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Cyclic vomiting syndrome

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Cyclic vomiting syndrome (CVS) is a functional disorder that constitutes a serious social problem and disturbs family dynamics due to vomiting intensity. Its identification based on clinical symptoms is helpful for the diagnosis and evolution of these.^b

Introduction

CVS is a functional gastrointestinal disorder characterized by stereotyped episodes of recurrent, explosive, and unexplained vomiting, separated by intervals of complete normality in which, after adequate evaluation, no cause is found to justify them. [1] It was first described in 1861 by HC Lombard, in Paris, and by Samuel Gee, in London, in 1882. [2] Although it was described more than a century ago, its etiology, pathogenesis, and diagnosis are still unknown, which has led to the interest in pediatric gastroenterologists for the study of this current pediatric enigma. [2, 3] It appears to be more common than initially thought. Recent studies have reported a prevalence of CVS five times higher than celiac disease. Pediatric age is the most affected, but it can appear in adults; there are reports of the clinical picture from 6 days of birth to 73 years of age. It occurs more frequently in females. [2]

Etiopathogenesis

Several hypotheses have been put forward about the etiology and pathogenesis of CVS since its original description. It is suspected that disorders produce it in the Cerebro-intestinal axis, which causes the body to respond in an exaggerated way with its normal defense mechanisms, such as nausea and vomiting, in the face of certain stimuli (stress, infections, overexertion, some food).s [4] Everything is the result of a disproportionately high secretion of corticotropin, cortisol, vasopressin and serotonin, which produce increased gastric and intestinal secretion, slow gastric emptying and activate the emetic reflex. Recently, other possibilities have been added, defended by some authors, such as gastrointestinal motility disorders and alteration in the obtaining of energy by the mitochondria, secondary to enzymatic defects of fatty acid metabolism or mutations in mitochondrial DNA. [2]

Clinical picture

Patients with SVC present severe and recurrent episodes of nausea and vomiting, very similar to each other. The onset is abrupt and occurs more frequently at night and early morning. In most cases, they are triggered by stressful situations (pleasant or unpleasant) and infections (common cold, sinusitis), although physical exhaustion and some foods such as cheese and chocolate can precipitate crises. [3, 5] The age at which

It appears is usually the pediatric one, in preschool and schoolchildren mostly; in adults, it is less frequent and occurs during the third and fourth decades of life. Some patients experience prodrome from minutes to hours, in whom they feel anguish and significant discomfort. [2, 3] Once the episode begins, vomiting repeats very frequently; there are more than 4 vomits per hour and can reach the figure of more than 50 emeses per episode. [5] The duration is uniform in 85% of cases, usually between 1 and 4 days, while in others, they persist for 14 days. Half of the patients have a regular (cyclical) recurrence, several times a month or several times a year, and maintain an almost constant symptom-free inter-critical interval, although different from one child to another. [2, 3, 5] Parents define their children's personalities as determined, moralistic, dedicated, aggressive, enthusiastic, and competitive. [5, 6] Among the most frequent complications, we can mention electrolyte disorders and dehydration, inadequate secretion of antidiuretic hormone (ADH), peptic esophagitis, and Mallory-Weiss syndrome. We also include school absenteeism, which significantly alters family dynamics and constitutes a serious social problem. In recent years in the study of this enigmatic syndrome, the following criteria, known as the Rome criteria, were established for diagnosis: s [1, 2, 3]

1. Essential diagnostic criteria: A history of three or more periods of severe, acute nausea and non-remitting vomiting, lasting hours or days, with symptom-free intervals of weeks or months. There are no gastrointestinal, metabolic, structural central nervous system or biochemical diseases.
2. Supporting diagnostic criteria: Stereotypic pattern (each episode is similar in the moment of appearance, intensity, duration, frequency, associated signs, and symptoms in the same individual). Self-limited (episodes resolve spontaneously without treatment). In children with CVS, a 10 times higher prevalence of epilepsy has been seen compared to children without them. Migraine headaches occur in 11% of affected children, more than twice that of the general population. [7] Irritable bowel is much more common in these patients and their families.

Differential Diagnosis

It is a challenge for the doctor to exclude the underlying diseases as occurs in other functional disorders, but for this, we do not have to do an exhaustive study of the

organic causes, and we cannot comfortably think that it is a new episode, but we must always rule out possible intercurrent organic problems in each crisis. [8]

Differential diagnosis between cyclic vomiting and chronic vomiting

In order to improve the detection of this condition, quantitative criteria have been established to differentiate cyclical vomiting from chronic vomiting. [8] There are two criteria: peak intensity (maximum number of vomits per hour) and frequency (average number of episodes per month). These quantitative criteria reinforce the qualitative pattern of intermittent vomiting attacks, separated by health intervals originally used to characterize SVC.

Treatment

The ideal cure and treatment for CVS are unknown. There have been no controlled clinical trials evaluating the efficacy of the drugs used. Therapeutic management is based on the personal experience of some researchers and the cases reported in the literature. Treatment aims to decrease the number and severity of episodes and help children cope with their illness. It must be customized for each patient and will depend on the stage of the disease. We will use drug prophylaxis in symptom-free intervals, as long as the attacks are so frequent or severe as to justify the daily use of drugs. [9] It also includes the reduction of the factors that trigger the attacks. Abortive therapy will begin when there are recognized prodromes before nausea begins. In those patients who cannot be prevented, we will begin treatment of the crisis as quickly as possible. Acid secretion inhibitors can be used to protect the esophageal mucosa and tooth enamel. Hydro electrolyte imbalances will be addressed if present. [9] In the gastroenterology department of the Pediatric University Hospital "Borrás," we studied patients with a probable diagnosis of CVS over 2 years, intending to know the frequency and identify and validate the clinical characteristics. Patients and parents/guardians were surveyed for symptoms, and the complete physical examination at the first visit was performed according to the Rome criteria. Complementary tests were indicated that included biochemical and hematological tests, parasitological and bacteriological studies of stool, urine culture, metabolic tests in urine, electroencephalogram, endoscopic and pathological studies of the upper digestive tract and imaging studies of the skull to rule out organic diseases as possible causes. We obtained a diagnosis of CVS in 19 patients: the 5-9 year-old group was the most affected; the female sex with 57.9% and 84.2% of the patients were white. Pale-ness 19 (100%), social withdrawal 11 (57.9%), abdominal pain 9 (47.4%), nausea 6 (31.6%), headache and diarrhea 5 (26.3%), vertigo and fever 4 (21.1%), sweating 3 (15.8%), photophobia and excessive salivation 2 (10.5%). Migraine headache (6 cases; 31.6%), irritable bowel syndrome (2 cases; 10.5%), and motion sickness

(1 case; 5.3%) were presented as associated diseases. Among the pathological antecedents in first-degree relatives, we found migraine headache (5 cases; 26.3%), irritable bowel syndrome (3 cases; 15.8%), epilepsy, and motion sickness (1 case; 5.3%). 63.2% identified specific situations that precipitated the crisis; of these 6 cases (31.6%) were stressful situations, 4 (21.1%) respiratory infections, and 2 (10.5%) were due to food. In 78.9% the episodes were stereotyped, the recurrence cyclical in 12 cases (63.2%) and irregular in 7 (36.8%) with 15 episodes on average per year. The duration of the episode was uniform in 15 cases (78.9%) and variable in 4 (21.1%). With recognized prodromes, only 5 cases (26.3%) while 14 (73.7%) had a sudden onset. Among the complications, isotonic dehydration was present in 11 patients (57.9%), peptic esophagitis in one patient (5.3%), as was Mallory-Weiss syndrome.

Conclusions

We conclude that CVS is relatively frequent in our outpatient Gastroenterology service.

Notes

- a. Email: fragoso@infomed.sld.cu
- b. Original version of this article is Ref. [1]

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About the role of the Soviet Union in World War II, on the occasion of the 75th anniversary of the victory

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Through the recall of extraordinary victories achieved by the Soviet Union, its role in the outcome of the war is weighted and the common falsifications and misrepresentations of the historical truth are refuted.^b

Introduction

As the year of the 75th anniversary of the victory over fascism approached, the distorting and defamatory campaigns about the role played by the Soviet Union in the defeat of fascist Germany and its allies intensified. In these circumstances, it is convenient to show, if only by means of a brief revision, the decisive role of the Soviets in World War II (Díaz Lezcano, 2008).

Development

When Hitler decided to invade the Soviet Union, Germany had immense resources, which allowed it to organize a powerful war machine consisting of 190 divisions with more than 5 million soldiers and some 4,170 tanks, 4,950 aircraft and more than 50,000 guns and other artillery pieces. These forces were organized into three groups of armies, which had the mission of advancing through the south, the center and the north, in the direction of the cities of Kiev, Moscow and Leningrad. Fascist troops penetrated deep and fast into Soviet territory and approached Moscow, due in part to Stalin's erroneous and disconcerting opinion about when Hitler would launch against the USSR (Hobsbawn, 1998).

But despite the lack of preparation and the great human and material losses suffered, the military and civilians offered a tenacious resistance to the invaders. This attitude of heroic resistance limited the rapid advance of the adversary and made possible the colossal feat of dismantling and transferring to the interior of the country a large part of the industries located in the western areas, which would have a decisive influence on the course of the war.

In mid-September, Hitler decided to strike the final blow and occupy Moscow. The German offensive began on October 2, but for two months the troops commanded by Marshal Fedor von Bock did not achieve their objective, although they advanced considerably. The offensive was definitively stopped in early December, with reserve reinforcements mobilized from Siberia and other eastern regions, the Soviets, led by the then General Gueorgui K. Zhukov, went on the counter-offensive and inflicted heavy losses on the Germans.

The victory of the Red Army in the battle of Moscow destroyed the myth of German invincibility and the plans of the blitzkrieg, while strengthening the fighting spirit of the Soviets and other peoples who were facing

fascism. The German generals attributed the defeat to the harsh Russian winter. The "General Cold" argument has been used to this day by politicians and historians to downplay the former feat of the Soviet people during the war.

Despite the defeat in Moscow, the year 1942 was still successful for Germany and its allies. On the eastern front, the fascists managed to occupy an extensive and rich southern region and by October they reached the city of Stalingrad (now Volgograd), from where it was planned to organize a new attack on Moscow following the Volga basin. Meanwhile, Marshal Rommel's forces were advancing in North Africa, despite resistance from the British and American troops, which formed the anti-fascist alliance with the USSR on January. The Japanese continued to expand into Asia and the Pacific, although they faced increasing opposition from the US Army and Navy, commanded by General Douglas MacArthur.

But at the beginning of 1943 the situation on all fronts gradually changed. Germany and its allies began to retreat in the different theaters of operations. This was fundamentally determined by the Soviet victory at the Battle of Stalingrad between late 1942 and early 1943. The Battle of Stalingrad definitely changed the course of the Great Patriotic War and the entire war. Some 2 million soldiers, more than 2,000 tanks and nearly 3,000 aircraft fought there. The Soviets managed to totally or partially annihilate two enemy armies and captured just over ninety thousand prisoners, including the head of the 6th German Army, Marshal Friedrich Von Paulus. It was a tremendous blow from which Germany could never recover materially and psychologically. From that moment on the Red Army went on the offensive throughout the eastern front.

Taking advantage of this the Anglo-American troops were able to deploy extensive operations in North Africa, from November 1942. With superiority in men and military equipment, the Western allies were defeating the resistance of the Italian-German forces, made up of about 200,000 troops, until finally defeating them in May 1943. The most important battle in that theater of operations was that of El Alamein, in the territory of Egypt. And while the war was ending on the African scene, in the Pacific the balance was progressively tilting against Japan clearly manifested in the

Battle of Guadalcanal, concluded in February 1943.

The largest tank battle of the entire war took place in Kursk. 6,500 battle tanks participated, in addition to 4,000 aircraft and just over 2 million soldiers. The Germans lost the bulk of their troops, some 30 divisions, and almost all the military technique used. From that moment on, the Soviets took the strategic initiative on the entire eastern front.

With this advantage the Anglo-American allies landed seven divisions on the Italian island of Sicily, thus executing the "Husky operation", which Churchill had conceived as a first step to organize an offensive in the Balkans with the objective of avoiding the safe Soviet advance in that area (*Correspondence*, 1957). But the situation on the peninsula made it advisable to move to the continental territory, an action that precipitated the collapse of the Mussolini regime, replaced on July 25 by the government of Marshal Pietro Badoglio. In the northern territory occupied by the Germans the so-called Social Republic was formed, headed by Mussolini, freed from its confinement by a Hitler commando.

Interpretations

Many Western historians and political leaders have attributed decisive weight to the successful operations of the Allies in North Africa and Italy, in which barely 1 million men participated, considering the two contending sides. These forgers of history come to compare the battles of Alamein and Sicily with those fought at Stalingrad and Kursk, giving them similar or greater importance. In reality it was the USSR fighting which facilitated the victories of the Allies on the African and Italian stages. The bloody fighting fought on the eastern front retained more than 70% of the forces and resources of the Germans and did not allow the transfer of troops.

Since Stalingrad and Kursk Hitler lost the strategic initiative, the fascist alliance was weakened and the spirit of resistance and faith in the victory of all peoples was strengthened. Prestigious personalities such as the President of the United States, Franklin D. Roosevelt, highlighted the extraordinary importance of those battles. The decisive role played by the USSR forced the Western allies to draw up joint plans with Stalin, finally accepting the Soviet demand to open a second front in Western Europe. The importance of the new front, which would not open until June 6, 1944, through the Normandy landings, has been exaggerated by Westerners to the point of considering it the decisive action of the Second World War in Europe.

In December 1944, taking advantage of a momentary interruption in the fighting on all fronts, Hitler decided to launch an offensive in the Ardennes area. The western allies went to the USSR to advance its winter offensive. Despite the tremendous effort that this represented, the Soviet military managed to anticipate its decisive offensive in ten days, which practically

saved the Anglo-American troops from certain defeat. The forgers of history either fail to mention this fact or grossly misrepresent it. The offensive advanced a front of more than a thousand kilometers, from the Baltic to the Carpathians that penetrated deep into Germany.

In this atmosphere the Yalta Conference in Crimea took place, which brought together for the second time the heads of the three great allied powers. The fact that the meeting took place on the territory of the Soviet Union was an explicit recognition of their extraordinary role in the struggle.

After Yalta, the target for all the allies was Berlin. The Anglo-American armies managed to cross the Rhine river at the end of March and began their advance towards the German capital. The Red Army, after liberating Austria, began a powerful offensive on Berlin, involving 3 army fronts, 8,000 aircraft and more than 6,000 tanks. On April 30, almost at the same time that the Soviet flag was being hoisted at the top of the Reichstag, the Führer's suicide occurred. Consequently, during the night of May 8 to 9, the representatives of the German high command signed the unconditional surrender. Shortly before, German troops had surrendered in northern Italy, as well as in Holland, Denmark, and Czechoslovakia. Thus ended the war in Europe.

Conclusions

The price paid by the Soviet people to rid humanity of fascism was enormous. They contributed 26 million deaths, 2 million missing and almost 20 million injured, many with total disability. To this must be added the disappearance of more than 80,000 cities and towns of all kinds and hundreds of thousands of kilometers of railways, roads and bridges, as well as other infrastructure works and economic facilities. A minimum of honesty must lead to recognize those realities and the great epic and sacrifice that Russians and millions of people around the world remember every May 9.

Notes

- a. Email: fragoso@infomed.sld.cu
- b. Original version of this article is (Díaz Lezcano, 2020).

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Featuring soft-matter for information storage applications

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Among the direct consequences of the verification of a crystal-to-glass transition in 2D interacting particles is that heat pulses can switch patterns, suggesting the design of bit-writing protocols for monodisperse systems.

Not very often the time comes for a theoretical physics project to be able to conduct a proof of concept, i.e. a demonstration in principle with the aim of verifying that a concept or theory has practical potential. That's usually a privilege of the experimental realm. But right away after we understood the out-of-equilibrium properties of 2D cluster-forming systems, in a joint effort involving a fairly large collaboration with researchers from Strasbourg, Innsbruck, Stellenbosch and Stockholm [1], it became clear that the steep change in the order parameters, allowing for temperature-controlled switch applications, was one of these happy opportunities.

This is actually a long story, so in order to make it short let's go quickly through the basics: in two dimensions, interacting systems in which particles are all of the same type (monodisperse) have a very contrasting ordering behavior when compared to systems with different types of particles (polydisperse). Essentially, monodisperse systems are hard to keep in a disordered state, while polydisperse cannot even order in the general case. That's a killing property for memory applications based on phase-change, i.e. materials with the ability to switch between amorphous and ordered configurations, instrumental for rewritable non-volatile-electronic or optical storage. Not surprisingly, devices for phase-change memory, which is a promising candidate for both the next generation of high-density ultra-fast memories and the emergence of cognitive computing hardware, are typically made of bulky alloys. The search, however, continues for 2D and quasi-2D materials, since they could improve density packaging, low power, etc.

Then it turned out that, while studying the apparently distant context of cold atomic systems with quantum supersolid properties, the concept of cluster-forming ability (the property of spontaneously forming small bunches of particles) arose as crucial feature for the bosonic potential interactions. As a result, a thorough set of computer simulations was performed to characterize, among other things, the evolution of the non-equilibrium dynamics of these cluster configurations after quenches. The study of cluster-forming potentials, also called ultra-soft in some communities, was an already established field of research, remarkably connecting a large number of soft-matter topics of diverse nature, from cold atoms and vortexes in type-1.5 superconductors to colloids and polymers. Consequently, the finding of stable amorphous states

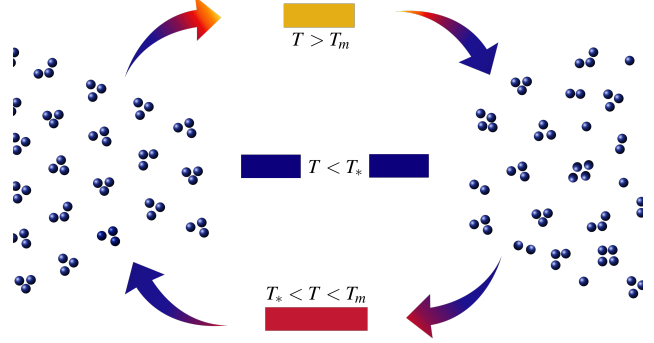


Figure 1: Schematic representation of the phase-change switching for a particle system interacting via cluster-forming potentials. The system is kept at a temperature $T < T_*$ (blue reservoir), a switch from the crystalline to the amorphous phase is obtained by heating the system to a temperature corresponding to the disordered phase $T > T_m$ (yellow reservoir), followed by a sudden cooling to the initial temperature. In turn, the ordered configuration can be reestablished by a moderate heating to a temperature $T_* < T < T_m$ (red reservoir).

that do not relax towards equilibrium after quenches in a vortex-matter model with ultrasoft interactions [1], was immediately generalizable to all cluster forming potentials.

In a nutshell, the trick is that clusters form quickly, in the very early stage of the evolution after quench, and then a slower cluster dynamics sets on, in which the whole system rearranges and, most importantly, individual particles hop between neighboring clusters. But the latter is an activated process, meaning that there will be a well-defined freezing temperature T_* below which individual particles have not enough energy to overcome the hopping barrier, forcing each cluster to keep a constant size. In turn, this random distribution of sizes act as a self-assembled effective polydispersity for the clusters ensemble, making the clustered system to depart from the normal monodisperse behavior, unable to go beyond the amorphous state and eventually arresting the dynamics^b.

In Fig. 1, a simple schematic representation of a bit writing protocol is illustrated, on the basis of this now possible stabilization of both, amorphous and ordered states depending on the temperature ramps. The system operates at a temperature below T_* . To go from crystalline to amorphous state, the system must be temporarily heated above the melting temperature of the crystal $T > T_m$ so that particles become fluid and

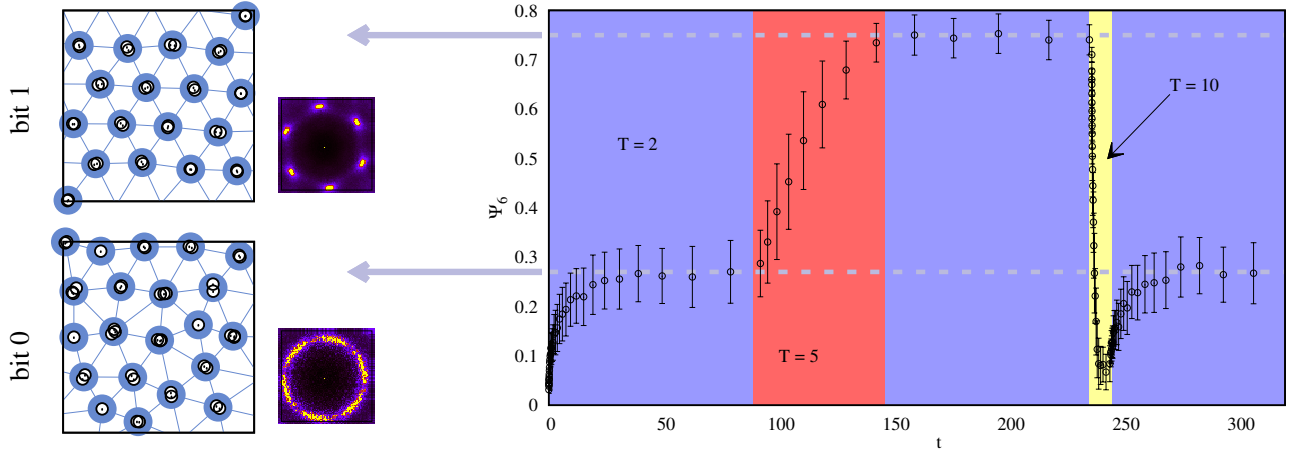


Figure 2: Simulation of the bit-writing operation in a system interacting via an ultrasoft potential with $T_m = 8$ and $T_* = 4$. The order parameter Ψ_6 is plotted as a function of time, and the temperature of the reservoirs along the time line is encoded with blue ($T = 2$), red ($T = 5$) and yellow ($T = 10$) shadows. The system is quenched at $t = 0$ from a fully disordered state to the operating temperature $T = 2$, and is quickly trapped in the amorphous state (bit 0), corresponding to an order parameter of about $\Psi_6 \approx 0.27$. A first pulse with $T = 5$ orders the system in a crystalline configuration (bit 1), corresponding to a parameter of $\Psi_6 \approx 0.75$. A second pulse with $T = 10$ fully disorder the arrangement and recovers the amorphous state. Left panels are typical configurations and structure factors corresponding to the two stable values of Ψ_6 at the origin of the arrows. Dashed lines in the graphics and the connecting shadow in the configuration panels are guides for the eye. Units of time and temperature are normalized to the units of friction coefficients and potential energy respectively (see Ref. [2]).

the subsequent quench develops the self-induced polydispersity explained above. On the other hand, going from amorphous to crystalline is achieved by heating to subcritical temperature, but fairly above T_* , so that the hopping dynamics is activated again and the system can evolve to the ordered configuration; which is of course kept when getting back to the operational temperature [2]. The range of real materials that can perform such a protocol is very wide in nature and, for most of them, the state of the art in experimental setups, controlling interactions, polydispersity and dimensionality, makes this idea very likely to be tested.

As a generic proof of concept, we performed computer simulations of such bit-writing process for an ultrasoft potential [2] with well-known melting and freezing temperatures. The aim was to demonstrate that the crystalline and amorphous structures can be easily tuned by heat pulses, so introducing a new type of phase-change behavior relevant for information storage applications. The results are depicted in Fig. 2, where the right plot shows time evolution of the six-fold orientational order parameter Ψ_6 , that is 1 for a perfect triangular structure and vanishes for fully disordered configurations. As can be observed, the two stable structures at the operational temperature, shown in the left panels with representative snapshots, can be switched by means of the application of targeted heat pulses. This verifies the feasibility of the hypothesized bit-writing protocol.

As briefly mentioned before, typical bit-reading principle for this kind of applications come in two variants associated to the crystalline-amorphous change: changes in the electronic properties (e.g. resistance),

and changes in optical properties. While the former is highly dependent on the specific nature of the system at hand, the latter can be easily characterized by the diffraction pattern insight obtained with the calculation of structure factors. In the small left-panels of Fig. 2 a quite sharp contrast is observed for the peak patterns of the two bits.

The discovered self-assembled polydispersity is thus an underlying mechanism with the potential to start a new branch of information storage devices. Whether the “disc” will be prototyped or not is way beyond our envision capability. Our numerical proof of concept was, however, both a hopeful call to spotlight cluster-forming systems for practical use, and a quite enjoyable stop in the way to understand the statistical physics of soft-matter.

Notes

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- Actually, the dynamics become glassy-like, with a two-step relaxation behavior (see Ref. [1])

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Important validation of 3D models of HIV-1 matrix shells

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Our efforts to improve a model of the HIV-1 virus structure led us to the development of software to validate hypothetical versions of the HIV-1 matrix shell. In this manuscript we reconstruct a full model of the HIV-1 envelop protein and predict its interaction with a previously published matrix shell structure. The evidence generated suggests a role of the HIV-1 matrix shell in viral entry.^b

In 2021 we developed a software that challenged published structures of the HIV-1 matrix shell [1]. Over the years, numerous papers have appeared in the literature claiming various hexagon-based configurations of the HIV-1 matrix shell depicting their hypothetical structures with connected hexagons or triangles. As a prove of concept, for our validation software, we processed the coordinates of one of the postulated HIV-1 matrix structures published by Kun Qu et al. in the prestigious journal *Science* [2] and showed structural abnormalities that such model contained (Fig 1). We are currently developing an open-source version of this software to aid the structural biology community validate their HIV-1 3D matrix shells prior to publication.

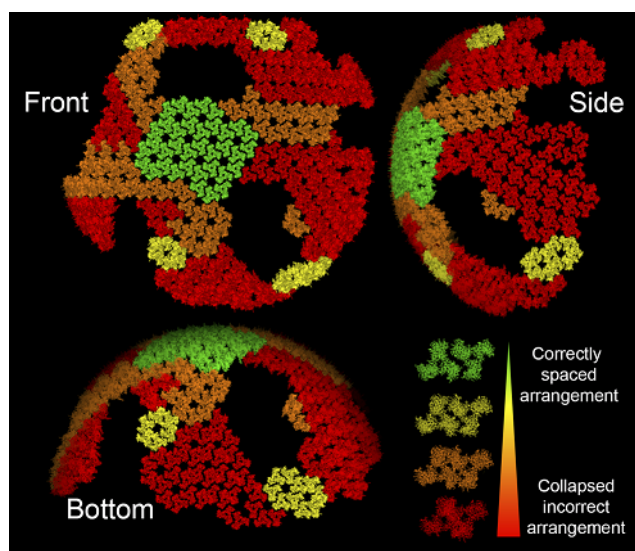


Figure 1: Reconstruction of a published HIV-1 matrix shell. The structure is rotated 90° to the left to show the side view (Side) or 90° upwards to show the bottom view. The color scale legend indicates correct positioning of adjacent HIV-1 matrix trimers in green. The color transition to yellow, orange, and red indicate increasingly more collapsed and thus inadequate matrix trimer positions.

To model a complete matrix shell, we needed an atomically complete model of the envelop (Env) glycoprotein (gp120/41). The structure of the Env complex and has not been fully determined by X-ray crystal-

lography or cryoEM. Thus, we reconstructed the Env glycoprotein using available crystal structures for the external domains of gp120/41 (PDB ID: 4ZMJ), the transmembrane domain (PDB ID: 6E8W), the amphipathic lentiviral lytic peptide domain (PDB ID: 5VWL). The structure of the remaining 40 residues was predicted in silico and the model was fitted in the cryoEM structure (EMDB ID: EMD-1814) using PowerFit.

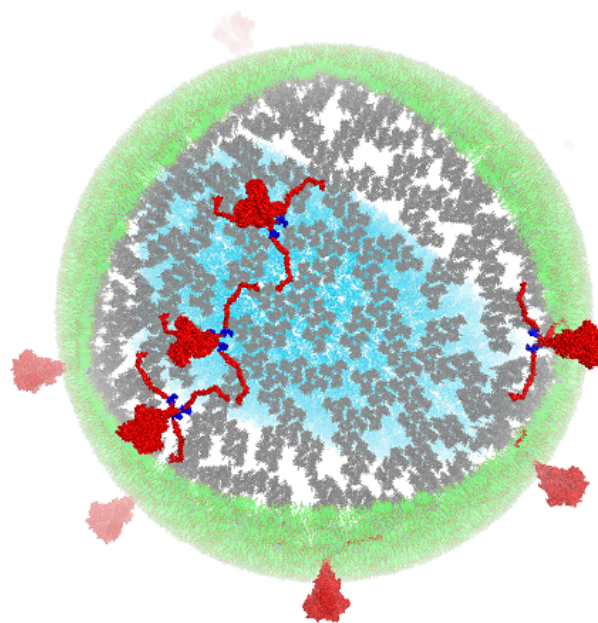


Figure 2: Full reconstruction of the HIV-1 viral particle. In light blue the viral core is shown with a full HIV-1 matrix shell (grey) without hexagonally arranged structures. The envelop proteins are shown in red, with their KS domain in dark blue. A lipid bilayer is depicted in light green.

With the structure of Env at hand, we were then able to improve our previous model of the HIV-1 shell [3] by including the Env proteins, thus considering the cytoplasmic domain of Env interacting with the matrix shell. Such interaction suggests a role of the matrix shell in facilitating viral entry by guiding the clustering of envelop proteins. By developing a mathematically possible arrangement for the matrix shell and

an atomic resolution HIV-1 Env glycoprotein, we were able to build an updated model of the HIV-1 particle (Fig 2) [1]. Our model highlights the critical interaction between the CT domain of clustered Env glycoproteins and points towards a model in which adjacent Env CT domains could interact to retain the necessary clusters of Env proteins for viral entry.

Notes

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b. Original version of this article is Ref. [1]

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