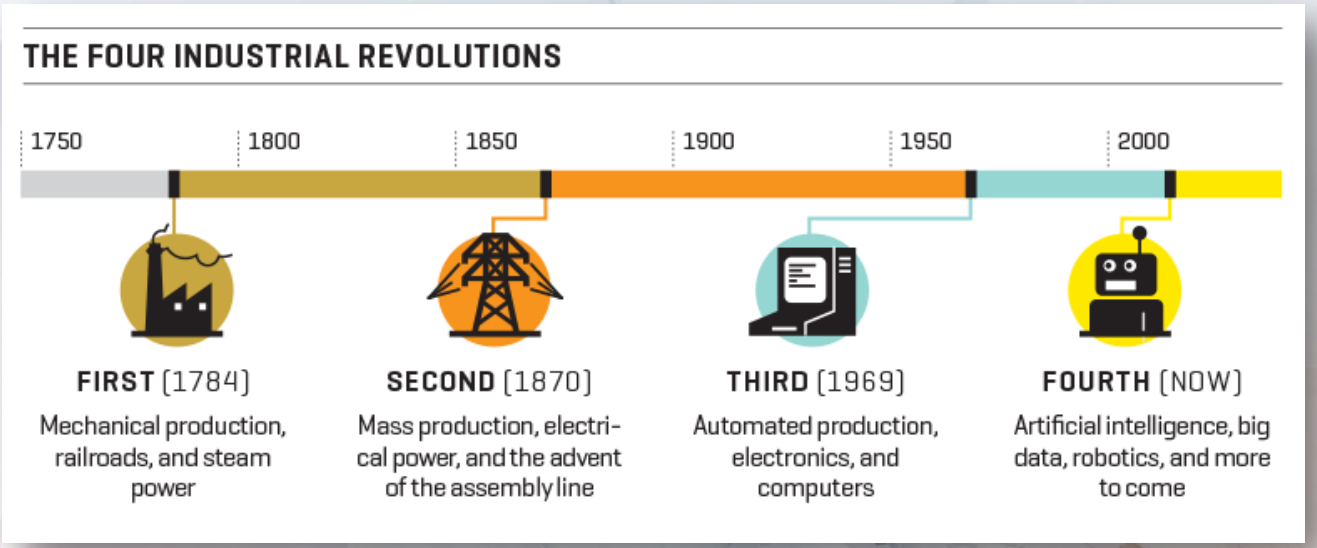
- **Market size and attributes:** The long-range U.S. cognitive enhancement market potential is estimated at $1 trillion, with the largest market being Generation Z. This generation's share of the U.S. population is projected to reach 25% in 2020, while in the EU, it is expected to rise to 21%. (8) Table 1 summarizes the needs of Generation Z and ancillary markets.

Market	Need
Generation Z	Expanded human value skills such as imagination and creativity to stay ahead of competition for jobs from artificial intelligence and automation.
Generation Z parents	Give their children every advantage in tomorrow's challenging economy.
Entrepreneurs	More innovation, creativity, energy and focus to overcome competition from China.
Personal growth seekers	Higher consciousness, greater clarity of purpose and accelerated personal evolution.
Spouses	Greater harmony in relationships, love and emotional intelligence.
Knowledge workers	More imagination, intuition and mental acuity to boost performance.
Families	Increased empathy, mindfulness, love, compassion and harmony.
Adult learners	Develop new skills faster and improve academic performance.
Meditators	Receive the benefits of meditation without the work.

- Table 1 -

- **Generation Z market:** Generation Z faces unprecedented challenges in career development as automation and artificial intelligence replace conventional jobs with new, more cognitively-demanding roles. As we enter the Fourth Industrial Revolution, artificial intelligence and robotics will eliminate millions of jobs in the next decade.

- **Market psychographics:** Genetic cognitive upgrades will become popular in the 2020s in a world where cannabis is widely legalized and cognitively-expanded states are commonplace (particularly among Generation Z).



"CRISPR has been widely celebrated as one of the most groundbreaking biotech discoveries of the 21st century."

– Fortune

- **Job market changes:** Research by McKinsey & Co. indicates that 45% of all current tasks could be automated with present technology. (9)

Technology will also create new kinds of jobs which do not exist today – up to 30% more in the near future, according to a World Economic Forum study. (10) Many of these new jobs will be cognitively-demanding, requiring imagination, creativity and mental acuity.

- **Value proposition:** Cognitive upgrades will expand a person's capacity for creative innovation and learning new competencies, delivering the mental boost young people need to stay ahead of artificial intelligence and automation. Upgraded young adults will have more focus, concentration and clarity for mastering key new skill sets critical for success in the Fourth Industrial Revolution economy, such as growth hacking, coding, behavioral psychology and data mining.

Cognitively-enhanced individuals will make ideal employees for companies competing in the 21st Century knowledge economy, since they have enriched cognitive capital for developing creative solutions to business problems. They will also be assets in the workplace due to their higher emotional balance and morale. Hence, the upgrades will have an economic value to employers.

Candidates for upgrades make an investment in themselves which pays dividends throughout their careers in the form of higher salaries and faster advancement. For professionals, these rewards could be comparable to the value of a college degree, and for entrepreneurs, potentially greater.

• **Market Positioning:** Cognitive upgrades can augment traditional undergraduate education to position young adults for success in tomorrow's challenging global economy. The upgrades offer several key advantages as shown in Table 2. Education and cognitive enhancement can be combined in several ways:

College Supplement: 4 year college + cognitive upgrade
College Hybrid: 2 year college + cognitive upgrade
College Alternative: Technical or business school + cognitive upgrade

Attribute	College Education	Cognitive Upgrade
Deliverable	Knowledge and soft skills	Hardwired abilities
Benefits primarily apply to	Professional life	Every aspect of life
Permanency of gains	Knowledge and skills can quickly become outdated	Permanent lifelong ability
Syllabus	Four years of study	One semester of study

- Table 2 -

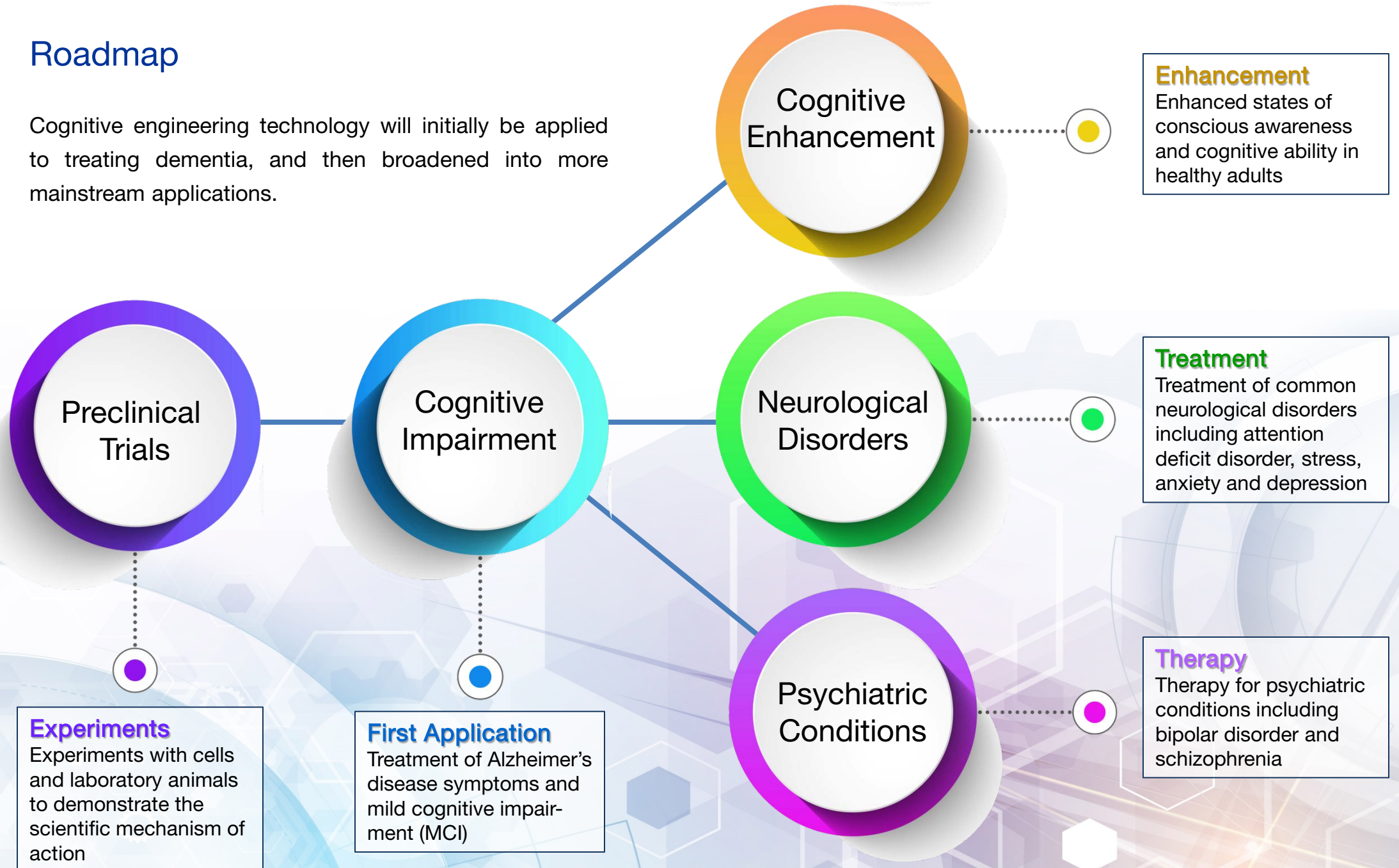
• **Forecast:** The perceived economic value of college degrees anchored the creation of $1.8 trillion in wealth during the last 20 years, which has flowed into the American economy in the form of student loans. (11) American families and their children were willing to spend this money because they believed a college education would provide valuable career and economic advantages.

The value of a college education in today's rapidly-changing world is increasingly coming under scrutiny. Some of America's most successful people have publicly questioned the value of a college degree, including Bill Gates, Steve Jobs, Mark Zuckerberg and Peter Thiel. Elon Musk has famously said, "There's no need even to have a college degree at all." (12)

In the coming years, cognitive upgrades could be valued on a par with college degrees, opening a new wealth creation paradigm similar in principle to student loans. Over time, this new model could conceivably generate $1 trillion in value.

Roadmap

Cognitive engineering technology will initially be applied to treating dementia, and then broadened into more mainstream applications.



Research Program

General-purpose cognitive enhancement technology will be benchmarked as a symptomatic reliever for Alzheimer's disease, providing a safe and effective treatment which sharpens clarity, focus and mental acuity. By leveraging the power of CRISPR, the R&D program will achieve proof-of-concept quickly at minimum cost.

Preclinical studies

In vitro experiments: Demonstrate the treatment's neuron-level mechanism of action by modifying neuron excitability and activity with CRISPR. Time frame: 2020 | Cost: $250K

In vivo experiments: Establish the treatment's efficacy in gene-edited laboratory animals using behavioral tests for measuring cognitive ability. Time frame: 2020 | Cost: $3M

Clinical trials

Phase 1 Safety: Determine safety and dosage in 20-50 healthy adult volunteers for an RNA version of the therapy with temporary effects. As a by-product, the Phase 1 trial will provide proof-of-concept for general-purpose human cognitive enhancement, generating headline news. Time frame: 2021 | Cost: $10M

Phase 2 Efficacy: Measure the RNA therapy's efficacy in relieving Alzheimer's symptoms in a group of several hundred patients Time frame: 2022 | Cost: $20M

Phase 3 Efficacy and adverse reactions: Measure the RNA therapy's efficacy in relieving Alzheimer's symptoms in a group of 300 to 3000 patients Time frame: 2023 | Cost: $40-80M depending on group size.

Summary

The human race is standing at the cusp of a Genetic Age. Hailed by Bloomberg as “the discovery of the century,” CRISPR is being compared to fundamental breakthroughs like the steam engine and the transistor. Public and private investment is pouring into CRISPR, and nothing can stop the technology. The genie is out of the bottle.

Although CRISPR’s initial applications are in medicine to correct defective genes, it can also be used on healthy genes to enhance human ability. Recent scientific advances have revealed how to modify our genes to raise conscious awareness and mental acuity. A genetic “smart pill” will enhance mental faculties such as concentration, mindfulness, creativity and intelligence, supplying a lifelong cognitive boost which elevates a person’s quality of life and ability to contribute to society.

In the workplace, cognitive upgrades will expand a person’s capacity for creative innovation and learning new competencies, helping people master key new skill sets critical for success in the Fourth Industrial Revolution.

Conclusions

The world today is shifting into a knowledge economy where cognitive capital is the prime currency. In the 21st Century, the ability to expand this capital and apply it to creating innovative solutions will determine the economic trajectory of individuals, communities, corporations and nations.

Although visionary leadership will be required to achieve the full promise of these scientific and technical innovations, the potential benefits are enormous. It will be up to progressive leaders to maximize the opportunities of these transformative technologies at every level of society.

Many challenges lie ahead, but there is considerable cause for optimism about the potential for cognitive engineering technologies to drive widespread changes in human knowledge and behavior which can generate substantial benefits across the globe.

Contact

Contact us to learn more about how you can participate in this vital new research to create a brighter future for humanity.

COGNITIVE GENETICS INSTITUTE

Voice: +1 (772) 324-8800 • Email: info@cognitivegenetics.co
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Supplementary Information

Exhibit I – Service Delivery

Professionally-certified counselors will screen applicants to determine suitable candidates for gene therapy. Approved candidates receive education to prepare them for genetic enhancement and support them in achieving their goals.

Graduates from this program receive counseling to help them harvest the greatest benefit from expanded awareness and remove any blocks or limitations which might interfere with their progress. Participants who successfully complete their education and counseling programs become eligible for genetic upgrades.

The results of each upgrade are scientifically verified with psychological tests and brainwave measuring equipment such as Brainmaster,™ Muse,™ Emotiv™ or other EEG devices to quantify awareness gains and improvements in cognitive functions.

Living in higher consciousness will be transformative for many people. Cognitively-enhanced individuals may experience positive shifts in personality, outlook, values, openness, relationships, professional interests, and many other areas. Graduates will attend continuing education programs which help them understand and navigate these changes to realize the greatest benefit for themselves, their families, their communities, and humanity.

Exhibit II – Social Responsibility

The influence of cognitively-enhanced individuals will spread through their families, communities and workplaces, ultimately benefitting humanity as a whole.

- *Families:* Expanded consciousness fosters harmony in human relationships. It enriches the spiritual dimension of families, bringing more awareness to family dynamics, and creating deeper and more meaningful relationships between spouses.

- *Communities:* Greater peace of mind and emotional balance will reduce conflicts individually and societally and improve community coherence.

- *Workplaces:* Employees with enriched cognitive capital can help companies develop creative solutions to business problems. Increased happiness and positive emotional states will also engender greater employee wellness by up-regulating epigenetic pathways.

- *Humanity:* A global shift towards higher consciousness will help people to realize their interconnectedness with the human community and nature. Heightened cognitive abilities can be applied to solving some of the planet's biggest challenges and problems. Greater awareness of humankind's spiritual dimension can open the way to a golden age of wisdom and foster accelerated progress in the arts and sciences.

Philanthropy

The socially-responsible implementation of cognitive engineering requires special measures to level the playing field to avoid exacerbating existing inequalities or creating a cognitive elite. Accordingly, a non-profit organization will manage a cognitive enhancement scholarship fund for deserving underprivileged individuals of high merit.

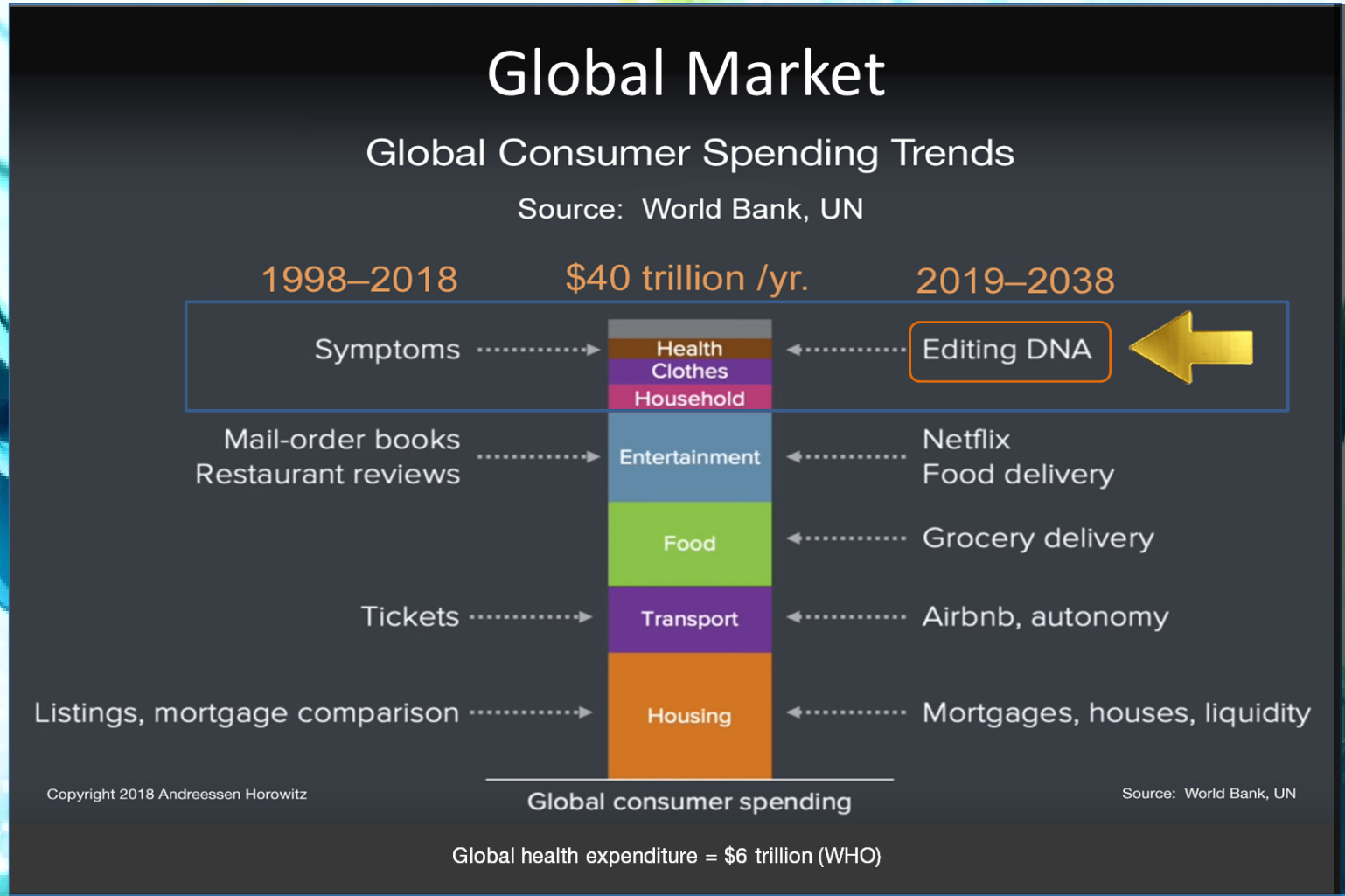
Exhibit III – Genetic Neuropsychology

A new branch of science is emerging for improving human behavior and cognition by genetically optimizing brain functioning. Genetic neuropsychology combines neuroscience, cognitive psychology and genetic engineering to treat neurological disorders. These disorders usually involve imbalances in various brain regions, and by normalizing the unbalanced areas with CRISPR, a disorder's behavioral and cognitive effects can be mitigated.

This new science is made possible by a revolutionary new form of CRISPR called CRISPR-T, which can dynamically deliver genome edits to most brain regions. This highly flexible technology can use any form of CRISPR to modify any neuron gene or RNA transcript and represents a foundational science breakthrough.

Treatable neurological conditions include attention deficit disorder (ADD), obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), anxiety, depression, psychosomatic issues, memory concerns, Alzheimer's disease symptoms, tinnitus and mild cognitive impairment (MCI).

Genetic neuropsychology can also be used for cognitive enhancement to raise conscious awareness, decrease inattention, reduce mind-wandering, lower craving, sharpen mental focus, increase concentration, enhance mindfulness, increase intuition and foster emotional balance.



- Neurological treatment market: According to World Bank projections, $6 trillion in global health expenditures will shift from treating symptoms with medicine to addressing causes with DNA editing in the next 20 years. (12)

The World Health Organization estimates cognitive impairment and other neurological disorders account for 10% of global health issues (13), which would represent $600 billion in costs.

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Apr 19, 2017 - ***Genomic technology has evolved from the stuff of science fiction to a tangible reality, with massive financial implications***. Just how ...

This report was prepared by Cognitive Genetics Institute, a research center dedicated to expanding the frontiers of human knowledge in the area of consciousness engineering. The Institute is a world leader in pioneering bold initiatives to discover new cognitive sciences and technologies which provide humanity with greater understanding of the behavior of awareness.

This research has identified emerging scientific discoveries and technical breakthroughs which can have an overarching effect on human cognition. The goal of this report is to help forward-thinking leaders understand how to leverage these new technologies to enrich humanity's cognitive capital around the world.

Cognitive Genetics' staff draws upon the Institute's international network of senior advisors in the scientific, business and academic fields. The Institute is a non-profit organization and its research is not commissioned by any business, government, or other institution. For further information, please contact us.

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Authors: MEE, J.L.

Office: +1 (772) 324-8800 • Email: info@cognitivegenetics.co • Web: CognitiveGenetics.co