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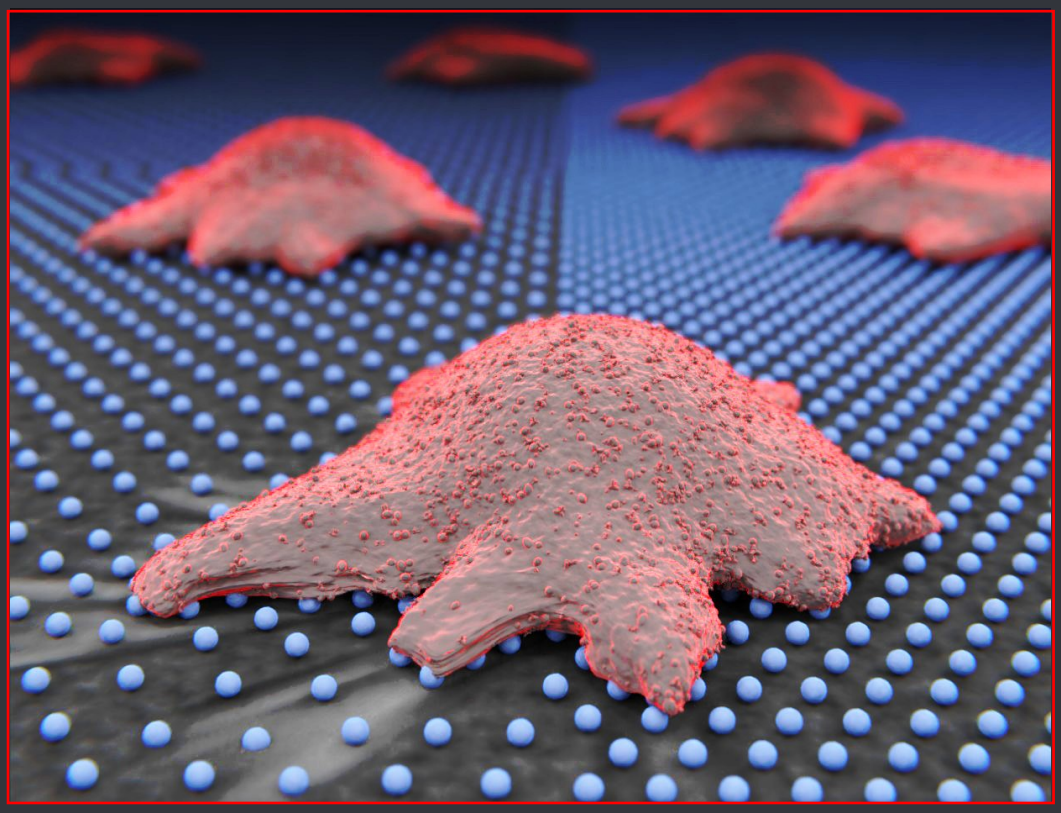

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# In this issue

Biofísica Magazine

EDITORIAL / ANALYSIS

# Leading women in Science: Why are we still so few?

Maria García-Parajo, *ICREA, ICFO Barcelona (Spain)*.

This is probably one of the questions that has received most attention in the last 15-20 years. In my opinion, the question is way too complex to be answered with a few facts.

After extensive research worldwide, it is clear that the intellectual capacities of men and women for natural and physical sciences are the same [1,2]. Acknowledging the abnormally low number of women in Science and in a true effort to recognize their *talent* and *added value*, several different policies have been implemented, both in USA and Europe, to increase female participation in Science. Indeed, things have improved a lot since my early days when I was doing my PhD at Imperial College (1989-1993). The building where I was doing research had ten floors, with only one female bathroom on the sixth floor, where all the administrative personnel (mostly women) were also located. But why would you need more female bathrooms? After all, we were only two females in the entire building doing the PhD at that time... In the Netherlands, where I moved years later, we had shared toilets (pragmatic Dutch approach...). Now, at my current institute in Barcelona, there is an equal number of toilets for women and men. We indeed have gained some equality! However, we need much more than this.

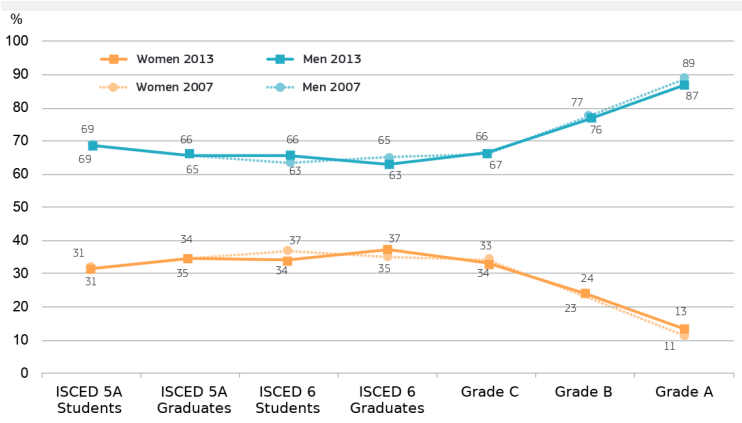


**Figure 1. Percentage of women and men in academic careers in science and engineering, students and academic staff (EU-28, 2007-2013)**. ISCED 5A students = bachelor level, ISCED 5A graduates = master's level, ISCED 6 students = PhD level, ISCED 6 graduates = Postdoc level, Grade C = Assistant Professor, Grade B = Associate Professor, Grade A = Full Professor. Taken from [3].

Compared to 20 years ago, the percentage of women starting their undergraduate studies in Science

and Engineering has increased to ~30%, not yet fully equal, but a proof that positive changes are occurring at the early stages of scientific training [3]. It also shows that girls have a genuine interest in these areas (a cheap excuse that has been often used to explain the low number of women in these careers). Yet, as we move up in the ladder, these numbers decrease dramatically, a trend that has not changed at all during the years, despite the implemented policies [3] (see Figure 1). What are the reasons? Have these measures failed?

There is certainly more flexibility regarding *maternity leave* and *childcare* (at least in Europe). I was recently talking to a female colleague Professor in Sweden, the paradise country for maternity leave. Yet, she told me that within a couple of months after giving birth, e-mails traffic decreased, the number of decision-making meetings she was not invited to increased, etc. The result: she continued working at home while breast feeding and changing pampers, and started working as soon as she could, before being completely ignored by her Department.

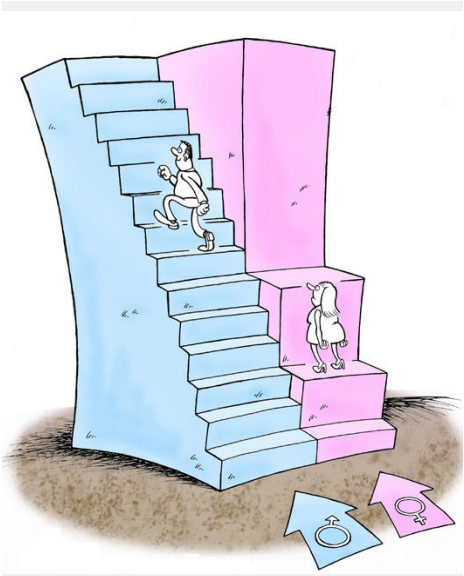

**Figure 2. It does not need a description...**. Taken from Science with and for Society – SwafS (European Commission).

*Positive discrimination* is another flawed policy. In my opinion it has done much more harm to us that real discrimination: Hearing comments at conferences or meetings linking the success of women to the "advantages" of their condition, and disregarding their true scientific capacity is common. Another flawed policy is to "force" equal participation of women and men in evaluation committees, conferences, editorial boards, etc. An excellent idea (in principle) to produce real changes in the system, but how could you possibly have 50% women participation in these events, if we barely account for 10-12% of senior professorship? The result (from my own experience) is that we get entangled into an enormous amount of commitments because we are always the same ones... with less time to be in the Lab doing actual research, which in turns works against our productivity level. Irritatingly enough, we are being approached to meet the equality criteria, rather than as a recognition for our merits.

**Irritatingly enough, we are being approached to meet the equality criteria, rather than as a recognition for our merits**

So yes, I think that these measures have failed: good intentions but no real improvements. Women face many more and greater obstacles than men in order to attain a senior position (Figure 2). Maternity is a fact, but in my opinion (and again from personal experience) is more of a myth rather than a real, permanent obstacle. Although significantly more difficult for women than for men, having a family should not constitute the reason for slowing down research or giving up women career ambitions. Open and obvious discrimination is hardly a reason or obstacle nowadays to stop women from climbing up the ladder to senior positions. Society has evolved and so have our rights. However, unconscious discrimination is undoubtedly there, surrounding us continuously from very early in our

careers (if not childhood), harming our *self-esteem* in a subtle but extremely effective way, to the extent that we are not even aware of it.

> **Maternity is a fact, but more of a myth than a permanent obstacle**

The truth is that doing excellent Science and reaching the top is awfully difficult, both for women and men. First, you need to be very smart. Second, it takes a titanic amount of time, commitment and effort. As already mentioned, women are as smart as men. This is not the problem. Do we have the time? and, are we willing to invest all the effort that it takes?

Time, dedication and commitment comes with hyper-focusing, making being successful in Science the first, and probably only priority in life. Despite the pragmatic facts that consume time and are not yet equally balanced (children, family, house-keeping etc), women are naturally more versatile, with broader interests in life and multi-task oriented. Obviously, this scatters the focus… but, women tend to work harder and longer hours to compensate for it. Thus, time constrains do not constitute the major reason either. The last point, is the effort and the sacrifices it takes to reach the top. Is it worth it? I am convinced it is, if you really love Science. Absolutely yes, if you are passionate about understanding the mysterious secrets of life and the laws of Nature. Here it is where I believe the difference between women and men comes into play. Men have been nourished and encouraged to be the best, to win since they are children, to reach as high as they possibly can, and of course very importantly, to enjoy their success, get pride and recognition for it. All these, feed into their egos' and boost their self-esteem. Armed with these battery of tools, they are ready to do whatever it takes to succeed in Science. Women have been swamped with continuous subliminal messages of discouragement, unrecognition, depreciation, fragility and inadequacy from our surrounding, even from our closest men colleagues, the ones we admire the most (unfortunately, some times, even from women).

> **Men have been nourished to be the best… Women have been swamped with continuous subliminal messages of discouragement**

Egos in Science are a big deal. How could we possibly keep our egos high and compete with those of our men colleagues, when our self-esteem is being continuously bombarded? This constant battle adds to the huge effort that women need to invest in to attain to the highest level. The result: despite a passion for Science and a brilliant mind, many women end-up quitting with the frustrating feeling that "I am just not good enough for Science".

Unless we seriously appreciate the huge negative impact of unconscious discrimination, and work hard on eradicating it from our societies, genuinely recognizing the talent of women in Science, things will not really change; no matter how many childcare and/or institutional policies are implemented.

Of note, while writing this comment, several of my female colleagues pointed out to me the positive influence that role models and mentoring have had in their careers. It is therefore of highest importance to share our experiences with young women researchers and to encourage active policies to mentor them on their way to the top.

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## References

1. "Sex differences in intelligence". *Wikipedia: The Free Encyclopedia*. Wikimedia Foundation, Inc. 12 September 2017. Available at https://en.wikipedia.org/wiki/Sex_differences_in_intelligence.
2. Halpern DF, Benbow CP, Geary DC, Gur RC, Hyde JS, Gernsbacher MA. "The Science of Sex Differences in Science and Mathematics". *Psychol Sci Public Interest*, **2007**, 8: 1. DOI:10.1111%2Fj.1529-1006.2007.00032.x.
3. European Commission. "She Figures 2015 – Gender in Research and Innovation". **2016**. Available online.

Biofísica Magazine

BEYOND BIOPHYSICS

# Mathematics and Biophysics

## A conversation with Paco Montero

Antonio Rey
*Universidad Complutense de Madrid (Spain)*

Mathematics is the *language of Science*. This old statement has been the moto of any mathematics professor we may have suffered, or enjoyed, in our scientific careers from the early years at high school. However, while this does not leave room for discussion in Physics, Computer Science or many branches of Chemistry, it has been somehow left aside in other scientific areas related to Life Sciences. Biophysics, being by definition well spread over all these subjects, may have developed an ambivalent feeling about the role that Mathematics has to play in this multidisciplinary topic.

In order to talk about this subject, I have met Professor Francisco ("Paco") Montero at the Chemistry Building of Complutense University in Madrid. It is the last week in July, and the building is slowly becoming more silent than it usually is. I climb three floors, from the Physical Chemistry Department, where I work, to the Biochemistry and Molecular Biology Department, where Paco has been Full Professor for many years now. His office/laboratory door reads "Biophysics" on top of the names of the people working in it. It has been that way for as long as I can remember, when Biophysics was not a trendy word. Now, it would probably be more precise to say *Bioinformatics* in order to properly refer to Paco's work, and it would still mean too many different things. However, from the very beginning he says: "I am a chemist by education, from one of the first generations who specialized in Biochemistry at this university. Nowadays, I don't know what I am". Fortunately, I add, Nature does not know what it is either, as it refuses to accommodate to the kind of compartments we are so fond of using.

We both are then chemists by education, and have used mathematical techniques to develop algorithms in different areas of Biophysics, from the times in which you needed to develop your own computer programs. It is interesting to realize that some people consider that those of us doing *theoretical* biophysics are mathematicians. Although I have met a few who really are, there are many physicists, chemists and other scientists doing this kind of work, in Spain and abroad. That is, in my opinion, one of the things that makes it so interesting.

Prof. Francisco Montero,

Universidad Complutense de Madrid

Paco tells me that he has been using mathematics in his research for several decades at many different levels. Just to mention a few, he starts with *differential calculus*, as the main tool for one of his long-established research lines in metabolic networks, *algebra*, for his work in genomics, all the mathematical tools which support *statistical mechanics* and lay the basis of molecular modeling, including the development of force fields, etc. Other biophysicists may mainly consider statistics for experimental data reduction, but many parts of mathematics are interesting here. Actually, he considers as standard in the history of Science that the birth of new disciplines (as Biophysics) has also created both boundaries and synergies in the basic sciences. This has pushed the latter to evolve in order to tackle the new challenges. For example, many developments in modern mathematics where forced by the new Physics formulated in the first half of the 20th century.

**It is the user's responsibility to know the limitations of the physical or mathematical models which provide the basis for computed results**

Biology has also had a role in the development of new mathematics. Many readers will be familiar with the concepts of neural networks and genetic (or, more generally, evolutionary) algorithms, just to name a couple. They have a clear biological inspiration and in the end they appear as computer algorithms which allow users from many different fields to benefit from them. However, in the middle they possess a clear mathematical formalism. Unfortunately, he says, many users do not seem to be aware of it, or even care about it. Modern science puts us all in such a rush... The availability of commercial (even free) computer packages, or web servers, for many bioinformatics developments, is able to bring useful tools to a large range of researchers, hiding the difficult mathematics under user-friendly graphical interfaces. Nevertheless, this may become *dangerous* if the users do not pay attention to the details of the method they are using. Although there are present-day programs that seem to be able to do *everything*, it is the user's responsibility to know the details of the algorithms behind, especially the limitations of the physical or mathematical models which in the end provide the basis for the computed results. This goes from apparently simple calculations, as a t-Student statistical test, to more complex cases. He mentions the flux balance analysis as a technique from his own work on metabolic networks which is today widely available, but whose results are taken in some occasions well beyond their possibilities of application. Furthermore, one can find in published scientific papers mistakes which clearly denote a lack of knowledge from careless users of the algorithms. As it used to be said some time ago, you enter the "garbage in, garbage out" risk. The computer program will provide some result in most of the cases, but if the input is wrong (or even worse, if the chosen methodology is not adequate), the results will be completely useless, and the user will not even know about it.

This brings the conversation to something that is very important to both of us. Since we work at a public university, the education of science students and the training of young scientific researchers

are among our top priorities. Paco mentions that at his classes, mainly for Biochemistry undergraduate or Master's students, he tries to emphasize as much as possible how important the mathematical background is for the use of bioinformatics algorithms, but also in order to understand modern experimental biophysical techniques. However, he feels that his students are reluctant to this kind of learning (and I can say from my own experience that the very same happens with most of my Chemistry students). In the case of computer software, they seldom go beyond the default options of the graphical user interface. And the worst thing is, Paco says, that at the end they pretend they can properly understand the results they have got, when this is very far from the reality.

> **This knowledge is important for any student, and especially crucial for those that are entering scientific research**

As an example, he considers inconceivable the possibility that one can understand an X-ray diffraction pattern without knowing what a Fourier transform is. The same can be said from many modern biophysical techniques, as NMR or FTIR. At least the researcher in charge of the experimental technique has to know to a reasonable degree the physics and the mathematics that link the initial collection of raw data from the measured sample to the final (hopefully) useful information. Even so, the standard users must at least have a basic knowledge of the *mathematics behind* the technique (either experimental or algorithmic) if he/she has to choose which one is to be employed in order to formulate the right question. Thus, this knowledge is important for any student, and especially crucial for those that are entering scientific research. It is interesting to note (sadly, perhaps) that in the last years it seems more complicated to convince an average biochemistry or chemistry student (not to mention someone from medical disciplines) of the advantages of having this mathematical background than it is to bring the attention of an average physics or mathematics student to the beautiful complexity of biological systems. In both cases, although this may force both sides to "switch languages" to a certain extent, the required effort would clearly pay off.

Paco mentions that Biochemistry and Biophysics have had a huge development from the middle of 20th century until today. The different experimental techniques provide vast amounts of data (just as an example he mentions genome analysis, including metagenomics). In order to make it useful, it has to be adequately framed. That is the work of informatics. Although many people may take it for granted these days, informatics does not just appear from nothing, it is a certain way of using mathematics. Of course, not everybody working in computation has to be a mathematician; we have already mentioned this. But he/she has to be a user of mathematics. Moreover, he/she has to show a certain ability for abstraction, as a way of mathematical thinking, which helps to put problems in the right perspective and, again, to pose the proper questions. Unfortunately, Paco feels that this may be becoming lost among the most common *bench scientists*. He proposes, as an example, explaining his students what a loop structure is in a simple algorithm. Something incredibly useful as a way of correctly structuring the mathematical operations of many calculations, becomes difficult to grasp without a specific way of thinking which he is missing in our current young students. At a different level, from my own experience, I have the same degree of frustration when teaching Quantum Chemistry to explain the atomic/molecular behavior of chemical/biological systems, and the same

could be said of Statistical Thermodynamics. In many occasions, you cannot use examples from the macroscopic world, since the laws that rule the behavior of the classic systems are different from those at the quantum scale. Mathematics takes the lead then, and the equations, and a proper way of looking at them, is what allows the systems to be understood.

Paco criticizes part of the design of the contents taught in modern university degrees related to Biophysics, at least in our university. He feels they do not leave room enough for basic mathematics, but on the other hand they are redundant in other topics, which are repeated in different years. Professors are encouraged to teach the latest scientific developments even in the early years, and that may become a mistake if it comes at the cost of suppressing basic, well-established and useful disciplines, as mathematics. Novelties may become relevant or fade off after just a few months or years. In any case, they have to be understood to be properly explored, and we may not be giving the students the proper tools for that. Mathematics is one of those important tools. A set of topics that provides a solid background for science, including of course Biophysics.

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Biofísica Magazine



# Viroporins: A new target for fighting viral infections

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Over the last years an increasing number of viruses have jumped into the mass media and several names or acronyms (*Ebola*, *zika*, *SARS*, *MERS*,...) have become familiar to the general public because of the high mortality rates associated with their infection in humans. The threat they pose to human life has to do mainly with the risk of infection spreading from the initial outbreak location to other countries and population sectors. Along with these pathogens, there are other viruses that remain a serious health problem, despite considerable therapeutic advances: The human immunodeficiency virus (HIV), responsible for the immunodeficiency syndrome (AIDS); the Hepatitis C virus (HCV), causing hepatitis C and some cancers; the influenza A virus (IAV); the Human respiratory syncytial virus (HRSV) a major cause of lower respiratory tract infections during infancy and childhood. This list is far from complete.

## Viroporins

With the exception of the first two viruses just mentioned, all these pathogens share a common feature: They encode at least one protein with the characteristic ability to form ion channels or pores in some of the host cell membranes [Ewart et al. 1996, Henkel et al. 2010, Pavlovic et al. 2003, Pinto et al. 1992, Wilson et al. 2004, Surya et al. 2015, Lu et al. 2006, Gan et al. 2008], the preferred localization being the endoplasmic reticulum (ER), the Golgi apparatus and the plasma membrane. These proteins were coined as viroporins because of their similarity to the ion channels commonly known as porins. In fact, the vast majority of viroporins are simple, poorly specific hydrophilic pores, often lacking any voltage-dependence or gating mechanism. The existence of viroporins was proposed nearly forty years ago after the observation of enhanced membrane permeability in virus-infected cells [Nieva et al. 2012, Carrasco, 1978]. Although they are usually small hydrophobic proteins (less than 100 amino acids) they exhibit marked differences in their tertiary structure, known at atomic resolution only in a few cases. They have at least one amphipathic helix that constitutes its transmembrane domain (TM). In fact, they have been classified according to the number of TMs and their topology (**Figure 1**). Viroporin self-assembly and oligomerization, commonly tetrameric, pentameric, hexameric or even heptameric, is a requisite for ion channel formation. From the initial identification of the first

viroporins, *electrophysiology* has been a valuable tool for virologists in their attempts to unravel the significance and biological role of the ion channel activity in the viral life cycle. The viroporin field is relatively new and opens a wealth of interesting questions to ion channel biophysicist too. Here is a brief summary of the accumulated evidence of the relevance of viroporin ion channel (IC) activity and some of the key observations following electrophysiological studies of a few viroporins in model membranes.

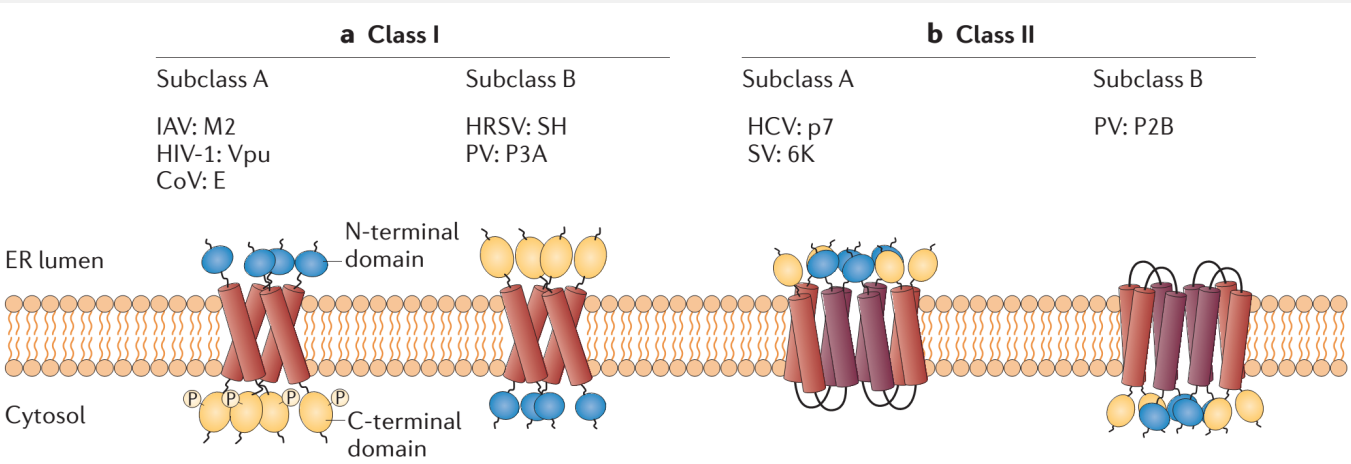


**Figure 1. Classification of viroporins according to the number of TMs and the membrane topology of the constituent monomers.** Clasees are named I or II for single or double membrane-spanning domains, respectively. Recent evidence of a viroporin with 3 TMs (protein 3a from SARS-CoV) would update this scheme to account for a new third Class. *Reprinted by permission* from Macmillan Publishers Ltd: Nieva, Madan & Carrasco. *Nat Rev Microbiol* 2012, 10: 563, copyright 2012.

## Relevance of viroporin ion channel activity

The cell homeostasis involves a tightly regulated balance of the concentration of the main monovalent ($K^+$, $Na^+$ and $Cl^-$) and divalent (mainly $Ca^{2+}$) ions and protons in the subcellular compartments and the extracellular media. Therefore, any viroporin-induced change of the asymmetric distribution of ions between different cell organelles may be crucial. Viroporins may modify the electrochemical gradients that are essential for proper cell functioning [Dubyak, 2004]. Of particular importance for cell function is keeping the Ca2+ concentration at its optimum level in each compartment. Given that there are differences of two to three orders of magnitude in $Ca^{2+}$ concentration between the ER and the cytosol, it is expected that some viroporins like SARS-CoV-E [Nieto-Torres, 2015a] and the Rotavirus NSP4 [Pham et al. 2017], which are $Ca^{2+}$ conducting channels, may disrupt the cellular $Ca^{2+}$ homeostasis. The loss of ion homeostasis may lead to stress responses and even to apoptosis [Nieva et al. 2012, Madan et al 2008, Bhowmick et al. 2012]. In some cases the cell response involves the activation of a macromolecular complex called the inflammasome, key in the stimulation of innate immunity [Nieto-Torres et al. 2014].

Virologists have reported various effects of viroporin IC activity, not only from *in vitro* assays but also from several *in vivo* experiments with mice. Firstly, viroporins stimulate key aspects of the viral cycle such as entry, assembly, trafficking and release of viral particles. In general, viroporin defective viruses exhibit much lower viral yields. They also favor virus propagation, as has been shown after pharmacological inhibition of the viroporin ion conductance in the IAV M2 protein. In addition, viroporins are also involved in pathogenesis. (**Figure 2**) shows several pathways stimulated by viroporin IC activity leading to pathology. In fact, some viroporin-deleted viruses have been used as potential vaccine candidates [Nieto-Torres, 2015a]. A recent study that combined *in vitro* and *in vivo* experiments proved that animals infected with the SARS-CoV lacking E protein IC activity showed a reduced mortality in comparison with those inoculated with the parental virus [Nieto-Torres et al. 2014].

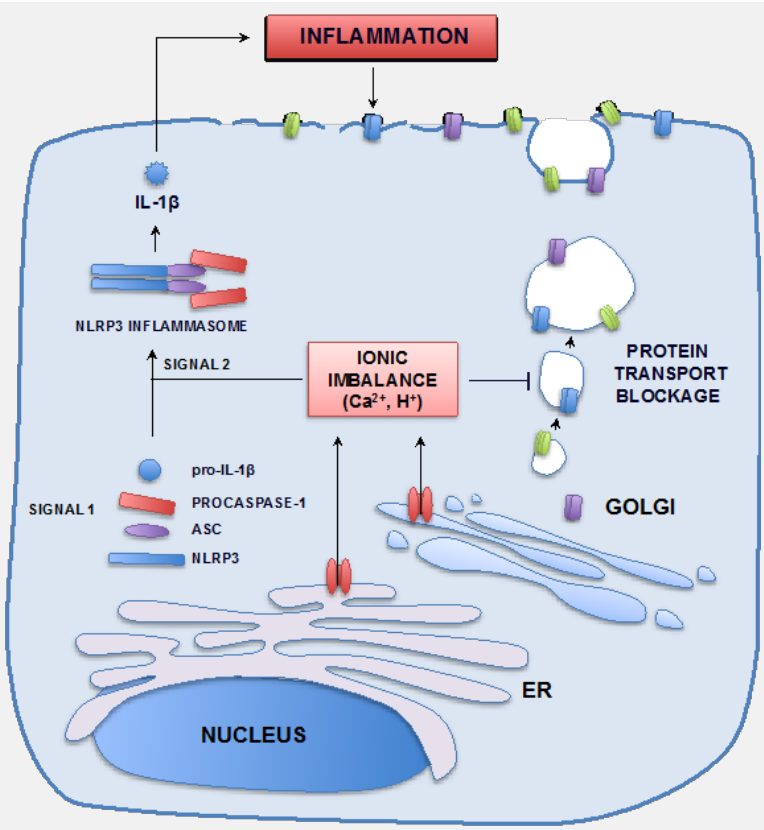


**Figure 2. Pathways stimulated by viroporin ion channel activity leading to pathology.** Molecular patterns associated with viral infections are recognized by cellular sensors (signal 1), which activate the transcription and translation of the NLRP3 inflammasome components (NLRP3, ASC and procaspase-1) and the inactive pro-IL-1β. Viroporins inserted in the intracellular organelles, such as the ER or the Golgi apparatus, favor the leakage of $Ca^{2+}$ and $H^+$ ions that move following their electrochemical gradient into the cell cytoplasm. This ionic imbalance (signal 2) induces the assembly of the inflammasome complex, which triggers the maturation of pro-IL-1β into IL-1β through the action of caspase-1. Secreted IL-1β mediates a potent pro-inflammatory response that can be deleterious for the cell and the organism, when overstimulated. In addition, alteration of ionic milieus in intracellular compartments comes along with a protein transport delay or blockage. This results in a decrease of the levels of MHC-I molecules (blue rectangles) at the plasma membrane, preventing the infected cell to be recognized by the immune system. Protein transport blockage also diminishes the levels and activity in the cell surface of ion channels and transporters, crucial in the resolution of edema accumulation. *Reprinted under* CC-BY license from Nieto-Torres, *et al*. *Viruses* 2015, 7: 2786.

In view of the relevance of viroporin IC activity in viral production, propagation and pathogenesis, these protein channels represent a promising target for combined therapeutic interventions [Hyser 2015, Scott & Griffin 2015]. This has motivated the search for inhibitors of the IC activity. A number of compounds that interfere with viroporins IC activity have been reported and assayed in model membranes and sometimes in cell cultures, but just a few are adequate for pharmacological use. Amantadine was the first inhibitor approved for humans, and it has been used for around 20 years in the treatment of IAV infections [Oxford 2007] since it binds to the M2 protein, blocking ion conductance.

## Studying viroporins at the single-channel level: lessons we learn

Electrophysiological techniques are a valuable tool to investigate the IC properties of viroporins, using their different variants: Planar lipid bilayer, liposome patch-clamp, whole-cell patch clamp, and liposome swelling assays. All of them provide useful information about the size of the solutes able to permeate across viroporins, the influence of the membrane composition on IC formation, the external conditions (pH, ionic concentrations) that modulate the IC conductance and selective properties, etc.

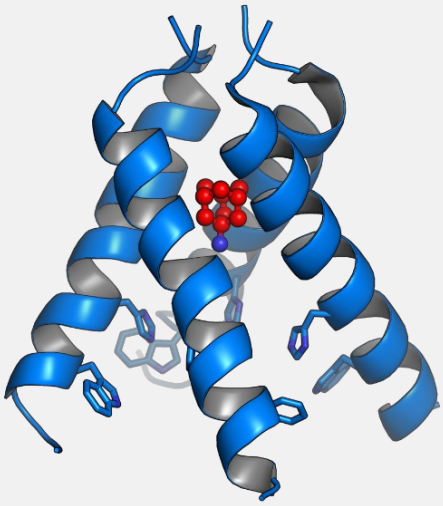

**Figure 3. The crystal structure of the transmembrane proton channel domain of the influenza A M2 protein.** The model shows tetrameric arrangement of helices with a channel-blocking drug, amantadine, located in the center (red). Rendered from PDB ID 3C9J, published in Thomaston et al. 2015. By Opabinia regalis – *own work*, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=51193047.

The lack of knowledge about the tertiary structure of most viroporins at atomic resolution makes electrophysiological measurements even more necessary, particularly if one wants to pinpoint the amino acid residues that are essential for viroporin assembly, oligomerization and IC activity. The analysis and manipulation of viroporin IC properties at the molecular level represents a new challenge for the collaboration between virologists and biophysicists, to benefit from synergies between their respective expertise. Note that, in general, electrophysiology equipment and skills are not a typical part of the virology lab. Over the recent years a lot of useful information has been gathered, but there is still much more to learn in the future.

Given the difficulty of using the purified full protein, evidence of identical results (conductance, selectivity, oligomerization state) in terms of IC activity using the viroporin and a peptide with the protein TM domain amino acid sequence is extremely important [Verdiá-Báguena et al. 2012, 2013]. Also, at a general level, it has been reported that channel properties examined in giant unilamellar vesicles and planar lipid bilayers are fully consistent with each other [Largo et al. 2016].

As viroporins localize in different membranes that vary in lipid composition, it is essential to test the influence of the membrane lipid composition on IC properties. Experiments with lipids that induce membrane negative curvature (like phosphatidylethanolamine, PE) yield lower probability of SARS-CoV E channel formation [Verdiá-Báguena et al. 2012]. In addition, whenever a negatively charged lipid takes part in membrane composition, single-channel conductance and ion selectivity depart substantially from the values measured in neutral lipid membranes (**Figure 4**). Both facts are consistent with SARS-CoV E viroporin being a protein-lipid pore, i.e. a dynamic structure in which assembled TM helices are combined with lipid molecules to form a hydrophilic pore. This trait is probably characteristic of many more viroporins.

Apart from the IAV M2 protein, which is highly selective for protons, most other viroporins usually show mild ion selectivity, meaning that in general these channels do not display preference for a particular ion. Still, this general statement is a source of misconceptions because channel selectivity is often strongly dependent on a number of factors alien to the channel itself, like ion concentrations, pH, the host membrane composition, etc. **Figure 5A** illustrates this fact with reversal potential measurements performed with the SARS-CoV E channel. This is the potential difference needed to get zero electric current when there is an ionic concentration gradient across the channel, and is the usual measure of channel ion selectivity.

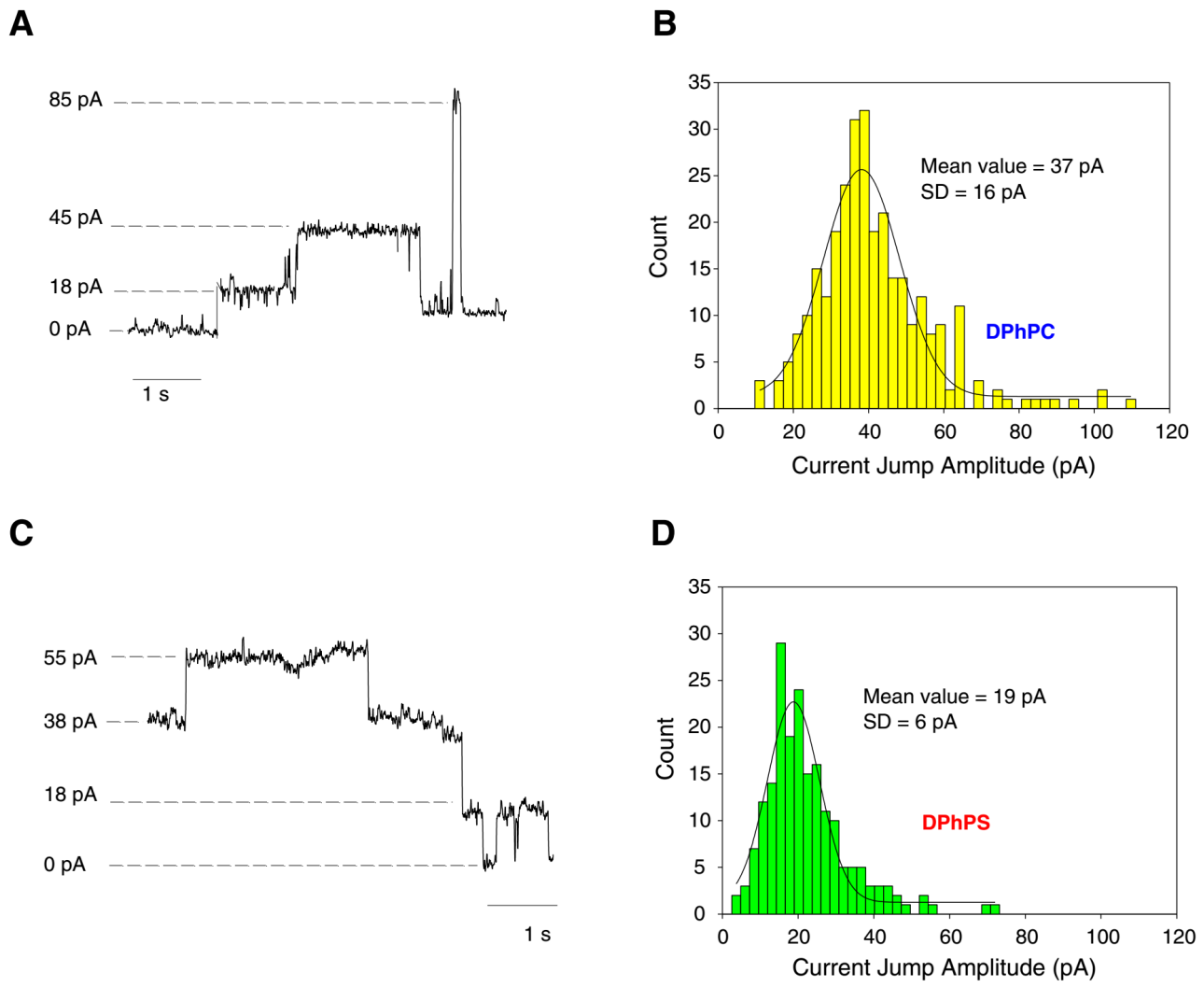


**Figure 4. SARS-CoV E channel current recordings and histograms of the current jump amplitude in 1 M KCl at pH 6.** **A** and **B**: Traces and histogram of channels formed in neutral DPhPC membranes. **C** and **D**: Traces and histogram of channels formed in negatively charged DPhPS membranes. As the corresponding histograms show, the current jump levels in DPhPS membranes are better defined than in DPhPC, where a larger variety of current jump amplitudes are recorded. *Reprinted from* Verdiá-Báguena, *et al*. *BBA-Biomembranes* 2013, 1828: 2026. copyright 2013, with permission from Elsevier.

The most obvious message of these plots is the strong change of the viroporin selectivity with the environment acidity: If the viroporin is inserted in a negatively charged membrane, the channel goes from ideal cation selective, at neutral pH, up to moderate anion selective at very low pH. The charged lipid content of the membrane is a key determinant of the channel selectivity at neutral pH (compare

the red and green symbols in **Figure 5A**). In addition, trace amounts of divalent cations (orange symbols) also induce large changes in channel selectivity.

Viroporins might look at first sight rather simple, passive diffusion, hydrophilic pores, almost unable to discriminate between small ions. However, even a single mutation in one amino acid is enough to abolish IC activity [Nieto-Torres et al. 2014]. As soon as the atomic structure of more viroporins is resolved, a more efficient search for inhibitors will be possible.

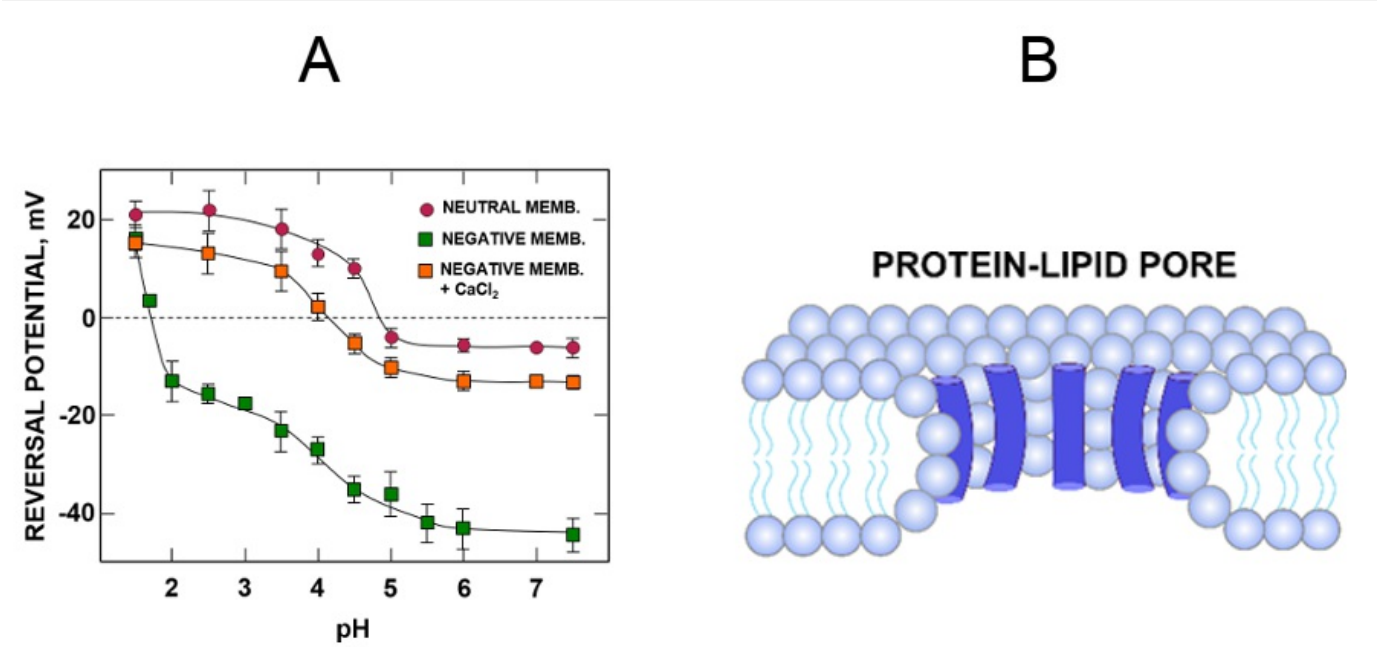


**Figure 5. pH modulation of SARS-CoV E protein channel selectivity in neutral and charged lipid membranes in monovalent ions (KCl) and divalent salt (CaCl2) solutions.** (**A**) The reversal potential was measured in asymmetric (500/50 mM) KCl solutions in neutral DPhPC (red circles) and negatively charged DPhPS membranes (green squares). In a third series of measurements with DPhPS membranes, 15 mM $CaCl_2$ were added on both KCl solutions (orange squares). In KCl solutions, the channel behaves as an almost perfect cation selective pore at neutral pH in charged membranes, whereas in neutral membranes it barely selects cations over anions. A small amount of $CaCl_2$ reduces the cationic selectivity. In addition, the change of reversal potential upon acidification of the solution reflects two consecutive titrations (at pH ~4 and pH ~1.5) in charged membranes and KCl solutions (green squares), in contrast with a single titration in the other two series. (**B**) The cartoon outlines a protein-lipid pore where lipid head groups (cyan) are oriented towards the pore, modulating ion conductance and selectivity. Panel **A** *Reprinted from* Nieto-Torres et al. *Virology* 2015, 485: 330. copyright 2015, with permission from Elsevier. Panel **B** *Reprinted under* CC-BY license from Nieto-Torres et al. *Viruses* 2015, 7: 2786.

## Conclusions and future prospects

Unlike many other channels with key neurophysiological functions, the viroporin research field is still in its infancy. So far, there is solid evidence that they are key contributors to virus propagation and stimulators of pathogenesis, but the specific mechanisms linking IC activity with the virus life cycle need to be disclosed in most viroporins. Understanding the molecular and physicochemical structure of these protein channels is a first step towards the rational design of specific IC activity inhibitors and strategies to fight viral infection. The interaction between the viroporin TM domain and the membrane in terms of the lipid charge and lamellar or non-lamellar phase is not completely understood yet. In any case, viroporins emerge as excellent candidates for development of novel antiviral therapies.

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## References

Bhowmick R, Halder UC, Chattopadhyay S, Chanda S, Nandi S, Bagchi P, Nayak MK, Chakrabarti O, Kobayashi N, Chawla-Sarkar M. "Rotaviral enterotoxin nonstructural protein 4 targets mitochondria for activation of apoptosis during infection". *J Biol Chem* **2012**, 287: 35004. DOI:10.1074/jbc.M112.369595.

Carrasco L. "Membrane leakiness after viral infection and a new approach to the development of antiviral agents". *Nature* **1978**, 272: 694. DOI:10.1038/272694a0.

Dubyak GR. "Ion homeostasis, channels, and transporters: An update on cellular mechanisms"*Adv Physiol Educ* **2004**, 28: 143. DOI: 10.1152/advan.00046.2004.

Ewart GD, Sutherland T, Gage PW, Cox GB "The Vpu protein of human immunodeficiency virus type 1 forms cation-selective ion channels". *J Virol* **1996**, 70: 7108. PMCID: PMC190763.

Gan SW, Ng L, Lin X, Gong X, Torres J "Structure and ion channel activity of the human respiratory syncytial virus (hRSV) small hydrophobic protein transmembrane domain". *Protein Sci* **2008**, 17: 813. DOI: 10.1110/ps.073366208.

Henkel M, Mitzner D, Henklein P, Meyer-Almes FJ, Moroni A, Difrancesco ML, Henkes LM, Kreim M, Kast SM, Schubert U, Thiel G. "The proapoptotic influenza A virus protein PB1-F2 forms a nonselective ion channel"*PLoS One* **2010**, 5: e11112. DOI:10.1371/journal.pone.0011112.

Hyser JM. "Viroporins", in *Electrophysiology of Unconventional Channels and Pores*(Delcour AH, *Ed.*), 153–181, Springer, Switzerland, **2015**.

Largo E, Verdiá-Báguena C, Aguilella VM, Nieva JL, Alcaraz A "Ion channel activity of the CFSV p7 viroporin in surrogates of the ER lipid bilayer". *BBA Biomembranes* **2016**, 1858: 30. DOI: 10.1016/j.bbamem.2015.10.007.

Lu W, Zheng BJ, Xu K, Schwarz W, Du L, Wong CK, Chen J, Duan S, Deubel V, Sun B"Severe acute respiratory syndrome-associated coronavirus 3a protein forms an ion channel and modulates virus release". *Proc Natl Acad Sci USA* **2006**, 103: 12540. DOI:10.1073/pnas.0605402103.

Madan V, Castello A, Carrasco L "Viroporins from RNA viruses induce caspase-dependent apoptosis".*Cell Microbiol* **2008**, 10: 437. DOI:10.1111/j.1462-5822.2007.01057.x.

Nieto-Torres JL, Dediego ML, Verdiá-Báguena C, Jimenez-Guardeño JM, Regla-Nava JA, Fernandez-Delgado R, Castaño-Rodriguez C, Alcaraz A, Torres J, Aguilella VM, Enjuanes L. "Severe acute respiratory syndrome coronavirus envelope protein ion channel activity promotes virus fitness and pathogenesis". *PLoS Pathog* **2014**, 10:

e1004077. DOI: 10.1371/journal.ppat.1004077.

Nieto-Torres JL, Verdiá-Báguena C, Castaño-Rodriguez C, Aguilella VM. Enjuanes L. "Relevance of viroporin ion channel activity on viral replication and pathogenesis". *Viruses* **2015a**, 7: 3552. DOI: 10.3390/v7072786.

Nieto-Torres JL, Verdia-Baguena C, Jimenez-Guardeno JM, Regla-Nava JA, Castano-Rodriguez C, Fernandez-Delgado R, Torres J, Aguilella VM, Enjuanes L. "Severe acute respiratory syndrome coronavirus E protein transports calcium ions and activates the NLRP3 inflammasome". *Virology* **2015b**, 485: 330. DOI: 10.1016/j.virol.2015.08.010.

Nieva JL, Madan V, Carrasco L. "Viroporins: Structure and biological functions". *Nat Rev Microbiol* **2012**, 10: 563. DOI: 10.1038/nrmicro2820.

Oxford JS. "Antivirals for the treatment and prevention of epidemic and pandemic influenza". *Influenza Other Respir Viruses* **2007**, 1: 27. DOI: 10.1111/j.1750-2659.2006.00006.x.

Pavlovic D, Neville DC, Argaud O, Blumberg B, Dwek RA, Fischer WB, Zitzmann N. "The hepatitis C virus p7 protein forms an ion channel that is inhibited by long-alkyl-chain iminosugar derivatives". *Proc Natl Acad Sci USA* **2003**, 100: 6104. DOI: 10.1073/pnas.1031527100.

Pham T, Perry JL, Dosey TL, Delcour AH, Hyser JM. "The Rotavirus NSP4 Viroporin Domain is a Calcium-conducting Ion Channel". *Sci Rep* **2017**, 7: 43487. DOI: 10.1038/srep43487.

Pinto LH, Holsinger LJ, Lamb RA. "Influenza virus M2 protein has ion channel activity". *Cell* **1992**, 69: 517. DOI: 10.1016/0092-8674(92)90452-I.

Scott C, Griffin S. "Viroporins: structure, function and potential as antiviral targets". *J Gen Virol.* **2015**, 96: 2000. DOI: 10.1099/vir.0.000201.

Surya W, Li Y, Verdia-Baguena C, Aguilella V.M, Torres J. "MERS coronavirus envelope protein has a single transmembrane domain that forms pentameric ion channels". *Virus Res* **2015**, 201: 61. DOI: 10.1016/j.virusres.2015.02.023.

Thomaston JL, Alfonso-Prieto M, Woldeyes RA, Fraser JS, Klein ML, Fiorin G, DeGrado WF. "High-resolution structures of the M2 channel from influenza A virus reveal dynamic pathways for proton stabilization and transduction". *Proc Natl Acad Sci USA* **2015**, 112: 14260. DOI: 10.1073/pnas.1518493112.

Verdiá-Báguena C, Nieto-Torres JL, Alcaraz A, Dediego ML, Torres J, Aguilella VM, Enjuanes L. "Coronavirus E protein forms ion channels with functionally and structurally-involved membrane lipids". *Virology* **2012**, 432: 485. DOI: 10.1016/j.virol.2012.07.005.

Verdiá-Báguena C, Nieto-Torres JL, Alcaraz A, Dediego ML, Enjuanes L, Aguilella VM. "Analysis of SARS-CoV E protein ion channel activity by tuning the protein and lipid charge". *Biochim Biophys Acta* **2013**, 1828: 2026. DOI: 10.1016/j.bbamem.2013.05.008.

Wilson L, McKinlay C, Gage P. "SARS coronavirus E protein forms cation-selective ion channels". *Virology* **2004**, 330: 322. DOI: 10.1016/j.virol.2004.09.033.

Biofísica Magazine

CONFERENCE REPORTS / EVENTS / NEWS

# REPORT – On the XVI International Congress of the Spanish Biophysical Society (Seville 6-8 June 2017)

Irene Díaz-Moreno, *cicCartuja, Sevilla (Spain); chair of the 16th SBE Congress.*

The XVI International Congress of the Spanish Biophysical Society – SBE took place at the Scientific Research Centre Isla de la Cartuja (cicCartuja) in Seville, on the 6th-8th of June 2017.

Three years after the foundation of the Spanish Biophysical Society – SBE in 1986, the II Congress of the Society was celebrated in Seville, with Prof. José López-Barneo as President. At that time, two main motivations led Prof. López-Barneo to organize the meeting: i) The need to foster quantitative research at the molecular and cellular level in our country, by organizing conferences in the field of biophysics and ii) the aim to establish ties between Spain, Portugal and South America. Therefore, the II Congress of the Spanish Biophysical Society was renamed I Ibero-American Biophysics Congress.

Almost 30 years later, the Organizing and Scientific Committees of the XVI SBE Congress still share both motivations. The diversity of topics tackled by the Society members and, specifically, the XVI SBE Congress participants, reveal how interdisciplinary is Biophysics, with a specially high impact in Medicine and Biotechnology. Indeed, it is difficult to fully understand any molecular or cellular mechanism without quantifying it. To strengthen ties with South America through contacts with

LaFEBS, we invited Prof. Amodeo as a Plenary Speaker. Likewise, the partnership with the Portuguese Biophysical Society in the Symposium on Cellular Biophysics as part of this Congress expressed the nexus with Portugal. In summary, the XVI edition of the SBE Congress has brought together 210 participants and 94 talks. Among these participants, 35 young researchers were awarded fellowships supported by SBE (31 fellows) or the International Society of Magnetic Resonance (4 fellows).

The scientific program comprised six Plenary Lectures that were given by excellent speakers. Having the opportunity to listen to Profs. José López-Barneo, Alan Fersht, Anthony Watts, Gabriela Amodeo, Jesús Seoane and Yifan Cheng was, without any doubt, a great pleasure. We also celebrated eight Parallel Symposia focused on the most challenging topics in Biophysics. Two of these Symposia were supported by the Spanish Channel Network and Chemistry and Physics of Lipids / Elsevier; a third symposium was jointly organized by the Spanish and the Portuguese Biophysical Societies. Symposia included guest lectures by well-recognized scientists as well as short communications, which were selected from the submitted abstracts. In this regard, we made an effort to give preference to young researchers from all institutes and universities of our country.

The result was a fascinating and impressive scientific program, which although busy, left ample time for lively discussions during coffee breaks and lunches, as well as a cocktail after the Opening session and a Congress dinner after the Closing session. The program included the Poster Party session on Wednesday (June 7) afternoon, where young scientists had the opportunity to present and discuss their recent scientific achievements. This Congress edition awarded a prize to the two best posters, sponsored by SBE and, as a novelty, by FEBS Letters. Regarding **SBE awards** (named Manuel Rico, Enrique Pérez-Payá and SBE-33 awards) our society recognized the scientific trajectory of six outstanding researchers in our field, whose talks were scheduled on Thursday (June 8) before closing the Congress. Altogether we hope the 16th SBE Congress met all your expectations.

A singularity of the XVI Congress of SBE was the outreach activity Biophysics in the City, which aimed to bring Biophysics closer to Society. The activity, named Molecular Cooking, took place on Thursday morning (June 8th) at the Rectorate of the University of Seville and dealt with the physical-chemical techniques used in molecular and avant-garde cuisine.
Another singularity was the inclusion of a search tool in the website of the congress which allowed access to abstracts by


Attendees to *Molecular Cooking*, within the outreach activity *Biophysics in the City*.

keywords. In addition, a survey to know feedbacks from participants was also included in the web account of each participant, from where it was possible to download a certificate to the Congress. Thanks to the effort of Editors of **Bio*física***, a Special Issue with all abstracts presented during the XVI SBE Congress was published.

As Chair of the XVI Congress of SBE, I would like to end by thanking all participants attending the Congress of our Society. In particular, thanks to the invited speakers as their acceptances allowed us to curate an excellent list of lecturers, thus making the Congress highly attractive, as the high participation – 210 delegates – corroborated. I really appreciate the invaluable advice in the organization of this Congress from Prof. Miguel A. De la Rosa, Rafael Fernández-Chacón, Pedro M. Nieto, Antonio Díaz-Quintana and all members of the Biointeractomics Group who spent a lot of time in preparing this event and were willing to help you during the days at cicCartuja. In addition, I would like to thank Viajes El Corte Inglés PCO and the EffiSciences company, for their support with logistics and designing the website of the Congress. Last, but not least, I could not forget to mention SBE and the University of Seville for their funding, as well as our Sponsors and Exhibitors in this Congress edition: AntalGenics, Avanti, BCNPeptides, Bruker, Elsevier, FEBS Letters, Hamamatsu, Iesmat, Ismar, Malvern, Primaderm, TA Instruments, Labclinics, Lasing, MTB, Nanion, NanoTemper, Pall-FortéBio, Paralab and Wyatt.

About the II Spanish Biophysical Congress held in Seville in 1989, José López-Barneo said:

> *Among the activities or events that I have organized, this is one of the most satisfying, despite the fact that it required a lot of work. It has been more than 25 years since then and I still hear Spanish, and foreign colleagues, remembering in an endearing way what it meant for them.*

From our side, organizing the XVI Spanish Biophysical Congress in 2017 has been also an unforgettable experience and, without any doubt, one of the events that has enriched our professional lifes. Beyond the scientific and social commitment of the Organizing Committee, we really expect that this Congress had stimulated the research vocation of young participants in the well-established and interdisciplinary field of Biophysics. In parallel with the Congress in 1989, we wish that all participants have nice memories of these days at cicCartuja and at Seville, if possible, at least for the next 25 years!.

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Biofísica Magazine

AWARDS / NOMINATIONS / SBE PRIZES

# SBE Prizes 2018 – Call for Nominations




## The 2018 call for nominations to SBE Prizes is now open

The SBE offers yearly special awards to recognize excellence in the field of Biophysics. These prizes are given in the following three categories:

### XV 'MANUEL RICO' – BRUKER PRIZE

**DEADLINE FEBRUARY 28TH 2018.**

> *Recognizes an outstanding Biophysics career, performed in Spain mainly during the last 10 years.*

#### Sponsored by

Bruker Española S.A..

#### Addressed to

Biophysicists working on Structure/Function of molecules who develope their main activity in Spain. **Preference** is given to members of the SBE .

#### Award

3000 € and a talk delivered by the awardee during a special session of the 6th Iberian / 10th Iberoamerican Biophysics Congress – 2018 IIBC (Castellón, June 20 – 22, 2018).

### How to apply

E-mail a letter to José Miguel Mancheño, addressed to the President of the SBE (Dr. Antonio Ferrer Montiel), attaching a *Curriculum vitae* and a summary of your most relevant scientific achievements.

### More information

See *here* the Complete Bases and instructions to apply.

### Past winners of this prize

2017: Alicia Alonso (Bilbao) and María García-Parajo (Barcelona)
2016: F. Xavier Gomis-Rüth (Barcelona)
2015: Juan A. Hermoso (Madrid)
2014: Óscar Llorca (Madrid)
2013: José Manuel Sánchez Ruiz (Granada) and Félix Ritort (Barcelona)
2012: Antonio V. Ferrer Montiel (Elche-Alicante) and Marta Bruix (Madrid)
2011: Ignacio Fita (Barcelona)
2010: Modesto Orozco (Barcelona) and José Luis Rodríguez Arrondo (Bilbao)
2008: José García de la Torre (Murcia)
2006: Jesús Pérez Gil (Madrid)
2004: Javier Sancho (Zaragoza)
2002: José María Valpuesta (Madrid)
2000: Miquel Pons (Barcelona)
1998: Rafael Picorel (Zaragoza)

## 'E. PÉREZ PAYA' – SBE 40 PRIZE

**DEADLINE FEBRUARY 28TH 2018.**

> *Recognizes the trajectory of a Biophysicist with age under 40 with a special contribution to the progress of Biophysics in Spain.*

### Sponsored by

BCN Peptides and Prima – Derm.

### Addressed to

Biophysicists under 40 who develope their main activity in Spain. **Preference** is given to members of the SBE and to achievements from the last 10 years.

## Award

1500 € and a talk delivered by the awardee during a special session of the 6th Iberian / 10th Iberoamerican Biophysics Congress – 2018 IIBC (Castellón, June 20 – 22, 2018).

## How to apply

E-mail a letter to José Miguel Mancheño, addressed to the President of the SBE (Dr. Antonio Ferrer Montiel), attaching a *Curriculum vitae* and a summary of your most relevant scientific achievements.

## More information

See *here* the Complete Bases and instructions to apply.

## Past winners of this prize

2017: Emilio J. Cocinero (Leioa-Bizkaia) and Carlo Manzo (Vic-Barcelona)
2016: Raúl Pérez-Jiménez (San Sebastian)
2015: Irene Diaz Moreno (Sevilla)
2014: Fernando Moreno (Madrid)

Sponsored by SBE and Werfen-Izasa-Beckman-Coulter:
2013: Xavier Salvatella (Barcelona)
2012: José Manuel Gómez Vilar (Lejona-Vizcaya)
2011: Teresa Giráldez (La Laguna)
2010: Pau Bernardó (Barcelona)

# ANTALGENICS – SBE 33 PRIZE

**DEADLINE FEBRUARY 28TH 2018.**

> *Recognizes a young Biophysicist with age under 33, who have contributed significantly to the developmen of Biophysics, in Spain and/or abroad.*

## Sponsored by

AntalGenics.

## Addressed to

Outstanding young Biophysicists under 33, independently of the country where their work has been done. **Preference** is given to members of the SBE.

## Award

1000 € and a talk delivered by the awardee during a special session of the 6th Iberian / 10th

Iberoamerican Biophysics Congress – 2018 IIBC (Castellón, June 20 – 22, 2018).

## How to apply

E-mail a letter to José Miguel Mancheño, addressed to the President of the SBE (Dr. Antonio Ferrer Montiel), attaching a *Curriculum vitae* and a summary of your most relevant scientific achievements.

## More information

See *here* the Complete Bases and instructions to apply.

## Past winners of this prize

2017: María Queralt-Martín (Bethesda) and Álvaro Inglés (Klosterneuburg)
2016: Lorena Redondo-Morata (Marseille)
2016: Lorena Redondo-Morata (Marseille)
2015: Cecilia Artola (Madrid)
2014: Jorge Alegre Cebollada (Madrid)
2013: Anna Shnyrova (Bilbao)
2012: Sergi García Manyes (London)

Biofísica Magazine

SBE PRIZES

# Imagin'Action image contest 2018


## SBE announces the third "IMAGIN'ACTION" image contest!

> *Launched on January 8th 2018 on the SBE social media and websites.*

## Deadline and how to participate

Submit your images in electronic format by e-mail to community.manager@sbe.es before February 19th, 2018.

## Extract of *Rules*

### Download *here* the complete official rules

- Submissions are limited to max 3 images per contestant.
- Images may be obtained by any method, but must have a direct connection to biophysics.
- All images submitted must include a title and a short description (max. 50 words).
- The winner will be chosen among pre-selected images (max. 10) as a result of the following

**NOTE that the winner will be chosen 50% from public vote. Stay tunned with SBE social media: / !**

procedure: **a)** 50% out of Popular vote in SBE social media: / (between February 22nd and March7th, 2018. **b)** 50% out of punctuation given by a panel of judges.

- The prize, sponsored by Hamamatsu Spain, will consist on a free inscription to the 6th Iberian / 10th Iberoamerican Biophysics Congress – 2018 IIBC (Castellón, June 20 – 22, 2018) plus € 250 to cover travel expenses.
- The winner and two other finalists will have their images displayed in the main hall at the location of the 6th Iberian / 10th Iberoamerican Biophysics Congress.

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# 6th Iberian / 10th Iberoamerican Biophysics Congress


*6th International Iberian Biophysics Congress* and *10th Iberoamerican Congress of Biophysics*.
**June 20 – 22, 2018**, Castellón (Spain).

## Presentation

On behalf of the Organizing Committee, it is my pleasure to invite you to attend the *6th International Iberian Biophysics Congress* and *X Iberoamerican Congress of Biophysics*. This international conference has a tradition of almost two decades. The 2018 edition is organized under the auspices of the Spanish Biophysical Society – SBE, the Portuguese Biophysical Society – SPBf and the Latin American Federation of Biophysical Societies – LAFeBS.

**IIBC-2018** will be held in Castellón (Spain) on 20-22 June 2018, in the campus facilities of Universitat Jaume I.

The scientific program includes several Plenary Lectures, as well as Parallel Symposia on selected topics covering the main research areas of Biophysics. Symposia will host invited talks and also short communications selected from submitted abstracts with preference for young researchers. Following the tradition of previous Meetings, a New and Notable Workshop will take place in the morning of the

first day. The organizers are committed to make the Poster Sessions a place for networking and the occasion of fruitful and lively discussions in a relaxed atmosphere. Reduced registration fees will apply to participants who are SBE members. Moreover, a number of grants sponsored by SBE and SPBf will be available to encourage young researchers' participation.

Looking forward to seeing you in Castellón.

Best regards,

**Vicente Aguilella**, Chair of the Organizing Committee

## Deadlines

- Third "IMAGIN'ACTION" image contest: February 19th 2018.
- Nominations for SBE Prizes: February 28th 2018.
- Application for Bursaries (SBE): March 5th 2018.
- Application for Bursaries (SPBF): February 20th 2018.
- Early Registration (low fee): March 23rd 2018.
- Abstract Submission: April 15th 2018.
- Late Registration: June 20th 2018.

## More information

Please, visit the Congress Web Site.

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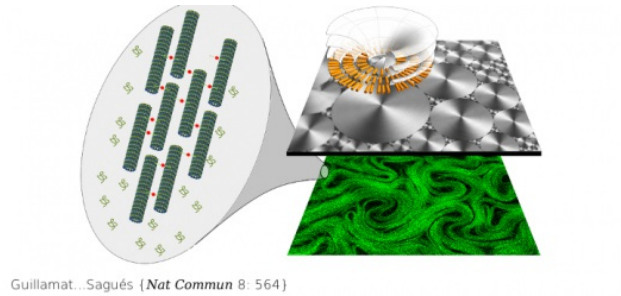
## PAPERS OF THE MONTH BY SBE MEMBERS: SEPTEMBER - DECEMBER 2107



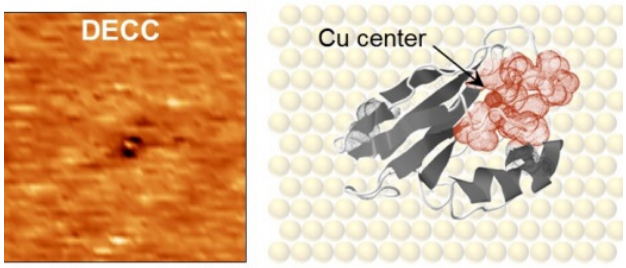
Guillamat...Sagués {*Nat Commun* 8: 564}

HIGHLIGHTS2017 / SEP. 2017

### Taming active turbulence with patterned soft interfaces

*Guillamat P, Ignes-Mullol J, Sagues F.*

Nat Commun 2017 Sep; 8: 564.



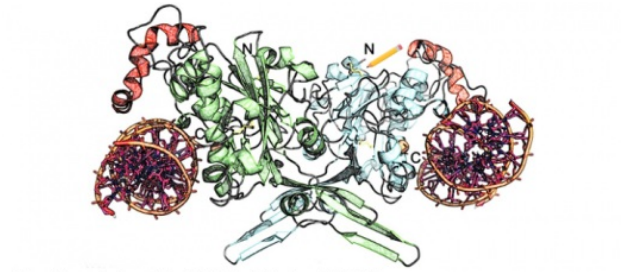

López-Martínez...Gorostiza {*Small* 13: 1700958}

HIGHLIGHTS2017 / SEP. 2017

### Differential Electrochemical Conductance Imaging at the Nanoscale

*Lopez-Martinez M, Artes JM, Sarasso V, Carminati M, Diez-Perez I, Sanz F, Gorostiza P.*

Small 2017 Sep; 13: 1700958.



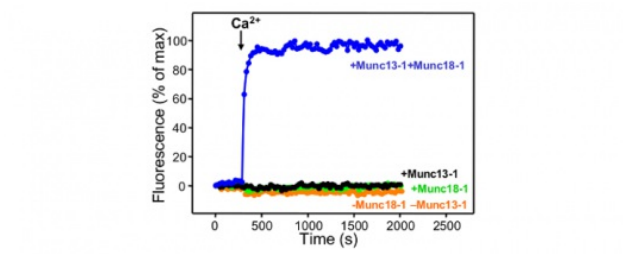
Oliva...Gago, Jiménez-Ruiz {*Nucleic Acids Res* 45: 9030}

HIGHLIGHTS2017 / SEP. 2017

### Structure-based domain assignment in *Leishmania infantum* EndoG: characterization of a pH-dependent regulatory switch and a C-terminal extension that largely dictates DNA substrate preferences

*Oliva C, Sanchez-Murcia PA, Rico E, Bravo A, Menendez M, Gago F, Jimenez-Ruiz A.*

Nucleic Acids Res 2017 Sep; 45: 9030.




Liu...Rizo {*Nat Protoc* 12: 2014}

HIGHLIGHTS2017 / SEP. 2017

### Simultaneous lipid and content mixing assays for in vitro reconstitution studies of synaptic vesicle fusion

*Liu X, Seven AB, Xu J, Esser V, Su L, Ma C, Rizo J.*

Nat Protoc 2017 Sep; 12: 2014.

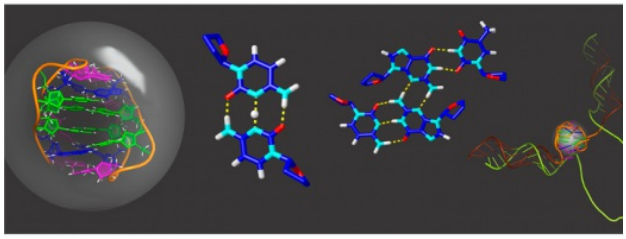

Zamora...Valle {*Sci Adv* 3: eaao2182}

HIGHLIGHTS2017 / SEP. 2017

## Potyvirus virion structure shows conserved protein fold and RNA binding site in ssRNA viruses

*Zamora M, Mendez-Lopez E, Agirrezabala X, Cuesta R, Lavin JL, Sanchez-Pina MA, Aranda MA, Valle M.*

Sci Adv 2017 Sep; 3: eaao2182.



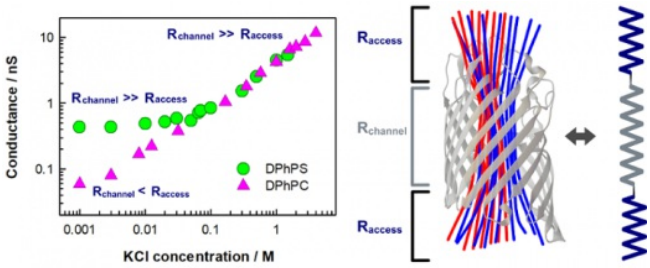
Mir...Gonzalez {*J Am Chem Soc* 139: 13985}

HIGHLIGHTS2017 / OCT. 2017

## Prevalent Sequences in the Human Genome Can Form Mini i-Motif Structures at Physiological pH

*Mir B, Serrano I, Buitrago D, Orozco M, Escaja N, Gonzalez C.*

J Am Chem Soc 2017 Oct; 139: 13985.



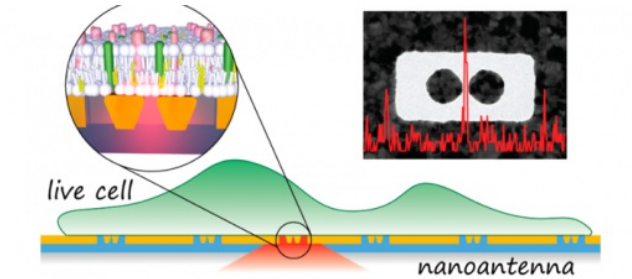

Alcaraz...Aguilella {*ACS Nano* 11: 10392}

HIGHLIGHTS2017 / OCT. 2017

## Ion Transport in Confined Geometries below the Nanoscale: Access Resistance Dominates Protein Channel Conductance in Diluted Solutions

*Alcaraz A, Lopez ML, Queralt-Martin M, Aguilella VM.*

ACS Nano 2017 Oct; 11: 10392.



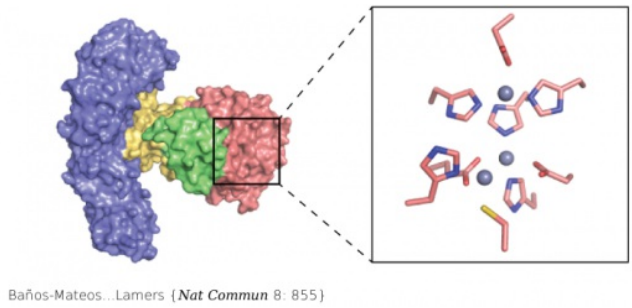

Regmi...García-Parajo {*Nano Lett* 17: 6295}

HIGHLIGHTS2017 / OCT. 2017

## Planar Optical Nanoantennas Resolve Cholesterol-Dependent Nanoscale Heterogeneities in the Plasma Membrane of Living Cells

*Regmi R, Winkler PM, Flauraud V, Borgman KJE, Manzo C, Brugger J, Rigneault H, Wenger J, Garcia-Parajo MF.*

Nano Lett 2017 Oct; 17: 6295.



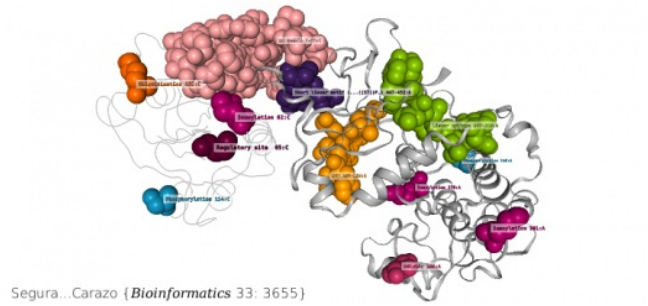
Baños-Mateos...Lamers {*Nat Commun* 8: 855}

HIGHLIGHTS2017 / OCT. 2017

## High-fidelity DNA replication in *Mycobacterium tuberculosis* relies on a trinuclear zinc center

*Baños-Mateos S, van Roon AM, Lang UF, Maslen SL, Skehel JM, Lamers MH.*

Nat Commun 2017 Oct; 8: 855.



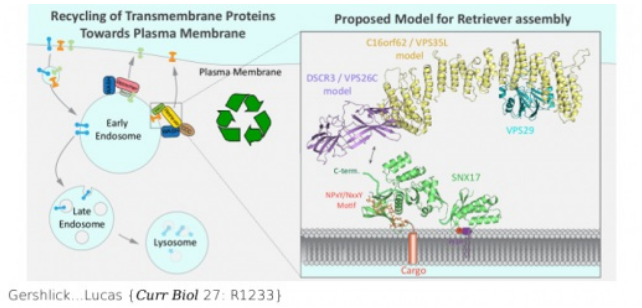
Segura...Carazo {*Bioinformatics* 33: 3655}

HIGHLIGHTS2017 / NOV. 2017

## 3DBIONOTES v2.0: a web server for the automatic annotation of macromolecular structures

*Segura J, Sanchez-Garcia R, Martinez M, Cuenca-Alba J, Tabas-Madrid D, Sorzano COS, Carazo JM.*

Bioinformatics 2017 Nov; 33: 3655.



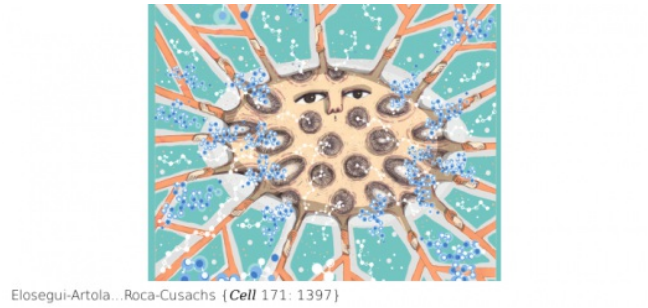

Gershlick...Lucas {*Curr Biol* 27: R1233}

HIGHLIGHTS2017 / NOV. 2017

## Endosomal Trafficking: Retromer and Retriever Are Relatives in Recycling

*Gershlick DC, Lucas M.*

Curr Biol 2017 Nov; 27: R1233.



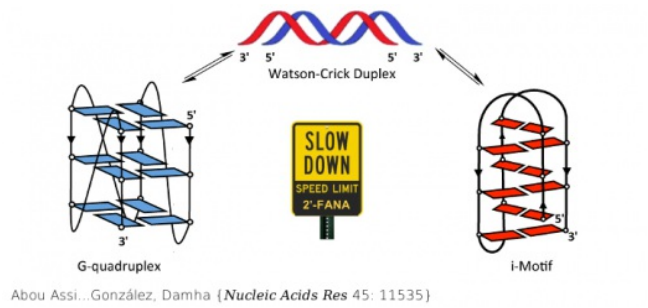
Elosegui-Artola...Roca-Cusachs {*Cell* 171: 1397}

HIGHLIGHTS2017 / NOV. 2017

## Force Triggers YAP Nuclear Entry by Regulating Transport across Nuclear Pores

*Elosegui-Artola A, Andreu I, Beedle AEM, Lezamiz A, Uroz M, Kosmalska AJ, Oria R, Kechagia JZ, Rico-Lastres P, Le Roux AL, Roca-Cusachs P.*

Cell 2017 Nov; 171: 1397.

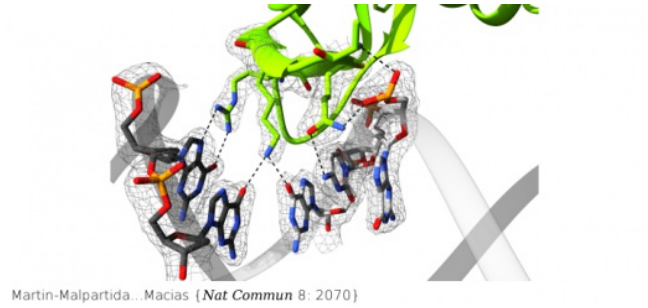


Abou Assi...González, Damha {*Nucleic Acids Res* 45: 11535}

HIGHLIGHTS2017 / NOV. 2017

## 2′-Fluoroarabinonucleic acid modification traps G-quadruplex and i-motif structures in human telomeric DNA

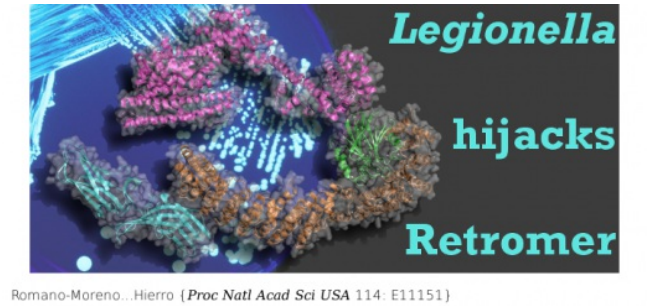
*Abou Assi H, El-Khoury R, González C, Damha MJ.*
Nucleic Acids Res 2017 Nov; 45: 11535.


Martin-Malpartida...Macias {*Nat Commun* 8: 2070}

DEC. 2017 / HIGHLIGHTS2017

## Structural basis for genome wide recognition of 5-bp GC motifs by SMAD transcription factors

*Martin-Malpartida P, Batet M, Kaczmarska Z, Freier R, Gomes T, Aragon E, Zou Y, Wang Q, Xi Q, Ruiz L, Vea A, Marquez JA, Massague J, Macias MJ.*
Nat Commun 2017 Dec; 8: 2070.

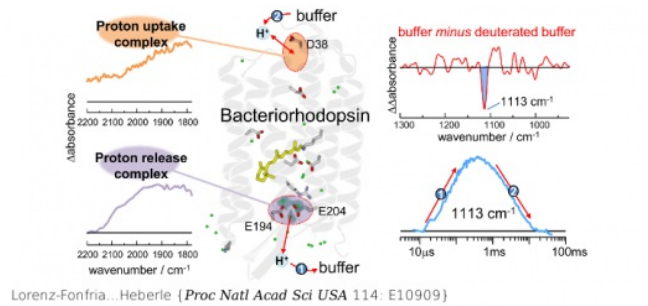


Romano-Moreno...Hierro {*Proc Natl Acad Sci USA* 114: E11151}

DEC. 2017 / HIGHLIGHTS2017

## Molecular mechanism for the subversion of the retromer coat by the Legionella effector RidL

*Romano-Moreno M, Rojas AL, Williamson CD, Gershlick DC, Lucas M, Isupov MN, Bonifacino JS, Machner MP, Hierro A.*
Proc Natl Acad Sci U S A 2017 Dec; 114: E11151.

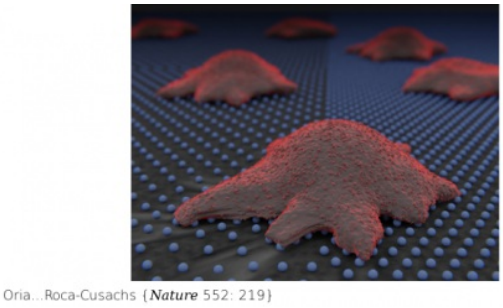


Lorenz-Fonfria...Heberle {*Proc Natl Acad Sci USA* 114: E10909}

DEC. 2017 / HIGHLIGHTS2017 / UNCATEGORIZED

## pH-sensitive vibrational probe reveals a cytoplasmic protonated cluster in bacteriorhodopsin

*Lorenz-Fonfria VA, Saita M, Lazarova T, Schlesinger R, Heberle J.*
Proc Natl Acad Sci U S A 2017 Dec; 114: E10909.

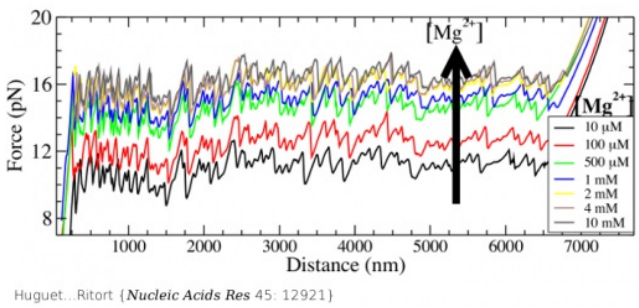



DEC. 2017 / HIGHLIGHTS2017

## Force loading explains spatial sensing of ligands by cells

*Oria R, Wiegand T, Escribano J, Elosegui-Artola A, Uriarte JJ, Moreno-Pulido C, Platzman I, Delcanale P, Albertazzi L, Navajas D, Trepat X, Garcia-Aznar JM, Cavalcanti-Adam EA, Roca-Cusachs P.*

Nature 2017 Dec; 552: 219.




DEC. 2017 / HIGHLIGHTS2017

## Derivation of nearest-neighbor DNA parameters in magnesium from single molecule experiments

*Huguet JM, Ribezzi-Crivellari M, Bizarro CV, Ritort F.*

Nucleic Acids Res 2017 Dec; 45: 12921.