Antibiotic Masquerading Natural

A previous study has shown that a type of squill growing in Madeira produces a chemical compound that may be useful as a medicinal drug. [16]

A completely new resistance gene, which is likely to counteract the newest aminoglycoside-drug plazomycin, was recently discovered by scientists in Gothenburg, Sweden. [15]

Now investigators at Massachusetts General Hospital (MGH) have modified the system to be nearly free of this requirement, making it possible to potentially target any location across the entire human genome. [14]

An ancient group of microbes that contains some of the smallest life forms on Earth also has the smallest CRISPR gene-editing machinery discovered to date. [13]

ETH scientists have been able to prove that a protein structure widespread in nature – the amyloid – is theoretically capable of multiplying itself. [12]

UZH researchers have discovered a previously unknown way in which proteins interact with one another and cells organize themselves. [11]

Dr Martin Sweatman from the University of Edinburgh's School of Engineering has discovered a simple physical principle that might explain how life started on Earth. [10]

Nearly 75 years ago, Nobel Prize-winning physicist Erwin Schrödinger wondered if the mysterious world of quantum mechanics played a role in biology. A recent finding by Northwestern University's Prem Kumar adds further evidence that the answer might be yes. [9]

A UNSW Australia-led team of researchers has discovered how algae that survive in very low levels of light are able to switch on and off a weird quantum phenomenon that occurs during photosynthesis. [8]

This paper contains the review of quantum entanglement investigations in living systems, and in the quantum mechanically modeled photoactive prebiotic kernel systems. [7]

The human body is a constant flux of thousands of chemical/biological interactions and processes connecting molecules, cells, organs, and fluids, throughout the brain, body, and nervous system. Up until recently it was thought that all these interactions

operated in a linear sequence, passing on information much like a runner passing the baton to the next runner. However, the latest findings in quantum biology and biophysics have discovered that there is in fact a tremendous degree of coherence within all living systems.

The accelerating electrons explain not only the Maxwell Equations and the Special Relativity, but the Heisenberg Uncertainty Relation, the Wave-Particle Duality and the electron's spin also, building the Bridge between the Classical and Quantum Theories.

The Planck Distribution Law of the electromagnetic oscillators explains the electron/proton mass rate and the Weak and Strong Interactions by the diffraction patterns. The Weak Interaction changes the diffraction patterns by moving the electric charge from one side to the other side of the diffraction pattern, which violates the CP and Time reversal symmetry.

The diffraction patterns and the locality of the self-maintaining electromagnetic potential explains also the Quantum Entanglement, giving it as a natural part of the Relativistic Quantum Theory and making possible to understand the Quantum Biology.

Contents

Preface

We define our modeled self-assembled supramolecular photoactive centers, composed of one or more sensitizer molecules, precursors of fatty acids and a number of water molecules, as a photoactive prebiotic kernel system. [7]

The human body is a constant flux of thousands of chemical/biological interactions and processes connecting molecules, cells, organs, and fluids, throughout the brain, body, and nervous system. Up until recently it was thought that all these interactions operated in a linear sequence, passing on information much like a runner passing the baton to the next runner. However, the latest findings in quantum biology and biophysics have discovered that there is in fact a tremendous degree of coherence within all living systems. [5]

Quantum entanglement is a physical phenomenon that occurs when pairs or groups of particles are generated or interact in ways such that the quantum state of each particle cannot be described independently – instead, a quantum state may be given for the system as a whole. [4]

I think that we have a simple bridge between the classical and quantum mechanics by understanding the Heisenberg Uncertainty Relations. It makes clear that the particles are not point like but have a dx and dp uncertainty.

An antibiotic masquerading as a natural compound in the giant Madeiran squill

A previous study has shown that a type of squill growing in Madeira produces a chemical compound that may be useful as a medicinal drug. But a new study from researchers at Uppsala University has shown that this is probably not true: instead, the plant had likely accumulated antibiotics from contaminated soil.

All chemical compounds in nature are built through biosynthesis, a process where plants, animals and microorganisms produce complex compounds from simpler structures. Some of these are produced with the goal of protecting the organism, e.g. the toxic compounds produced by plants to poison herbivores. The fields of pharmacognosy and natural products chemistry are focused on taking these compounds from nature and repurposing them for use in human medicine.

Today, we know quite a lot about biosynthesis within different organisms. Using this knowledge, we can even predict the kinds of chemical compounds that we expect to find within nature—and the ones we do not.

This knowledge led Luke Robertson, postdoctoral fellow working between the Department of Ecology and Genetics and the Department of Medicinal Chemistry, to question the proposed structure of a chemical compound discovered within the Madeiran squill (Scilla madeirensis, Asparagaceae). A previous study had reported that a compound produced by the plant might be useful for the treatment of prostate hyperplasia. But the structure of the compound looked strange: it did not fit with any known biosynthetic pathway. Closer examination led Robertson to the conclusion that the

researchers had not only misidentified the chemical structure—but that they had found a substance that was not produced by the plant at all. They had discovered a synthetic antibiotic: sulfadiazine.

"The tools we use to identify the structures of organic compounds can be complex; we don't just put data into a computer and it then spits out a chemical structure back at us. It's like solving a riddle—and two people might have different answers to the same riddle" said Luke Robertson.

But where did the sulfadiazine come from? While the compound was clearly isolated from within the plant, we know that sulfadiazine is synthetic; that is, produced only by humans. The only reasonable explanation, according to Robertson, is that the drug had contaminated the plant and the surrounding area through polluted fertilizer. Sulfadiazine is widely used within the livestock industry and is known to be spread throughout the environment via animal manure. The compound then builds up within soil and is later accumulated within plants.

"It is incredibly important that we identify chemical structures correctly. Drug companies stand to lose millions by discovering a compound with potential to be used as a human drug, but then patenting the incorrect chemical structure. If another company figures this out, they can effectively 'steal' the compounds patent". [16]

Completely new antibiotic resistance gene has spread unnoticed to several pathogens

Aminoglycoside antibiotics are critically important for treating several types of infections with multi-resistant bacteria. A completely new resistance gene, which is likely to counteract the newest aminoglycoside-drug plazomycin, was recently discovered by scientists in Gothenburg, Sweden.

The bacterial gene the team discovered in river sediment from India does not resemble any known antibiotic resistance gene. But when the scientist compared its DNA sequence to already published bacterial DNA sequences, they found that it was already present in several pathogens, including Salmonella and Pseudomonas, from the U.S., China and Italy. Until now, no one had realized that it was a resistance gene.

The research team has named the gene gar as it provides resistance to aminoglycoside antibiotics that carry a garosamine group. This is the case for the newest aminoglycoside drug, plazomycin, developed to circumvent most existing aminoglycoside resistance mechanisms.

Professor Joakim Larsson, senior author of the study and director of the Centre for Antibiotic Resistance Research at University of Gothenburg, Sweden, says, "It is good news that the gar gene still seems to be rather rare, but as it is spreading, it will likely further complicate treatment of already multi-resistant bacteria. Pseudomonas aeruginosa, for example, is a common cause of hospital-acquired pneumonia. Being able to treat secondary bacterial lung infections is something that we are particularly worried about these days when the world is hit by the COVID-19 pandemic."

Rather than investigating bacterial isolates from patients, the researchers looked for novel resistance genes in in waste-water-impacted rivers in India, a country already struggling hard with increasing antibiotic resistance. The scientists´ approach of investigating environmental samples turned out to be an effective way of discovering resistance genes that, so far, are carried only by few people. "Early discovery of resistance genes can help us managing their spread, facilitate gene-based diagnostics and perhaps also guide industry to develop drugs that can circumvent the resistance," says Joakim Larsson.

Around the world, companies and academic researcher try to develop new antibiotics, but their success is very limited. Even when they succeed, the development seems inevitable: "Every antibiotic mankind has developed so far has eventually been met by resistance in at least some of the pathogens it was intended to treat. The gar gene is just the latest in a series of genes that one by one reduces the value of antibiotics," says Joakim Larsson.

The research group in Gothenburg studies the environments role in antibiotic resistance, particularly as source for resistance genes that can move from harmless environmental species to those that cause disease. "The enormous diversity of bacteria in the environment around us probably already harbor genes to every antibiotic we ever will develop—unless we start thinking very differently about how antibiotics are designed," says Joakim Larsson.

The study is published in the scientific journal *Microbiome*. [15]

Capabilities of CRISPR gene editing expanded

Many basic and clinical researchers are testing the potential of a simple and efficient gene editing approach to study and correct disease-causing mutations for conditions ranging from blindness to cancer, but the technology is constrained by a requirement that a certain short DNA sequence be present at the gene editing site.

Now investigators at Massachusetts General Hospital (MGH) have modified the system to be nearly free of this requirement, making it possible to potentially target any location across the entire human genome. Their advance is described in Science.

The clustered regularly interspaced short palindromic repeat (CRISPR)—associated protein 9 (Cas9) genome editing technology is a defense strategy used by bacteria to make cuts to the DNA of invading viruses.

For the CRISPR-Cas9 system to work, a bacterial defense protein called Cas9 seeks out a short region—called a protospacer adjacent motif (or PAM)—that is present in the viral DNA but not in the bacterial DNA. CRISPR-Cas9 has been harnessed for editing the human genome because such PAM sequences are also quite common in our DNA; however, genes that are not near a PAM cannot be targeted.

To overcome this hurdle, a team led by Benjamin P. Kleinstiver, a biochemist at MGH's Center for Genomic Medicine, engineered variants of a Cas9 protein that do not require a specific PAM to bind and cut DNA. The two new Cas9 variants, named SpG and SpRY, allow editing of DNA sequences at efficiencies not achievable with conventional CRISPR-Cas9 enzymes.

"Because the engineered proteins can target much more freely, they enable targeting of previously inaccessible regions of the genome," said Kleinstiver. "By nearly completely relaxing the requirement for the enzymes to recognize a PAM, many genome editing applications are now possible. And since nearly the entire genome is targetable, one of the most exciting implications is that that the entire genome is 'druggable' from a DNA-editing perspective."

The researchers next plan to better understand the mechanism of how these proteins function, while exploring their unique capabilities for a variety of different applications. In the meantime, they are optimistic that the new Cas9 variants will be a meaningful advance for the genome editing community.

"We have demonstrated that these new enzymes will allow researchers to generate biologically and clinically relevant genetic modifications that were previously unfeasible." said lead author Russell T. Walton, also of MGH's Center for Genomic Medicine. [14]

Smallest life forms have smallest working CRISPR system

An ancient group of microbes that contains some of the smallest life forms on Earth also has the smallest CRISPR gene-editing machinery discovered to date.

The peewee protein machinery, dubbed Cas14, is related to but one-third the size of the Cas9 protein, the business end of the revolutionary gene-editing tool CRISPR-Cas9. While Cas9 was isolated from bacteria, Cas14 was found in the genome of a group of Archaea—a primitive relative of bacteria—that contains some of the smallest cells and smallest genomes known.

Cas9 and other Cas proteins are part of a defense system evolved by microbes to protect themselves from viruses. All are targeted enzymes that seek out and bind very selectively to a specific DNA or RNA sequence—in microbes, those that match sequences stored in its CRISPR memory banks after earlier viral infections—and then cuts the DNA or RNA to disable the new invader.

Like Cas9, Cas14 has potential as a biotech tool. Because of its small size, Cas14 could be useful in editing genes in small cells or in some viruses. But with its single-stranded DNA cutting activity, it is more likely to improve rapid CRISPR diagnostic systems now under development for infectious diseases, genetic mutations and cancer.

"For molecular diagnostics, you want to be able to target double-stranded DNA, single-stranded DNA and RNA," said Lucas Harrington, a UC Berkeley graduate student and first author of a paper reporting the discovery. "Cas12 is really good at double-stranded DNA recognition, Cas13 is really good at single-stranded RNA recognition and now Cas14 completes the set: it is really good at single-stranded DNA recognition."

Cas14 is similar to Cas12 and Cas13 in that, after binding to its target DNA sequence, it begins indiscriminately cutting all single-stranded DNA inside a cell. Cas9, in contrast, binds and cuts only the targeted DNA.

The wanton cutting of DNA is a possible disadvantage in therapy, but a great advantage in diagnostics. The Cas14 protein can be paired with a fluorescent marker attached to a piece of single-stranded DNA. When Cas14 binds to its target DNA sequence—a cancer gene or a gene in infectious bacteria—and starts cutting DNA, it will also cut the DNA linked with the marker, generating a fluorescent signal.

"Cas14 targets single-stranded DNA in a much more specific way than Cas12 does," added Harrington's colleague, Janice Chen, who recently received her Ph.D. from UC Berkeley. "That was a really unexpected finding. Because it is so small, we barely thought it could work, but actually it is super-specific, which makes it also a really powerful addition to the diagnostic toolbox."

Harrington, Chen and their colleagues, including CRISPR-Cas9 inventor Jennifer Doudna, a UC Berkeley professor of molecular and cell biology and of chemistry, have adapted Cas14 to work with their diagnostic system, called DETECTR, which now uses Cas12 and Cas13 to quickly detect the presence of infectious organisms and genetic mutations. Harrington, Doudna and Chen are co-founders of a company, Mammoth Biosciences, that is commercializing DETECTR.

The discovery will be reported online Oct. 18 in advance of print publication in the journal *Science*. Doudna is a Howard Hughes Medical Institute investigator and co-director of the Innovative Genomics Institute. Banfield is the microbiology lead for IGI.

Mining metagenomes

The Cas14 protein was found by co-first authors Harrington and David Burstein, now a professor at Tel Aviv University in Israel, as they looked for Cas variants in a database of microbial genomes created over the past 15 years by their UC Berkeley colleagues—a team led by Jill Banfield, professor of earth and planetary science and of environmental sciences, policy and management. The genomes, numbering in the tens of thousands, were obtained by metagenomic sequencing of all the DNA in samples from a variety of exotic environments. Cas14 was found in the genome of Archaea sequenced from groundwater samples obtained from a toxic cleanup site in Rifle, Colorado.

Two years ago, Harrington and Burstein discovered other small Cas proteins, CasX and CasY, while mining the metagenomics database.

Cas14 is half the size—between 400 and 700 amino acids in length—of CasX and smaller than all other known Cas systems, which range in length from 950 to 1,400 amino acids.

"By happenstance, we found these very small proteins, which other people just throw away because they don't look like previously known CRISPR systems. They are too small," Harrington said. "We decided, what the heck, let's give it a shot. We tested it out and we were actually shocked to find that these were actual functional systems."

Finding the gene for Cas14 in the database was only the beginning. Most Cas proteins to date have been found in bacteria, and thus work well in the standard lab bacterium, E. coli. But Cas14 is from Archaea—and a group of the smallest of the Archaea, called DPANN. All Cas proteins incorporate bits

of RNA for targeting and binding, but Cas14 won't work with CRISPR-Cas9 RNAs, so the team also had to fish out of the database the two RNAs that must be present for Cas14 to function.

In addition, DPANN Archaea cannot be grown in the lab—they appear to be parasitic or in some way dependent on other larger Archaea—so the researchers had to create the right environment in a test tube.

Consistent with its origins in a more primitive microbe, the slimmed down Cas14 appears to be a more primitive version of the larger and more complex Cas9 and Cas12 proteins, Harrington said, hinting that the molecules have evolved over eons to be more specialized. The researchers hope to learn from such primitive Cas proteins, which are the essential components of the Cas enzyme, so that they can design the most compact and sleek gene cutters they can.

Harrington noted that the metagenomic mining turned up various versions of Cas14 that may prove to be useful biotech tools. "One amazing thing ... is just how diverse these systems are," he said. "We've described more than 40 new CRISPR-Cas14 systems and eight different subtypes. This opens up the floodgates for investigation of these new CRISPR systems." [13]

A protein that self-replicates

ETH scientists have been able to prove that a protein structure widespread in nature – the amyloid – is theoretically capable of multiplying itself. This makes it a potential predecessor to molecules that are regarded as the building blocks of life.

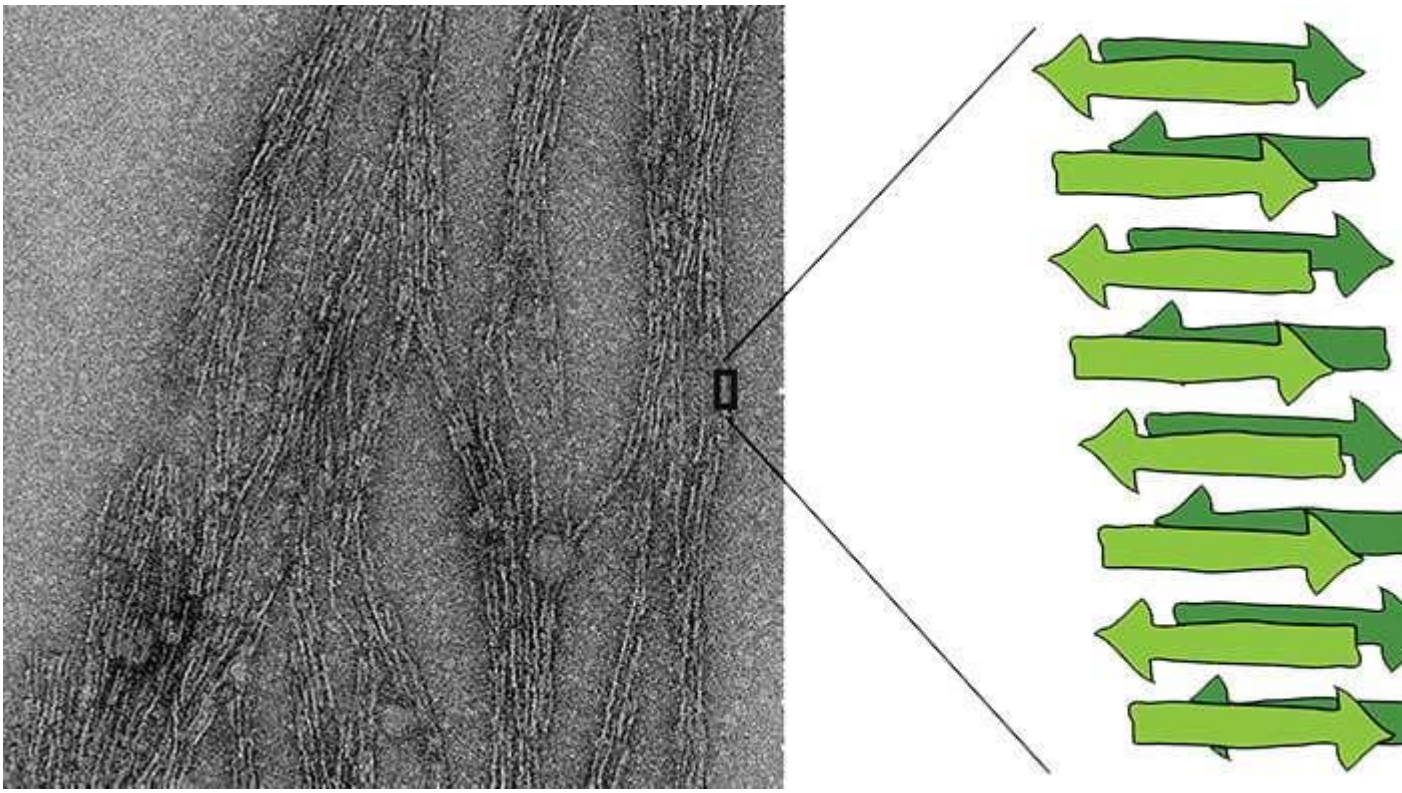
Long regarded as a biological aberration, amyloids are fibrous aggregates of short protein fragments. Amyloids have a bad reputation because they are thought to be the cause of multiple neurodegenerative diseases, including Alzheimer's, Parkinson's and Creutzfeldt–Jakob disease.

It was only recently that researchers discovered that amyloids appear as structural and functional building blocks in a wide range of life forms, from bacteria, yeast and fungi to humans. In vertebrates, they play a role in the production of the pigment melanin, while yeast cells use amyloid aggregates to form a kind of molecular memory.

Catalysts in prebiotic evolution

Composed of short peptides, amyloid fibres can accelerate chemical reactions in a similar way to enzymes; they have thus been viewed for several years as candidates for the first precursor molecules of life. Until now, however, an important chemical property was lacking in the theory of amyloids role in abiogenesis: self-replication.

Early proponents of the amyloid hypothesis include ETH Professor Roland Riek and his senior assistant Jason Greenwald, from the Laboratory of Physical Chemistry. In an experiment, they have now been able to show that amyloids can serve as a chemical template for the synthesis of short peptides. And the critical point: "This ability also potentially applies to the amyloid itself – meaning the molecules can self-replicate," says Riek. The researchers reported their findings in a study in *Nature Communications*.



Left: electron micrograph of an amyloid fibre. In green is a diagram of the sheet structure characteristic for amyloids, consisting of multiple short peptide chains. Credit: Jason Greenwald/ETH Zurich

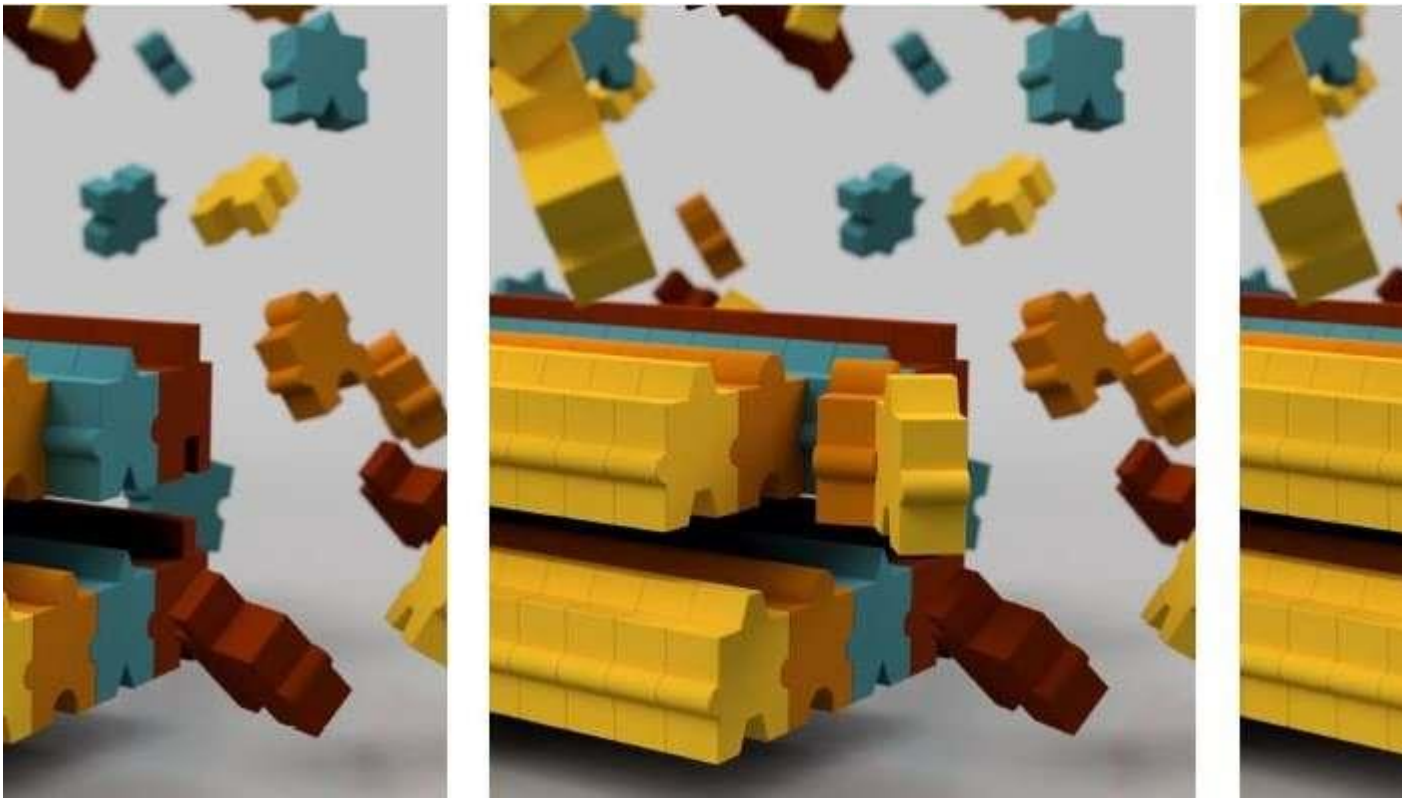
Template for self-replication

The ability to self-replicate is regarded as an essential prerequisite for every early form of life. By proving that amyloids self-replicate, Riek and his team have not only highlighted another amazing aspect of this commonly underestimated protein, but also filled in a previously missing link in the amyloid hypothesis' argument.

Almost two years earlier, the ETH scientists had already proven in an experiment that amyloid structures can spontaneously form with astounding ease – from simple amino acids that probably already existed when the Earth was still lifeless, and under reaction conditions that appear very plausible for the primordial soup (as ETH News reported).

The same is true for the newly discovered peptide synthesis: "The reaction mechanism seems to be of a general nature. It is stable over a wide range of temperatures and salt concentrations, in both acidic and alkaline environments," explains Greenwald.

This discovery strengthens the researchers' opinion that early in evolutionary history, amyloids could have played a central role in the development of early life forms as information carriers and catalytic units.



The self-replication mechanism of amyloid fibres depicted schematically: piece by piece, specific amino acids (coloured building blocks) settle at the right site and chemically combine. During the process, the growing amyloid serves as a …more

Not just an RNA world

Until now, however, the most widespread idea for the molecular beginnings of life has been the RNA hypothesis, which sees ribonucleic acid (RNA) as the only key player in the prebiotic primordial soup. This is because, like the genetic material DNA, RNA molecules can code information, and are also able to self-replicate.

The ETH researchers are now picking away at the prevailing dogma of an RNA-based world. They think that the amyloid hypothesis is more plausible; firstly, because RNA molecules with a biological function are much larger and more complex, so they are unlikely to form spontaneously under prebiotic conditions. "Additionally, amyloids are much more stable than early nucleic acid polymers, and they have a much simpler abiotic synthesis route compared to the complexity of known catalytic RNAs," says Greenwald.

Riek adds: "We will never be able to prove which is true – to do so, we would have to turn back the last 4 to 4.5 billion years of evolution. However, we suspect that it was not one, but multiple molecular processes with various predecessor molecules that were involved in the creation of life." [12]

New interaction mechanism of proteins discovered

UZH researchers have discovered a previously unknown way in which proteins interact with one another and cells organize themselves. This new mechanism involves two fully unstructured proteins forming an ultra-high-affinity complex due to their opposite net charge. Proteins usually bind one another as a result of perfectly matching shapes in their three-dimensional structures.

Proteins are among the most important biomolecules and are the key mediators of molecular communication between and within cells. For two proteins to bind, specific regions of their three-dimensional structures have to match one another exactly, as a key fits into a lock. The structure of proteins is extremely important for their functioning and for triggering the required responses in cells. Now, researchers at the University of Zurich, together with colleagues from Denmark and the U.S., have discovered that unstructured proteins can also have ultra-high-affinity interactions.

One of these proteins is histone H1, which, as a component of chromatin, is responsible for DNA packaging. Its binding partner, prothymosin α, acts as a kind of shuttle that deposits and removes the histone from the DNA. This process determines whether or not genes in specific parts of the DNA can be read. Both proteins are involved in several regulatory processes in the body, such as cell division and proliferation, and therefore also play a role when it comes to a number of diseases, including cancer. Ben Schuler, professor at the Department of Biochemistry at UZH and head of the research project published in *Nature*, says, "The interesting thing about these proteins is that they're completely unstructured—like boiled noodles in water." How such disordered proteins should be able to interact according to the key/lock principle had puzzled the team of researchers.

Notably, the two proteins bind to one another much more strongly than the average protein partners. The research team used single-molecule fluorescence and nuclear magnetic resonance spectroscopy to determine the arrangement of the proteins. Observed in isolation, they show extended unstructured protein chains. The chains become more compact as soon as both binding partners come together and form a complex. The strong interaction is caused by the strong electrostatic attraction, since histone H1 is highly positively charged while prothymosin α is highly negatively charged. Even more surprising was the discovery that the protein complex was also fully unstructured, as several analyses confirmed.

To investigate the shape of the protein complex, the researchers labeled both proteins with fluorescent probes, which they then added to selected sites on the proteins. Together with computer simulations, this molecular map yielded the following results: Histone 1 interacts with prothymosin α preferably in its central region, which is the region with the highest charge density. Moreover, it emerged that the complex is highly dynamic: The proteins' position in the complex changes extremely quickly—in a matter of approx. 100 nanoseconds.

The interaction behavior is likely to be fairly common. Cells have many proteins that contain highly charged sequences and may be able to form such protein complexes. There are hundreds of such proteins in the human body alone. "It's likely that the interaction between disordered, highly charged proteins is a basic mechanism for how cells function and organize themselves," concludes Ben Schuler. According to the biophysicist, textbooks will need revision to account for this new way of

binding. The discovery is also relevant for developing new therapies, since unstructured proteins are largely unresponsive to traditional drugs, which bind to specific structures on the protein surface. [11]

Particles in charged solution form clusters that reproduce

Dr Martin Sweatman from the University of Edinburgh's School of Engineering has discovered a simple physical principle that might explain how life started on Earth.
He has shown that particles that become charged in solution, like many biological molecules, can form giant clusters that can reproduce. Reproduction is shown to be driven by simple physics—a balance of forces between short-range attraction and long-range repulsion. Once cluster reproduction begins, he suggests chemical evolution of clusters could follow, leading eventually to life.

Many biological molecules, like DNA and proteins, might show this behaviour. Even the building blocks of life, amino acids and nucleobases, might show this behaviour. Reproduction in modern cells might even be driven by this simple physical mechanism, i.e. chemistry is not so important.

Dr Sweatman's research uses theoretical methods and computer simulations of simple particles. They clearly show giant clusters of molecules with the right balance of forces can reproduce. No chemistry is involved. However, these theoretical predictions have yet to be confirmed by experiment.

Dr Sweatman said, "Although it will be difficult to see this behaviour for solutions of small biomolecules, it should be possible to confirm this behaviour experimentally with much larger particles that can be seen under a microscope, like charged colloids.

"If this behaviour is confirmed, then we take another step towards Darwin's idea of life beginning in a warm little pond. A simple evaporation and condensation cycle in a pond might be sufficient to drive cluster reproduction initially. Survival of the fittest clusters of chemicals might then eventually lead to life."

The research has been published in the international journal *Molecular Physics*.

Experiment demonstrates quantum mechanical effects from biological systems

Nearly 75 years ago, Nobel Prize-winning physicist Erwin Schrödinger wondered if the mysterious world of quantum mechanics played a role in biology. A recent finding by Northwestern University's Prem Kumar adds further evidence that the answer might be yes.
Kumar and his team have, for the first time, created quantum entanglement from a biological system. This finding could advance scientists' fundamental understanding of biology and

potentially open doors to exploit biological tools to enable new functions by harnessing quantum mechanics.

"Can we apply quantum tools to learn about biology?" said Kumar, professor of electrical engineering and computer science in Northwestern's McCormick School of Engineering and of physics and astronomy in the Weinberg College of Arts and Sciences. "People have asked this question for many, many years—dating back to the dawn of quantum mechanics. The reason we are interested in these new quantum states is because they allow applications that are otherwise impossible."

Partially supported by the Defense Advanced Research Projects Agency, the research was published Dec. 5 in *Nature Communications*.

Quantum entanglement is one of quantum mechanics' most mystifying phenomena. When two particles—such as atoms, photons, or electrons—are entangled, they experience an inexplicable link that is maintained even if the particles are on opposite sides of the universe. While entangled, the particles' behavior is tied one another. If one particle is found spinning in one direction, for example, then the other particle instantaneously changes its spin in a corresponding manner dictated by the entanglement. Researchers, including Kumar, have been interested in harnessing quantum entanglement for several applications, including quantum communications. Because the particles can communicate without wires or cables, they could be used to send secure messages or help build an extremely fast "quantum Internet."

"Researchers have been trying to entangle a larger and larger set of atoms or photons to develop substrates on which to design and build a quantum machine," Kumar said. "My laboratory is asking if we can build these machines on a biological substrate."

In the study, Kumar's team used green fluorescent proteins, which are responsible for bioluminescence and commonly used in biomedical research. The team attempted to entangle the photons generated from the fluorescing molecules within the algae's barrel-shaped protein structure by exposing them to spontaneous four-wave mixing, a process in which multiple wavelengths interact with one another to produce new wavelengths.

Through a series of these experiments, Kumar and his team successfully demonstrated a type of entanglement, called polarization entanglement, between photon pairs. The same feature used to make glasses for viewing 3D movies, polarization is the orientation of oscillations in light waves. A wave can oscillate vertically, horizontally, or at different angles. In Kumar's entangled pairs, the photons' polarizations are entangled, meaning that the oscillation directions of light waves are linked. Kumar also noticed that the barrel-shaped structure surrounding the fluorescing molecules protected the entanglement from being disrupted.

"When I measured the vertical polarization of one particle, we knew it would be the same in the other," he said. "If we measured the horizontal polarization of one particle, we could predict the horizontal polarization in the other particle. We created an entangled state that correlated in all possibilities simultaneously."

Now that they have demonstrated that it's possible to create quantum entanglement from biological particles, next Kumar and his team plan to make a biological substrate of entangled

particles, which could be used to build a quantum machine. Then, they will seek to understand if a biological substrate works more efficiently than a synthetic one. [9]

Quantum biology: Algae evolved to switch quantum coherence on and off

A UNSW Australia-led team of researchers has discovered how algae that survive in very low levels of light are able to switch on and off a weird quantum phenomenon that occurs during photosynthesis.

The function in the algae of this quantum effect, known as coherence, remains a mystery, but it is thought it could help them harvest energy from the sun much more efficiently. Working out its role in a living organism could lead to technological advances, such as better organic solar cells and quantum-based electronic devices.

The research is published in the journal Proceedings of the National Academy of Sciences.

It is part of an emerging field called quantum biology, in which evidence is growing that quantum phenomena are operating in nature, not just the laboratory, and may even account for how birds can navigate using the earth's magnetic field.

"We studied tiny single-celled algae called cryptophytes that thrive in the bottom of pools of water, or under thick ice, where very little light reaches them," says senior author, Professor Paul Curmi, of the UNSW School of Physics.

"Most cryptophytes have a light-harvesting system where quantum coherence is present. But we have found a class of cryptophytes where it is switched off because of a genetic mutation that alters the shape of a light-harvesting protein.

"This is a very exciting find. It means we will be able to uncover the role of quantum coherence in photosynthesis by comparing organisms with the two different types of proteins."

In the weird world of quantum physics, a system that is coherent – with all quantum waves in step with each other – can exist in many different states simultaneously, an effect known as superposition. This phenomenon is usually only observed under tightly controlled laboratory conditions.

So the team, which includes Professor Gregory Scholes from the University of Toronto in Canada, was surprised to discover in 2010 that the transfer of energy between molecules in the light harvesting systems from two different cryptophyte species was coherent.

The same effect has been found in green sulphur bacteria that also survive in very low light levels.

"The assumption is that this could increase the efficiency of photosynthesis, allowing the algae and bacteria to exist on almost no light," says Professor Curmi.

"Once a light-harvesting protein has captured sunlight, it needs to get that trapped energy to the reaction centre in the cell as quickly as possible, where the energy is converted into chemical energy for the organism.

"It was assumed the energy gets to the reaction centre in a random fashion, like a drunk staggering home. But quantum coherence would allow the energy to test every possible pathway simultaneously before travelling via the quickest route."

In the new study, the team used x-ray crystallography to work out the crystal structure of the lightharvesting complexes from three different species of cryptophytes.

They found that in two species a genetic mutation has led to the insertion of an extra amino acid that changes the structure of the protein complex, disrupting coherence.

"This shows cryptophytes have evolved an elegant but powerful genetic switch to control coherence and change the mechanisms used for light harvesting," says Professor Curmi.

The next step will be to compare the biology of different cryptophytes, such as whether they inhabit different environmental niches, to work out whether the quantum coherence effect is assisting their survival. [8]

Photoactive Prebiotic Systems

We propose that life first emerged in the form of such minimal photoactive prebiotic kernel systems and later in the process of evolution these photoactive prebiotic kernel systems would have produced fatty acids and covered themselves with fatty acid envelopes to become the minimal cells of the Fatty Acid World. Specifically, we model self-assembling of photoactive prebiotic systems with observed quantum entanglement phenomena. We address the idea that quantum entanglement was important in the first stages of origins of life and evolution of the biospheres because simultaneously excite two prebiotic kernels in the system by appearance of two additional quantum entangled excited states, leading to faster growth and self-replication of minimal living cells. The quantum mechanically modeled possibility of synthesizing artificial selfreproducing quantum entangled prebiotic kernel systems and minimal cells also impacts the possibility of the most probable path of emergence of photocells on the Earth or elsewhere. We also examine the quantum entangled logic gates discovered in the modeled systems composed of two prebiotic kernels. Such logic gates may have application in the destruction of cancer cells or becoming building blocks of new forms of artificial cells including magnetically active ones.

Significance Statement

Our investigated self-assembly of molecules towards supramolecular bioorganic and minimal cellular systems depends on the quantum mechanics laws which induce hydrogen and Van der Waals bindings (Tamulis A, Grigalavicius, M, Orig Life Evol Biosph 41:51-71, 2011).

In the work presented here, quantum entanglement takes the form of a quantum superposition of the active components in synthesized self-assembling and self-replicating living systems. When a quantum calculation of an entangled system is made that causes one photoactive biomolecule of such a pair to take on a definite value (e.g., electron density transfer or electron spin density

transfer), the other member of this entangled pair will be found to have taken the appropriately correlated value (e.g., electron density transfer or electron spin density transfer). In our simulations, the separation distance of supramolecular bio systems changes took place during geometry optimization procedures, which mimic real-world intermolecular interaction processes.

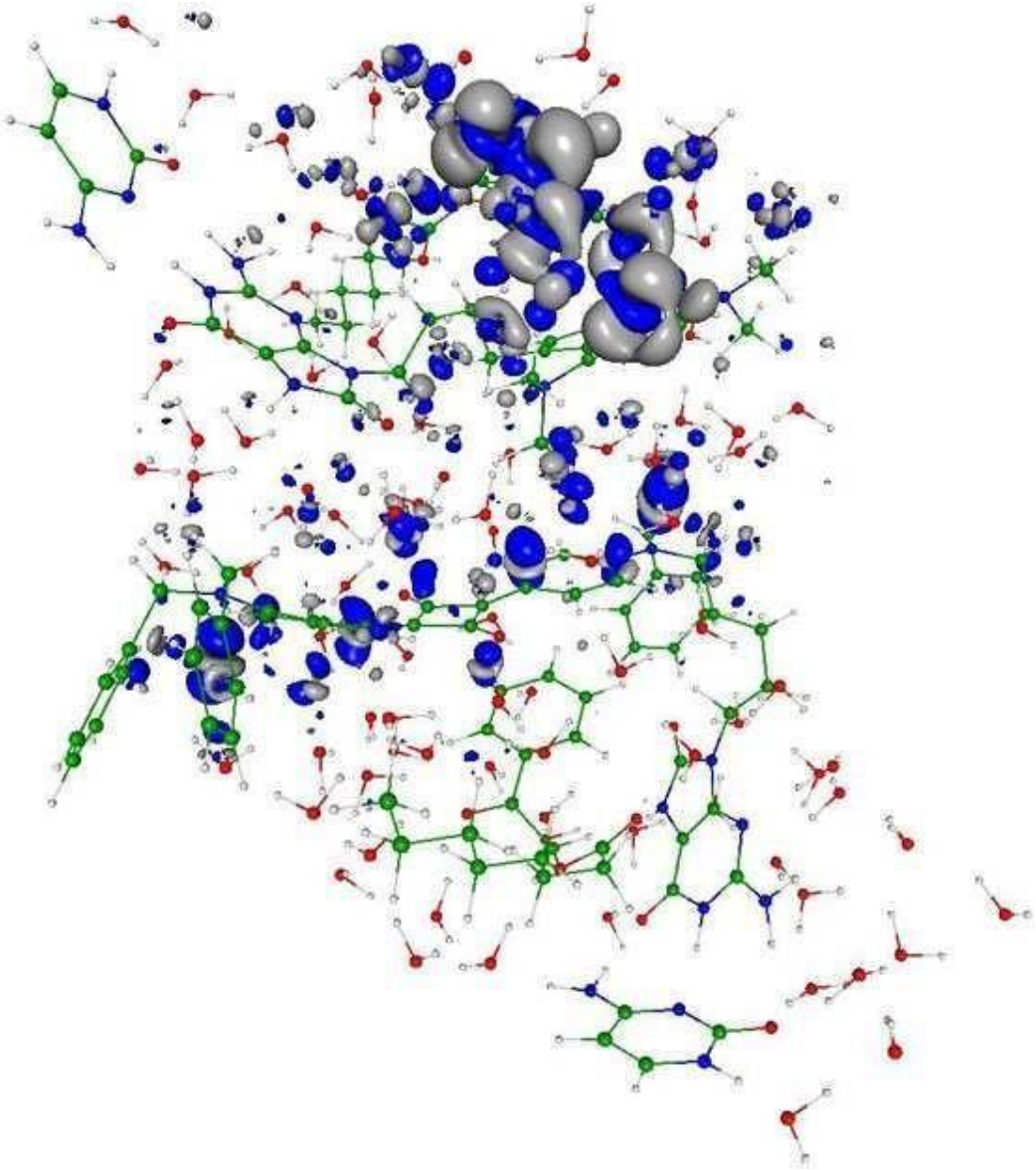
Our discovered phenomenon of the quantum entanglement in the prebiotic systems enhance the photosynthesis in the proposed systems because simultaneously excite two prebiotic kernels in the system by appearance of two additional quantum entangled excited states (Tamulis A, Grigalavicius M, Baltrusaitis J, Orig Life Evol Biosph 43:49-66, 2013; Tamulis A, Grigalavicius M, Krisciukaitis S (2014) , J Comput Theor Nanos, 11, 1597-1608, 2014; Tamulis A, Grigalavicius M, 8:117-140, 2014.). We can propose that quantum entanglement enhanced the emergence of photosynthetic prebiotic kernels and accelerated the evolution of photosynthetic life because of additional absorbed light energy, leading to faster growth and self-replication of minimal living cells.

We can state that: Livings are self-assembled and self-replicating wet and warm stochastically moving supramolecular systems where quantum entanglement can be continuously generated and destroyed by non-equilibrium effects in an environment where no static entanglement exists; quantum entanglement involve the biomolecule inside one living or between other neighboring livings.

This warm quantum coherence is basic for the explanation of DNA stability and for the understanding of brain magnetic orientation during migration in more than 50 species of birds, fishes and insects. Exists experimental evidence for quantum-coherent is used for more efficient light-harvesting in plant photosynthesis. Quantum entanglement exists in supramolecules determining the sense of smell and in the brain neurons microtubules due to quantum vibrations.

In the work presented here, we started to design and quantum mechanical investigations of the molecular logical devices which are useful for construction of nano medicine biorobots against the molecular diseases such a cancer tumors, and against the new kinds of synthesized microorganisms and nano guns.

Figure legend



You can see in the enclosed figure the quantum entanglement phenomenon in the closely selfassembled two synthesized protocell system due to the photo excited electron charge transfer from one protocell to another that leads to closer self-assembly and exchange of energy and information.

Visualization of the electron charge tunneling associated with the 6th (467.3 nm) excited state. The transition is mainly from squarine molecule of the first protocell situated in the bottom of this bi cellular system to precursor of fatty acid (pFA) molecule of the second subsystem (in the top) and little from the 1,4-bis(N,N-dimethylamino)naphthalene molecule (in the top-right) to the same pFA molecule of the second subsystem (in the top). The electron cloud hole is indicated by the dark blue color while the transferred electron cloud location is designated by the gray color.

As a result, these nonlinear quantum interactions compressed the overall molecular system resulting in a smaller gap between the HOMO and LUMO electron energy levels which allows

enhanced tunneling of photo excited electrons from the sensitizer squarine and (1,4bis(N,Ndimethylamino)naphthalene) to the pFA molecule resulting in its cleavage. The new fatty acid joins the existing minimal cell thus increasing it in size. After reaching some critical size, the minimal cell should divide (i.e. self-replicate) into two separate smaller minimal cells. [7]

Quantum Biology

Researchers have long suspected that something unusual is afoot in photosynthesis. Particles of light called photons, streaming down from the Sun; arrive randomly at the chlorophyll molecules and other light-absorbing 'antenna' pigments that cluster inside the cells of every leaf, and within every photosynthetic bacterium. But once the photons' energy is deposited, it doesn't stay random. Somehow, it gets channeled into a steady flow towards the cell's photosynthetic reaction centre, which can then use it at maximum efficiency to convert carbon dioxide into sugars. Quantum coherence in photosynthesis seems to be beneficial to the organisms using it. But did their ability to exploit quantum effects evolve through natural selection? Or is quantum coherence just an accidental side effect of the way certain molecules are structured? [6]

Quantum Consciousness

Extensive scientific investigation has found that a form of quantum coherence operates within living biological systems through what is known as biological excitations and biophoton emission. What this means is that metabolic energy is stored as a form of electromechanical and electromagnetic excitations. These coherent excitations are considered responsible for generating and maintaining long-range order via the transformation of energy and very weak electromagnetic signals. After nearly twenty years of experimental research, Fritz-Albert Popp put forward the hypothesis that biophotons are emitted from a coherent electrodynamics field within the living system.

What this means is that each living cell is giving off, or resonating, a biophoton field of coherent energy. If each cell is emitting this field, then the whole living system is, in effect, a resonating field-a ubiquitous nonlocal field. And since biophotons are the entities through which the living system communicates, there is near-instantaneous intercommunication throughout. And this, claims Popp, is the basis for coherent biological organization -- referred to as quantum coherence. This discovery led Popp to state that the capacity for evolution rests not on aggressive struggle and rivalry but on the capacity for communication and cooperation. In this sense the built-in capacity for species evolution is not based on the individual but rather living systems that are interlinked within a coherent whole: Living systems are thus neither the subjects alone, nor objects isolated, but both subjects and objects in a mutually communicating universe of meaning. . . . Just as the cells in an organism take on different tasks for the whole, different populations enfold information not only for themselves, but for all other organisms, expanding the consciousness of the whole, while at the same time becoming more and more aware of this collective consciousness.

Biophysicist Mae-Wan Ho describes how the living organism, including the human body, is coordinated throughout and is "coherent beyond our wildest dreams." It appears that every part of our body is "in communication with every other part through a dynamic, tunable, responsive, liquid crystalline medium that pervades the whole body, from organs and tissues to the interior of every cell."

What this tells us is that the medium of our bodies is a form of liquid crystal, an ideal transmitter of communication, resonance, and coherence. These relatively new developments in biophysics have discovered that all biological organisms are constituted of a liquid crystalline medium. Further, DNA is a liquid-crystal, lattice-type structure (which some refer to as a liquid crystal gel), whereby body cells are involved in a holographic instantaneous communication via the emitting of biophotons (a source based on light). This implies that all living biological organisms continuously emit radiations of light that form a field of coherence and communication. Moreover, biophysics has discovered that living organisms are permeated by quantum wave forms. [5]

Creating quantum technology

Another area of potential application is in quantum computing. The long-standing goal of the physicists and engineers working in this area is to manipulate data encoded in quantum bits (qubits) of information, such as the spin-up and spin-down states of an electron or of an atomic nucleus. Qubits can exist in both states at once, thus permitting the simultaneous exploration of all possible answers to the computation that they encode. In principle, this would give quantum computers the power to find the best solution far more quickly than today's computers can — but only if the qubits can maintain their coherence, without the noise of the surrounding environment, such as the jostling of neighboring atoms, destroying the synchrony of the waves. [6]

Quantum Entanglement

Measurements of physical properties such as position, momentum, spin, polarization, etc. performed on entangled particles are found to be appropriately correlated. For example, if a pair of particles is generated in such a way that their total spin is known to be zero, and one particle is found to have clockwise spin on a certain axis, then the spin of the other particle, measured on the same axis, will be found to be counterclockwise. Because of the nature of quantum measurement, however, this behavior gives rise to effects that can appear paradoxical: any measurement of a property of a particle can be seen as acting on that particle (e.g. by collapsing a number of superimposed states); and in the case of entangled particles, such action must be on the entangled system as a whole. It thus appears that one particle of an entangled pair "knows" what measurement has been performed on the other, and with what outcome, even though there is no known means for such information to be communicated between the particles, which at the time of measurement may be separated by arbitrarily large distances. [4]

The Bridge

The accelerating electrons explain not only the Maxwell Equations and the Special Relativity, but the Heisenberg Uncertainty Relation, the wave particle duality and the electron's spin also, building the bridge between the Classical and Quantum Theories. [1]

Accelerating charges

The moving charges are self maintain the electromagnetic field locally, causing their movement and this is the result of their acceleration under the force of this field. In the classical physics the charges will distributed along the electric current so that the electric potential lowering along the current, by linearly increasing the way they take every next time period because this accelerated motion. The same thing happens on the atomic scale giving a dp impulse difference and a dx way difference between the different part of the not point like particles.

Relativistic effect

Another bridge between the classical and quantum mechanics in the realm of relativity is that the charge distribution is lowering in the reference frame of the accelerating charges linearly: $ds/dt = at$ (time coordinate), but in the reference frame of the current it is parabolic: $s = a/2\ t^2$ (geometric coordinate).

Heisenberg Uncertainty Relation

In the atomic scale the Heisenberg uncertainty relation gives the same result, since the moving electron in the atom accelerating in the electric field of the proton, causing a charge distribution on delta x position difference and with a delta p momentum difference such a way that they product is about the half Planck reduced constant. For the proton this delta x much less in the nucleon, than in the orbit of the electron in the atom, the delta p is much higher because of the greater proton mass.

This means that the electron and proton are not point like particles, but has a real charge distribution.

Wave – Particle Duality

The accelerating electrons explains the wave – particle duality of the electrons and photons, since the elementary charges are distributed on delta x position with delta p impulse and creating a wave packet of the electron. The photon gives the electromagnetic particle of the mediating force of the electrons electromagnetic field with the same distribution of wavelengths.

Atomic model

The constantly accelerating electron in the Hydrogen atom is moving on the equipotential line of the proton and it's kinetic and potential energy will be constant. Its energy will change only when it

is changing its way to another equipotential line with another value of potential energy or getting free with enough kinetic energy. This means that the Rutherford-Bohr atomic model is right and only that changing acceleration of the electric charge causes radiation, not the steady acceleration. The steady acceleration of the charges only creates a centric parabolic steady electric field around the charge, the magnetic field. This gives the magnetic moment of the atoms, summing up the proton and electron magnetic moments caused by their circular motions and spins.

The Relativistic Bridge

Commonly accepted idea that the relativistic effect on the particle physics it is the fermions' spin - another unresolved problem in the classical concepts. If the electric charges can move only with accelerated motions in the self maintaining electromagnetic field, once upon a time they would reach the velocity of the electromagnetic field. The resolution of this problem is the spinning particle, constantly accelerating and not reaching the velocity of light because the acceleration is radial. One origin of the Quantum Physics is the Planck Distribution Law of the electromagnetic oscillators, giving equal intensity for 2 different wavelengths on any temperature. Any of these two wavelengths will give equal intensity diffraction patterns, building different asymmetric constructions, for example proton - electron structures (atoms), molecules, etc. Since the particles are centers of diffraction patterns they also have particle – wave duality as the electromagnetic waves have. [2]

The weak interaction

The weak interaction transforms an electric charge in the diffraction pattern from one side to the other side, causing an electric dipole momentum change, which violates the CP and time reversal symmetry. The Electroweak Interaction shows that the Weak Interaction is basically electromagnetic in nature. The arrow of time shows the entropy grows by changing the temperature dependent diffraction patterns of the electromagnetic oscillators.

Another important issue of the quark model is when one quark changes its flavor such that a linear oscillation transforms into plane oscillation or vice versa, changing the charge value with 1 or -1. This kind of change in the oscillation mode requires not only parity change, but also charge and time changes (CPT symmetry) resulting a right handed anti-neutrino or a left handed neutrino.

The right handed anti-neutrino and the left handed neutrino exist only because changing back the quark flavor could happen only in reverse, because they are different geometrical constructions, the u is 2 dimensional and positively charged and the d is 1 dimensional and negatively charged. It needs also a time reversal, because anti particle (anti neutrino) is involved.

The neutrino is a 1/2spin creator particle to make equal the spins of the weak interaction, for example neutron decay to 2 fermions, every particle is fermions with ½ spin. The weak interaction changes the entropy since more or less particles will give more or less freedom of movement. The entropy change is a result of temperature change and breaks the equality of oscillator diffraction

intensity of the Maxwell–Boltzmann statistics. This way it changes the time coordinate measure and makes possible a different time dilation as of the special relativity.

The limit of the velocity of particles as the speed of light appropriate only for electrical charged particles, since the accelerated charges are self maintaining locally the accelerating electric force. The neutrinos are CP symmetry breaking particles compensated by time in the CPT symmetry, that is the time coordinate not works as in the electromagnetic interactions, consequently the speed of neutrinos is not limited by the speed of light.

The weak interaction T-asymmetry is in conjunction with the T-asymmetry of the second law of thermodynamics, meaning that locally lowering entropy (on extremely high temperature) causes the
weak interaction, for example the Hydrogen fusion.

Probably because it is a spin creating movement changing linear oscillation to 2 dimensional oscillation by changing d to u quark and creating anti neutrino going back in time relative to the proton and electron created from the neutron, it seems that the anti neutrino fastest then the velocity of the photons created also in this weak interaction?

A quark flavor changing shows that it is a reflection changes movement and the CP- and T-symmetry breaking!!! This flavor changing oscillation could prove that it could be also on higher level such as atoms, molecules, probably big biological significant molecules and responsible on the aging of the life.

Important to mention that the weak interaction is always contains particles and antiparticles, where the neutrinos (antineutrinos) present the opposite side. It means by Feynman's interpretation that these particles present the backward time and probably because this they seem to move faster than the speed of light in the reference frame of the other side.

Finally since the weak interaction is an electric dipole change with ½ spin creating; it is limited by the velocity of the electromagnetic wave, so the neutrino's velocity cannot exceed the velocity of light.

The General Weak Interaction

The Weak Interactions T-asymmetry is in conjunction with the T-asymmetry of the Second Law of Thermodynamics, meaning that locally lowering entropy (on extremely high temperature) causes for example the Hydrogen fusion. The arrow of time by the Second Law of Thermodynamics shows the increasing entropy and decreasing information by the Weak Interaction, changing the temperature dependent diffraction patterns. A good example of this is the neutron decay, creating more particles with less known information about them.
The neutrino oscillation of the Weak Interaction shows that it is a general electric dipole change and it is possible to any other temperature dependent entropy and information changing diffraction pattern of atoms, molecules and even complicated biological living structures. We can generalize the weak interaction on all of the decaying matter constructions, even on the biological too. This gives the limited lifetime for the biological constructions also by the arrow of

time. There should be a new research space of the Quantum Information Science the 'general neutrino oscillation' for the greater then subatomic matter structures as an electric dipole change.

There is also connection between statistical physics and evolutionary biology, since the arrow of time is working in the biological evolution also.
The Fluctuation Theorem says that there is a probability that entropy will flow in a direction opposite to that dictated by the Second Law of Thermodynamics. In this case the Information is growing that is the matter formulas are emerging from the chaos. So the Weak Interaction has two directions, samples for one direction is the Neutron decay, and Hydrogen fusion is the opposite direction.

Fermions and Bosons

The fermions are the diffraction patterns of the bosons such a way that they are both sides of the same thing.

Van Der Waals force

Named after the Dutch scientist Johannes Diderik van der Waals – who first proposed it in 1873 to explain the behaviour of gases – it is a very weak force that only becomes relevant when atoms and molecules are very close together. Fluctuations in the electronic cloud of an atom mean that it will have an instantaneous dipole moment. This can induce a dipole moment in a nearby atom, the result being an attractive dipole–dipole interaction.

Electromagnetic inertia and mass

Electromagnetic Induction

Since the magnetic induction creates a negative electric field as a result of the changing acceleration, it works as an electromagnetic inertia, causing an electromagnetic mass. [1]

Relativistic change of mass

The increasing mass of the electric charges the result of the increasing inductive electric force acting against the accelerating force. The decreasing mass of the decreasing acceleration is the result of the inductive electric force acting against the decreasing force. This is the relativistic mass change explanation, especially importantly explaining the mass reduction in case of velocity decrease.

The frequency dependence of mass

Since $E = h\nu$ and $E = mc^2$, $m = h\nu / c^2$ that is the m depends only on the ν frequency. It means that the mass of the proton and electron are electromagnetic and the result of the electromagnetic induction, caused by the changing acceleration of the spinning and moving charge! It could be that the m_o inertial mass is the result of the spin, since this is the only accelerating motion of the electric charge. Since the accelerating motion has different frequency for the electron in the atom

and the proton, they masses are different, also as the wavelengths on both sides of the diffraction pattern, giving equal intensity of radiation.

Electron – Proton mass rate

The Planck distribution law explains the different frequencies of the proton and electron, giving equal intensity to different lambda wavelengths! Also since the particles are diffraction patterns they have some closeness to each other – can be seen as a gravitational force. [2]

There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

Gravity from the point of view of quantum physics

The Gravitational force

The gravitational attractive force is basically a magnetic force.

The same electric charges can attract one another by the magnetic force if they are moving parallel in the same direction. Since the electrically neutral matter is composed of negative and positive charges they need 2 photons to mediate this attractive force, one per charges. The Bing Bang caused parallel moving of the matter gives this magnetic force, experienced as gravitational force.

Since graviton is a tensor field, it has spin = 2, could be 2 photons with spin = 1 together.

You can think about photons as virtual electron – positron pairs, obtaining the necessary virtual mass for gravity.

The mass as seen before a result of the diffraction, for example the proton – electron mass rate Mp=1840 Me. In order to move one of these diffraction maximum (electron or proton) we need to intervene into the diffraction pattern with a force appropriate to the intensity of this diffraction maximum, means its intensity or mass.

The Big Bang caused acceleration created radial currents of the matter, and since the matter is composed of negative and positive charges, these currents are creating magnetic field and attracting forces between the parallel moving electric currents. This is the gravitational force experienced by the matter, and also the mass is result of the electromagnetic forces between the charged particles. The positive and negative charged currents attracts each other or by the magnetic forces or by the much stronger electrostatic forces!?

The gravitational force attracting the matter, causing concentration of the matter in a small space and leaving much space with low matter concentration: dark matter and energy.
There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy

distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

The Higgs boson

By March 2013, the particle had been proven to behave, interact and decay in many of the expected ways predicted by the Standard Model, and was also tentatively confirmed to have + parity and zero spin, two fundamental criteria of a Higgs boson, making it also the first known scalar particle to be discovered in nature, although a number of other properties were not fully proven and some partial results do not yet precisely match those expected; in some cases data is also still awaited or being analyzed.

Since the Higgs boson is necessary to the W and Z bosons, the dipole change of the Weak interaction and the change in the magnetic effect caused gravitation must be conducted. The Wien law is also important to explain the Weak interaction, since it describes the T_{max} change and the diffraction patterns change. [2]

Higgs mechanism and Quantum Gravity

The magnetic induction creates a negative electric field, causing an electromagnetic inertia. Probably it is the mysterious Higgs field giving mass to the charged particles? We can think about the photon as an electron-positron pair, they have mass. The neutral particles are built from negative and positive charges, for example the neutron, decaying to proton and electron. The wave – particle duality makes sure that the particles are oscillating and creating magnetic induction as an inertial mass, explaining also the relativistic mass change. Higher frequency creates stronger magnetic induction, smaller frequency results lesser magnetic induction. It seems to me that the magnetic induction is the secret of the Higgs field.

In particle physics, the Higgs mechanism is a kind of mass generation mechanism, a process that gives mass to elementary particles. According to this theory, particles gain mass by interacting with the Higgs field that permeates all space. More precisely, the Higgs mechanism endows gauge bosons in a gauge theory with mass through absorption of Nambu–Goldstone bosons arising in spontaneous symmetry breaking.

The simplest implementation of the mechanism adds an extra Higgs field to the gauge theory. The spontaneous symmetry breaking of the underlying local symmetry triggers conversion of components of this Higgs field to Goldstone bosons which interact with (at least some of) the other fields in the theory, so as to produce mass terms for (at least some of) the gauge bosons. This mechanism may also leave behind elementary scalar (spin-0) particles, known as Higgs bosons.

In the Standard Model, the phrase "Higgs mechanism" refers specifically to the generation of masses for the $W^{\pm}$, and Z weak gauge bosons through electroweak symmetry breaking. The Large Hadron Collider at CERN announced results consistent with the Higgs particle on July 4, 2012 but stressed that further testing is needed to confirm the Standard Model.

What is the Spin?

So we know already that the new particle has spin zero or spin two and we could tell which one if we could detect the polarizations of the photons produced. Unfortunately this is difficult and neither ATLAS nor CMS are able to measure polarizations. The only direct and sure way to confirm that the particle is indeed a scalar is to plot the angular distribution of the photons in the rest frame of the centre of mass. A spin zero particles like the Higgs carries no directional information away from the original collision so the distribution will be even in all directions. This test will be possible when a much larger number of events have been observed. In the mean time we can settle for less certain indirect indicators.

The Graviton

In physics, the graviton is a hypothetical elementary particle that mediates the force of gravitation in the framework of quantum field theory. If it exists, the graviton is expected to be massless (because the gravitational force appears to have unlimited range) and must be a spin-2 boson. The spin follows from the fact that the source of gravitation is the stress-energy tensor, a second-rank tensor (compared to electromagnetism's spin-1 photon, the source of which is the four-current, a first-rank tensor). Additionally, it can be shown that any massless spin-2 field would give rise to a force indistinguishable from gravitation, because a massless spin-2 field must couple to (interact with) the stress-energy tensor in the same way that the gravitational field does. This result suggests that, if a massless spin-2 particle is discovered, it must be the graviton, so that the only experimental verification needed for the graviton may simply be the discovery of a massless spin-2 particle. [3]

Conclusions

Exists experimental evidence for quantum-coherent is used for more efficient light-harvesting in plant photosynthesis. Quantum entanglement exists in supramolecules determining the sense of smell and in the brain neurons microtubules due to quantum vibrations.

In the work presented here, we started to design and quantum mechanical investigations of the molecular logical devices which are useful for construction of nano medicine biorobots against the molecular diseases such a cancer tumors, and against the new kinds of synthesized microorganisms and nano guns. [7]

One of the most important conclusions is that the electric charges are moving in an accelerated way and even if their velocity is constant, they have an intrinsic acceleration anyway, the so called spin, since they need at least an intrinsic acceleration to make possible they movement . The accelerated charges self-maintaining potential shows the locality of the relativity, working on the quantum level also. [1]

The bridge between the classical and quantum theory is based on this intrinsic acceleration of the spin, explaining also the Heisenberg Uncertainty Principle. The particle – wave duality of the electric charges and the photon makes certain that they are both sides of the same thing. The

Secret of Quantum Entanglement that the particles are diffraction patterns of the

electromagnetic waves and this way their quantum states every time is the result of the quantum state of the intermediate electromagnetic waves. [2]
These relatively new developments in biophysics have discovered that all biological organisms are constituted of a liquid crystalline medium. Further, DNA is a liquid-crystal, lattice-type structure (which some refer to as a liquid crystal gel), whereby body cells are involved in a holographic instantaneous communication via the emitting of biophotons (a source based on light). This implies that all living biological organisms continuously emit radiations of light that form a field of coherence and communication. Moreover, biophysics has discovered that living organisms are permeated by quantum wave forms. [5]
Basing the gravitational force on the accelerating Universe caused magnetic force and the Planck Distribution Law of the electromagnetic waves caused diffraction gives us the basis to build a Unified Theory of the physical interactions also.

References

[1] The Magnetic field of the Electric current and the Magnetic induction

http://academia.edu/3833335/The_Magnetic_field_of_the_Electric_current

[2] 3 Dimensional String Theory http://academia.edu/3834454/3_Dimensional_String_Theory

[3] Graviton Production By Two Photon and Electron-Photon Processes In Kaluza-Klein Theories With
Large Extra Dimensions http://arxiv.org/abs/hep-ph/9909392

[4] Quantum Entanglement

http://en.wikipedia.org/wiki/Quantum_entanglemen

t

[5] Quantum Consciousness

https://realitysandwich.com/155783/quantum_consciousness_0/

[6] Quantum Biology http://www.nature.com/news/2011/110615/pdf/474272a.pdf [7]

Quantum entanglement in photoactive prebiotic systems

https://globalmedicaldiscovery.com/key-drug-discovery-articles/quantum-entanglementphotoactive-prebiotic-systems/
[8] Quantum biology: Algae evolved to switch quantum coherence on and off

http://phys.org/news/2014-06-quantum-biology-algae-evolved-coherence.html

[9] Experiment demonstrates quantum mechanical effects from biological systems

https://phys.org/news/2017-12-quantum-mechanical-effects-biological.html

[10] Particles in charged solution form clusters that reproduce

https://phys.org/news/2017-12-particles-solution-clusters.html

[11] New interaction mechanism of proteins discovered

https://phys.org/news/2018-02-interaction-mechanism-proteins.html

[12] A protein that self-replicates

https://phys.org/news/2018-02-protein-self-replicates.html

[13] Smallest life forms have smallest working CRISPR system

https://phys.org/news/2018-10-smallest-life-crispr.html

[14] Capabilities of CRISPR gene editing expanded

https://phys.org/news/2020-03-capabilities-crispr-gene.html

[15] Completely new antibiotic resistance gene has spread unnoticed to several pathogens

https://phys.org/news/2020-03-antibiotic-resistance-gene-unnoticed-pathogens.html

[16] An antibiotic masquerading as a natural compound in the giant Madeiran squill

https://phys.org/news/2020-04-antibiotic-masquerading-natural-compound-giant.html