

## Advice on submitting to Nature, Science, and PNAS

### Brief summary:

- Have scientists from the relevant *non-CS* disciplines read and review your work before you submit.
- For Nature/Science: write for a broad audience, have an interesting story, emphasize conceptual contributions. New ideas and interdisciplinary results are emphasized; mathematics is not valued, and should be significantly downplayed.
- Science appears to be a little more receptive to CS papers than Nature. PNAS is more receptive to “mathy” papers, but the previous bullet-point still applies to some extent.
- One common route for papers to go to PNAS is by invitation associated to a conference or workshop organized by a PNAS editor.

### Advice for Nature and Science:

- I think that whatever has a potentially wide appeal should be disseminated in such journals. And I think that a larger part of the TOC work does have a wider impact than we realize. If we truly believe in the “computational lens” theme (and I do), then this is the way to go.

The more good papers we send, the easier it will become to get them in. But the first papers that are sent should expect some difficulties: Language barriers, different emphasizes on similar problems in different communities, insufficient familiarity with relevant work in other communities and everything that comes with cross-area communication. One should also be ready for excellent work being rejected (and consider submitting to other similar journals). I have a fairly positive experience with the Science paper (though not free of conflict) and a less successful experience with *Econometrica* (very different journals, I know, but still). My main conclusion is that it is important to have others review the paper before submission from the community that is expected to review the submission. We did it with the Science submission and did it again after getting comments. It helped us avoid some potholes and dig our way out of others (in fact, just helping us interpret the reviewers' comments was invaluable).

This is all I can think of as a possibly useful advice for others. It seems obvious, but stupidly enough I didn't do it with the Econ submission and I think that a good paper was rejected for the wrong reasons.

- The most important thing I found in submitting a paper to Nature was keeping in mind that the main thrust of the paper should be accessible broadly to the scientific public, and that the paper cannot just be an advertisement of the results - it must provide sufficient details to be convincing (they do allow a substantial additional document called the supplementary information). Moreover, the article should have a news peg - i.e. what is the scientific news event that it is announcing. In my experience all this called for a reconceptualization of the results in the paper. It was also a very helpful process, in the sense that through the process of

writing and revising our Nature articles, we ended up with a much deeper understanding of our results.

- When we were preparing our paper Jon Kleinberg had some fantastic advice that we followed closely. The main thing I remember is that the paper should almost read like the second half of a standard theory paper, i.e., one should “go for the jugular” from the very beginning with minimal introduction. The bare minimum that allows statement of results. To the extent that the introduction exists it should be aimed at a physicist. Also, the less math the better. Finally, the conclusions section should not be a recap but rather a “zoom out” putting the work in perspective (something we usually do in the intro).
- I think my only advice is: Talk to scientists outside your area, again, and again, and again. This is at first slow, frustrating, and time consuming. But it's the only way to go. Find scientists (biologists, neuroscientists, chemists, you name it) who like your work and can help you communicate it.
- The contents of our Science submission did not appear in a conference. The key thing was that we never said the words theorem or proof. We explained the theorem in words. We pointed to another paper for the proofs and formal statements (that paper was on arxiv and later appeared in a mathematical journal). In our Science paper we "showed" the result by showing the results of simulations with some nice figures.
- I admit I'm not sure what advice to give, except it seems like for Nature/Science type publications one has to be fairly pushy. The process seems almost adversarial. From the journal's standpoint, they are prestigious enough to ask what makes your paper important enough it should be accepted. This attitude carries over to the reviewers, who I think are looking for reasons to reject the paper. Especially for people in TCS this may be a problem, since the reviewers (assuming they may be outside TCS, such as physicists, biologists, or statisticians, depending on the topic of the paper) will not be "on our side", and may even have a defensive attitude of not wanting these TCS interlopers coming in. ("Not invented here" syndrome.)

Because of this, I think you have to go in with a thick skin, and a willingness to fight for the work. Definitely having someone experienced with the journal read and edit your paper could be very helpful. It may even be worthwhile to find someone from the appropriate community to join the project and become an author if that's appropriate. I would describe the experience as challenging and difficult, and while probably in the end it was worthwhile, I'm glad it's not the framework used for every paper I write.

- I've had mostly good experiences submitting papers to "glamour" journals like Science and PNAS. Firstly, I think it would be very good if CS theorists started submitting more to these journals. The big advantage that they have over CS journals is that they have a sophisticated media operation that has the ear of the press. They provide materials to reporters and help encourage news coverage. This is great for popular understanding of science, and something in which TCS lags other sciences in.

Science uses professional editors, who are not experts in CS. It's true that they can have trouble finding good reviewers. But in my experience, they are happy to consider CS papers, and their difficulty comes mostly from their lack of experience handling TCS papers -- this is something that would change if we as a community submitted more papers to them. Our editor at Science was Gilbert Chin, who eventually found good reviewers for our paper.

All in all, I think the experience is a very positive one. The two shortcomings are that:

- 1) At Science, the editorial staff is not used to CS papers, and
- 2) Computer scientists do not as a rule read these journals.

But both of these problems would be fixed if we just submitted more to them, and their ability to attract wide attention is valuable.

- I think these journals (especially Nature/Science) are looking first and foremost for an interesting story that is accessible to a scientist without much background in TCS/math. Otherwise they are unlikely to even send it for peer review. Having a reasonably hot topic like social networks or big data certainly helps with that :)

Once you have a story you also need some substance to support it. My impression is that theory (proofs and algorithms) by itself is unlikely to be enough (and does not carry much weight more generally). So, unless it's something truly special I think it's not worth to put much emphasis on theory. Instead one needs to come up with some concrete examples of the ideas (e.g. data analysis or simulations) together with some good graphics.

Naturally, one needs to put quite a bit of thought and effort into the writing of the main body of the article (there is also supplemental part which could include some lower level details). Ideally, one should try to get help from someone more experienced with writing to general audience. Universities and big companies often have press/communications/grants people who can do that (although I myself ended up not using their help).

Regarding the formatting details my impression is that at the time of the initial submission they are not particularly strict about those. That is one should try to follow those but I think I worried more than necessary about small details like how to number figures. These things are then corrected if the paper is accepted.

- I have experience only with one submission to Science, hence I am not sure if the input I can provide is very typical. My impression with that submission was that the editors and reviewers liked the interplay between TCS and Biology.

Besides contributing the specific parallel algorithm for Maximal Independent Set in Graphs, the message of the paper was that understanding certain biological processes can lead to new designs for algorithms -- perhaps algorithms that are simpler and more robust (though possibly with less precise guarantees) than those known earlier. Thus, although the particular algorithm

and its analysis may be similar to others in the literature, the novelty was in the way it could have been inferred from the biological source.

Based on the experience with this paper I suspect that in Science they care more about such general principles, than about mathematical sophistication, and the principle is the one that has to be explained in a convincing way.

- This sounds like a worthwhile initiative. For better or worse, these journals get a lot of attention and having more TCS papers in them would help raise the profile of the field.

Having only tried this once, I can't offer much advice. Obviously the topic is very important -- the work should be of interest to a reasonably broad audience. In our case we had a conceptually simple result that was backed up by a lot of calculations, so we ended up with a 3-page paper with 80 pages of supplementary materials. The initial reaction we got from the editors seemed lukewarm, but we followed up with detailed responses to referees and revisions to the paper and eventually got it published.

- I think the most important thing is to answer in your submission why you are doing it, why this is new and groundbreaking and crucially why it has an impact on science in a broad context beyond TCS. Nature and Science will reject things they perceive as too narrow and of interest to only a small community. I think it is rather different to many works that appear at STOC/FOCS which while often solving technical challenges are often not as broad. For these journals the meaning and impact of results is often much more important than if it was technically challenging. It can also just be very novel and original insights even if a proof is technically easy. Maybe my question would be whether if you actually make it past the editors to be refereed, the TCS community would not themselves reject the work that the editors would let pass.

[One thing often not considered] is: how do I write a suitable letter to an editor. This is a very important part of the submission. E.g., at Nature an editor typically takes 6 to 7 papers per week under closer consideration to decide whether to send for review. They actually spend a lot of time in assessing the manuscript themselves and also discuss this with other editors before making a decision to review. PNAS is very different than Nature and Science in that there's specific editors in the field rather than a dedicated editorial board.

- I'm still more of a mathematical physicist than a computer scientist. My recent Nature paper very much reflects this. Although we made use of classic ideas from computer science to prove our results, the question we addressed (the spectral gap problem) is one that's important to theoretical physicists, not to computer scientists (who are unlikely ever to have encountered it as it concerns quantum many-body systems). I very much doubt we would have gotten our paper into Nature had it not been for its importance to theoretical physics.

Exactly the same story with my even more recent Science paper: computer science techniques, but applied to something that's very much a theoretical physics topic.

I know close colleagues in computer science who have submitted excellent results to Nature/Science and had them rejected by the editor. I think what the computer science community (and the mathematics community, for that matter) would need to understand if targeting Nature/Science is that these are Natural Sciences journals, not mathematics -- or even theoretical science -- journals. Nature/Science are predominantly interested in results that give significant new insight into how the physical or natural world behaves. They are not usually interested in mathematical theorems or proofs; that's simply not their remit. The overwhelming majority of what they publish is experimental science. It is extremely challenging even to get theoretical physics results published in Nature/Science, let alone theoretical work that has no direct connection to any of the natural sciences.

The handful of mathematics / theoretical computer science results published in Nature are invariably ones that have a strong physics motivation (even if the main focus of the authors themselves is mathematical). Another good example of this is the Achlioptas-Naor-Peres random k-SAT paper. Although their motivation was probably mathematical / theoretical computer science, the SAT/UNSAT threshold problem can be framed as a fundamental statistical physics question, and they emphasize this physics motivation in the Nature paper.

My impression is that PNAS is more open to theoretical work than Nature or Science. But I can't speak authoritatively here, as the only two papers I've ever submitted to PNAS were rejected!

- Although I am very interested in, and partly work on, subjects of theoretical computer science, I am a theoretical physicist. Thus it is for me very natural to publish in journals such as PNAS/Nature/Science (when I manage to ;-). In general I would love to read more works related to theoretical computer science in these journals, but the choice is mainly editorial.

For example, I know that Nature is very experimental oriented, while other journals of the same publishing groups (e.g. Nature Communications) are more open to theoretical works, and so also to theoretical computer science. I have recently submitted a work discussing an algorithm for searching solutions in random constraint satisfaction problems to Nature Communication, and the work received a very fair processing by the editor and the reviewers.

My experience is that also PNAS and Science are fairly open to theoretical works in general, and theoretical computer science works in particular.

So I would strongly invite theoretical computer scientists to submit their best quality works to this kind of journal.

- I should begin by saying that by training I am a physicist rather than a native member of the TCS community, and that may make some difference here. Furthermore, my field (quantum information) probably has an unusually high success rate with such journals.

That said, here are the points that strike me as possibly useful advice for publishing in such journals:

1) Science and Nature are often the subject of criticism for a perceived lack of rigour. However, this is a misunderstanding of the purpose of the articles in such journals. Your results are expected to be rigorously proven, but it is expected that any overly technical material will be included as supplemental material, while the main article will be used to convey the work in a way that is accessible to a broader scientific community. This means that your submission should be accessible to people outside your specific subfield. At the very least, it should be accessible to computer scientists and mathematicians of all stripes. This leads to my second point.

2) They care more about results than technique, which perhaps runs counter to the prevailing attitude in the TCS community. The purpose of these journals is to communicate results that are likely to be of interest and perhaps to impact researchers outside your own immediate area. This affects not just the way you present your results, but also the type of results for which this type of publication can be considered. In order to stand a reasonable chance of acceptance the results presented in a paper probably need to either have significant practical applications or bring about a significant conceptual shift.

3) In terms of presentation, it is usually the case that these papers are written in a significantly different style to TCS conference submissions. You have very limited space, and generally, though not always, the lemma-theorem-corollary structure is not used. The introduction usually combines motivation with survey of previous results. Notation and terminology is often introduced on an as needed basis, rather than in a dedicated section. It is also important to communicate not just the mathematical manipulations required to achieve a result, but also the intuition for why this works. Overall, my advice would be to think of structuring the paper more like you would structure a talk than a conventional TCS paper.

4) Getting Nature or Science papers which do not cross some kind of disciplinary boundary is quite rare. Usually the types of papers that get accepted end up having relevance to more than one community. In the case of quantum information there is a clear recipe for this: combine meaningful theoretical contributions with non-trivial experimental implementation. This requires expertise from two distinct communities, and ends up being a fairly successful recipe. Similarly, results which draw upon results or techniques in one field to solve some open problem in another tend to go down well. It is fairly easy to see why: by construction you have a wider community of interested readers.

- I don't have any particular comments -- I just carefully followed the advice on the Science website. Ditto the papers I've written in Nature. The editors were, I believe, assigned by the journal, not suggested by me.

I will make one broader remark: publishing in Science / Nature etc. may benefit theoretical CS in the short term politically. But I believe much more valuable is things like the experiments the ICLR conference (from the neural nets community) have been doing. They're pioneering new

models of scientific publishing which have the potential to improve the way that community operates.

See: <http://www.iclr.cc/doku.php?id=pubmodel>

See also the associated paper on OpenReview.net: <http://openreview.net/document/28cb8b58-d6f9-45c9-936f-c6c60e674381#28cb8b58-d6f9-45c9-936f-c6c60e674381>

By contrast, trying to publish in Science etc. seems like a retrograde step. Experiments like ICLR / OpenReview seem: (a) much better for the field; and (b) better for society.

Nature and Science do one thing well: they understand how to build relationships with the media and with the wider community. But, of course, there's no reason other journals can't do the same. For the most part, they just can't be bothered, as far as I can see.

- Of course it's important for more CS work to appear in Science. This is a journal widely read in by key people from many disciplines. To get a paper into Science, it should be obvious that it is a new and important idea with broad implications. Advances in narrow areas are rarely accepted in Science. The most acceptable are the papers that (a) explain their results precisely in clear language, not relying on discipline-specific jargon, and (b) also explain why their result is of broad importance.
- There is a big difference between Science / Nature and PNAS; I would not consider these as similar. It should be fairly easy to publish important CS papers in PNAS since we have members of the academy in our community and they can simply put the papers there if they want. Science and Nature are much harder, but also have a much higher impact. Of the three papers I was seriously involved with that were published in these journals, two got in because they had important new biological data (the computation was essential but the real selling point was the biological data). The third was a CS paper but had an interdisciplinary message. A few points that they seem to like / not like:
  1. Unusual connections between CS and other areas (biology, physics, ecology etc.)
  2. Computational methods for the analysis of large scale data (really large, but the focus can still be on the technical aspects). These should present examples that are of relevant interest with some new insights.
  3. Really important new technical results, but these need to be clear, short and put in historical context ("this problem has been open since 1940...") and should also discuss practical implications even if these are not attempted.

Beyond papers themselves both Nature and Science have a news section which can report on significant publications in other venues (for example STOC/FOCS). This may be a more viable option for theoretical papers though it requires a good PR person.

- Nature is a funny place to publish. It is very unusual for [us in astronomy] too. Basically the editor plays a very strong role in deciding whether your paper will be published there or not. So

find out which editor you would get and try and impress them first. Inflate your claims a little in your abstract for example or in general make sure it is clear why this is so new and what major longstanding problem you are finally solving etc.

In [astronomy] the editor has a super strong bias for “empirical” discoveries so it is very hard to publish theory.

In any case, the editor will decide whether or not he / she will send the paper to the referees or not. If they send it to referees it's pretty good news. A large fraction of papers don't make it past the editor. For [astronomy] this a weird concept. Most major journals would automatically send to referees before making decisions.

Once a manuscript makes it to the referees, typically 2, they will need at least 1 very enthusiastic to get it through.

Do not worry about the formatting details at all. Just word count, major things. How you present / spin the material is crucial. It will not affect the decision. If it gets past, they have tons of people to do the formatting etc.

It's not worth it to “pre-submit” / contact the editor in advance. The editor doesn't use that info much. It's not clear if it works as a positive or negative for authors (makes it sound like you are not sure it is worth a real shot in Nature etc.). If you find someone who has submitted to the same editor as you would it would be more useful info to have. If you publish a Nature Letter, though it is almost the same amount of time to write the actual paper.

- A message to the CS people *that will receive [Science/Nature] submissions as reviewers*: I think the editors of these top journals are doing a good job in terms of ensuring that at least one [reviewer] is a real expert in the field. As reviewers for these journals we should not take the attitude that the paper should be better than any other paper on the subject we have seen so far. Publishing papers on a subject in these journals increases visibility of the subject as a whole and so it is a good thing for the community as long as the paper is correct and, say, above-average interesting. As referees for these journals of papers from our community we should play a much more positive role than what comes to mind when we read the acceptance criteria about impact and ground-breaking nature.

### Advice for PNAS:

- I hope more TCS researchers will take such routes. It's not easy to write for such a broad and tough scientific audience, it takes you out of your comfort zone and forces you to face your demons. But what is science worth if this never happens?

Obviously, TCS authors submitting to PNAS should suggest TCS editors or members. Before writing such an article, I go back and skim articles in such venues that I have liked. Writing it in an appropriate way is crucial.

- I think it is good to publish in PNAS/Nature/Science, though I have mixed feelings about this.

On the one hand these journals are high profile and this gives visibility outside of our own field. Moreover here in Europe universities value such publications more than regular CS journals or conferences, because the impact factor is much higher. So it helps getting better internal and external evaluations of one's group. It also helps in order to get grants and funding. On the other hand these journals are expensive, for example for PNAS one has to pay \$1500 which is too much I find. In my area (quantum computing) especially when you write a paper together with physicists it is very natural to try such a journal and there are also natural editors like Zeilinger or Bennett who work in our field and know us.

I think that if the CS community sends more papers to such journals, editors that are closer to our field will be appointed.

- We were lucky to get in with flying colors so here is some advice on what I think made it happen:

-- Choose a topic of broad public interest and write the body in accessible terms with pictures, etc. (in our case we appealed directly to the NAS study initiated by Barack Obama). I personally think this was the most important part.

-- Put heavy mathematical content either in the end of the main body or into the appendix. I don't think the paper necessarily has to be a mathematical breakthrough for it to get in, broader appeal matters more, IMHO.

-- Make sure you have experiments on real data.

-- Expect to pay \$1500 for a regular article and \$2100 for a longer article (PNAS Plus).

-- Our suggested editors were: Cynthia Dwork (Microsoft Research Silicon Valley), Jon Kleinberg (Cornell University), Ronald Rivest (Massachusetts Institute of Technology), Butler Lampson (Microsoft Corporation). The actual editor eventually was Salil Vadhan.

As a physicist by training, I am very well aware of [the reputation that many of the papers in Nature/Science are wrong/dubious]. Our community can definitely help with correctness concerns since we prove stuff. I also really like the fact that such publications help promote our community among other scientists and establish CS as a key player in other fields. Also the reviewing process at PNAS is super-fast (a couple of months to get accepted, a few more to get published because of some minor changes).

Main downside I'd say is that I didn't feel like the reviewing process was very rigorous. Also, as I am sure you know there is a very dubious "contributed track" where NAS members can choose their own reviewers during the submission process. We didn't have any NAS members among authors so we didn't have to face this ethical dilemma: <http://www.nature.com/news/scientific-publishing-the-inside-track-1.15424>

- Our paper was invited for a special issue edited by Assaf Naor. As far as I remember there were no special issues (perhaps because it was invited). Would be good to ask [TCS editors] how to arrange for a special issue on a [TCS] topic.
- My only PNAS publication was invited to a special issue on geometry.
- Our paper appeared in a math oriented PNAS, so no special preparation was needed (the editor was Terry Tao). I find it important for the community and science that TCS ideas are published for general scientific audience.
- The only paper I have in PNAS appeared in a special feature about "Quantitative Geometry". Basically, Assaf Naor, the (main) organizer of the MSRI "Quantitative Geometry" program solicited submissions from participants of that program. The main "virtue" of that paper was his length: it was sufficiently short to pass the severe limits of PNAS. (This BTW may be a small tip: I think that the official maximum length of a PNAS article is 6 pages, but there is an understanding that mathematical papers can be a bit lengthier, maybe 8 pages, so do ask for this extension if it is needed).

Another tip is that the PNAS format for article is not very well suited for mathematical content, at least in my opinion, so to make it readable please submit a "reasonably formatted" version to the arXiv. This should be a no-brainer for TCS people, since we are used to the ill-suited format of CS conference proceedings (but the PNAS format is worse).

- Our PNAS paper was essentially invited for a special issue compiled by Assaf Naor. Had it not been then I would probably not have considered submitting it there. No changes to the presentation were made for the journal. The formatting process was odd and has hopefully improved since then. I believe we delivered TeX or PDF and they turned it into a Word file, which may have caused some math typos, though they may have been introduced by the editor accidentally. I guess a search in the Members database of NAS might show who would be good editors. Hope this helps.

I do believe it is important that more TCS papers appear in journals like this by the way. One reason for this is that they seem to be well read by journalists who write for popular science magazines, such as Scientific American and Science. I was approached by someone from a popular science website immediately after the PNAS publication. Getting TCS research (other than quantum computing, which seems to be pretty well hyped at the moment) covered in popular science magazines would undoubtedly be good for improving public view on the field. After recently subscribing to Scientific American, I got a little annoyed by how much physics and biology dominate. Quanta seems to have a much better balance, but having more coverage in the established journals and magazines would help to improve public overview of the types of questions TCS tries to deal with.

- For me, publishing in PNAS has been an important way to reach the broader scientific community. I send things there when I think they have a strong interdisciplinary impact: for instance, two of my recent papers on community detection in networks. In this particular field (networks / statistical physics) good choices for editor might be Peter Bickel, Gene Stanley, or Giorgio Parisi.

Note that neither of these papers was mathematically rigorous, although they contained well-defined predictions and conjectures based on techniques from physics. If I had a nice theory result with a real proof, I would probably send it to FOCS/STOC or a math journal, unless I thought it was a result that scientists from other fields could really understand and appreciate. A good example of this would be Chung, Graham, and Wilson's paper on quasirandom graphs; it barely sketched the proofs but it stated their (quite surprising) theorem.

- Some of the main points to be taken into account when deciding to submit:

*Conference versions:* Submission to PNAS appears to preclude submission to a CS-style conference, as papers in the latter are "validated by review": "PNAS considers results to have already been published if they have appeared in sufficient detail to allow replication, are publicly accessible with a fixed content, and have been validated by review."

*Open access:* The situation now seems reasonably liberal: preprints may be posted on ArXiv, and the accepted version (though not the PNAS formatted pdf) may be posted on ArXiv and institutional repositories.

*Editors:* "Authors must recommend three appropriate Editorial Board members, three NAS members who are expert in the paper's scientific area, and five qualified reviewers." It is unlikely that anyone particularly relevant will be found in the first category, but the other two categories should present less of a problem.

*Page charges:* PNAS requires authors to pay page charges.

*Page limit:* There is a strict page limit, though supplementary material can be submitted and will appear alongside the web version of the article.

*Typesetting:* Various irritations arise at the typesetting stage, but they can mostly be overcome. E.g., PNAS regards papers in CS-style conferences as “ephemera”, but after some negotiation were prepared to list them in the bibliography alongside journal articles. PNAS does now accept final versions for typesetting in LaTeX.

*Importance of submitting to PNAS and similar journals:* Probably only a small fraction of TCS papers are suitable for the PNAS treatment (results that are not massively technical, that relate to physical models, computational biology or quantum computing are examples that come to mind). So as a community we should avoid publication in PNAS/Nature/Science being used as a measure of success. Having said that, it is probably a good idea to reach out to other communities when the option arises.

- PNAS gets about 20,000 submissions per year, so it's inevitably bureaucratic. Follow the submission instructions pedantically! Otherwise details of formatting not so vital, though you should see how your paper looks in 2-column format.

The process is a bit opaque. Editors handle about one paper a month -- this means to either reject the paper, or to find referees and their own comments back up the line.

Although PNAS's stated policy is to expand beyond their traditional biology focus to other fields like Math or CS, in practice it's hard to judge what makes such a paper appropriate for PNAS. My suggestion is not to submit a "pure CS" paper but to do one that makes contact with some field outside CS.

Suggesting referees is important – typically a couple of the authors' suggestions are actually used.

- PNAS is very different [from Science], and the editors are members of the national academies. We are lucky to have many representatives in the TCS community who are members, and who therefore can serve as editors for PNAS. My experience at PNAS was not very different than submitting to a CS journal (except the reviewing time is much faster, and our paper attracted media attention).
- I mention some of the more special features. First, there is a page limit of 6 printed pages (39,000 characters) but can have support materials archived (but not published in print). Second, the processing is much faster than typical CS journals, the average time for receiving a decision is around 40 days. Third, PNAS is a journal for the broader science community, so they require a short "Significance Statement" that explains the significance of the results understandable to scientists outside of the field. PNAS has in recent years been encouraging "Direct Submissions" (compared to the “Contributions by NAS members” track of submissions), which basically is essentially the same as most current CS journals using electronic portals in form and substance, such as suggesting reviewers, editors etc.

The information is current up to a year ago. The authors should look at PNAS web site for their very comprehensive set of information packets.

- My experience is that the fashion may matter more than the mathematical depth of the research. If the research concerns stuff that general scientists (outside mathematics) care about, such as machine learning, data mining or similar stuffs, it has a much better chance.
- PNAS welcomes important work of all kinds.

One problem that some submissions from math sciences have is that the submitters actually don't have much experience reading science papers. They write papers that are more like announcements with no evidence or a series of definitions with no applications.

The key thing is there has to be a result and there has to be evidence just like if the paper were talking about a physics experiment or a biology experiment.

For computational studies, presenting computational outputs in a reproducible way, with code and data available, is a way to satisfy the definition of making something scientific.

- The only advice that I can really offer is to write a paper jointly with some physicists. The PNAS submission and review process seems to be already be familiar to them.

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## Some CS theory papers in Nature, Science, and PNAS

### Nature

#### *Random graphs, CSPs, phase transitions*

Achlioptas, Dimitris, Assaf Naor, and Yuval Peres. "Rigorous location of phase transitions in hard optimization problems." *Nature* 435.7043 (2005): 759-764.

Monasson, Rémi, et al. "Determining computational complexity from characteristic 'phase transitions'." *Nature* 400.6740 (1999): 133-137.

Gomes, Carla P., and Bart Selman. "Computational science: Can get satisfaction." *Nature* 435.7043 (2005): 751-752.

#### *Theory of networks and distributed systems*

Kleinberg, Jon M. "Navigation in a small world." *Nature* 406.6798 (2000): 845-845.

Kleinberg, Jon. "Computing: The wireless epidemic." *Nature* 449.7160 (2007): 287-288.

#### *Quantum topics*

Reichardt, Ben W., Falk Unger, and Umesh Vazirani. "Classical command of quantum systems." *Nature* 496.7446 (2013): 456-460.

Smith, Graeme, John A. Smolin, and Jon Yard. "Quantum communication with Gaussian channels of zero quantum capacity." *Nature Photonics* 5.10 (2011): 624-627.

Cubitt, Toby S., David Perez-Garcia, and Michael M. Wolf. "Undecidability of the spectral gap." *Nature* 528.7581 (2015): 207-211.

Lloyd, Seth. "Ultimate physical limits to computation." *Nature* 406.6799 (2000): 1047-1054.

### Science

#### *Random graphs, CSPs, phase transitions*

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