

Research & Development for scientists

Cash for Ideas



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You may have noticed a strange new addition on the website of the Nature Publishing Group – the Open Innovation Pavilion. On it, *Nature* says, readers have the opportunity to participate in research and development (R&D) challenges. As a “solver”, you can apply your expertise to (their) important problems, stretch your “creative boundaries” and eventually win cash awards. What’s going on? Jeremy Garwood investigates the growth of a new research practice: ‘Open Innovation’.

Nature’s Open Innovation Pavilion presents a long list of research problems that someone wants solving and they’re prepared to pay cash for the right solution. Under each problem’s title, the “challenge reward” tells you how much money you could win if you propose an acceptable answer. Most of the prizes are in the range \$10-50,000 but some go a lot higher – consider the \$1,250,000 up for grabs if you can “identify and source novel insecticidal proteins”!

Opening ‘closed’ innovation?

The website was launched in June 2009, the fruit of a collaboration between *Nature* and InnoCentive, the company “powering” this initiative. But InnoCentive has, in fact, been posting challenges on its own site since 2001. Its activities represent just one facet of a growing tendency in R&D towards what has been termed, ‘Open innovation’.

This movement is based on the perceived need to provide an alternative to

the previous system of “closed” innovation, classically exemplified by ‘Big Pharma’. The major pharmaceutical companies have been very research-intensive enterprises. And for good reasons! Their highly lucrative drug trade is based on the exclusive protection provided by the patent system – owning the patent for a new drug typically provides a 20-year period during which the drug can be legally sold at an artificially inflated price. After this period, other companies can manufacture and sell the drug, usually at a much lower price. This cycle of drug discovery and time-limited patent protection has encouraged pharmaceutical companies to invest heavily in their own R&D but secrecy and confidentiality are considered essential for maintaining a strict legal control over any research findings.

However, the cost of discovering and developing new commercial drugs has risen dramatically at a time when ‘Big Pharma’ has had difficulties in finding enough of them to maintain profits. Business crit-

ics and technology analysts now question whether the “closed”, legally-sealed, innovation system is productive enough. They argue that it would be better to take a risk by sharing some of their confidential information with outside researchers. A more open discussion of research problems and objectives, so they claim, could re-stimulate their rate of innovation. This, in turn, would result in finding paying solutions more rapidly, at lower cost, and would push those profit margins back up again.

InnoCentive – challenges pioneers

In a sense, InnoCentive was created as a result of R&D failures at Eli Lilly (currently the world’s 10th largest pharmaceutical company with around 40,000 employees). The idea for InnoCentive came in 1998 to Eli Lilly employees, Alpheus Bingham and Aaron Schacht, who were exploring ways of applying the internet to business. Elsewhere at Eli Lilly, there was growing frustration that their massive scientific staff couldn’t

solve certain problems in drug synthesis or development. Hence, Eli Lilly decided to test this move towards “open innovation”, providing majority seed funding for InnoCentive’s launch in 2001.

InnoCentive’s job is to act as an intermediary between companies with R&D problems and anybody out there who might have an answer. In addition to domains of direct interest to the pharmaceutical industry like drug chemistry, cell biology and biomedical research, InnoCentive also posts problems from engineering, computer science, maths, physics and general ‘business’.

Clients have included firms like SAP (computer software), Procter & Gamble (consumer goods), Pendulum (scientific instruments), Janssen (pharmaceutics), Solvay (chemicals), Dow AgroSciences and, of course, Eli Lilly. The company provides a consultancy service for its clients (who are referred to as “seekers”). “Science advisers” and “problem definers” are on hand to help them identify appropriate challenges for posting online.

An appropriate award fee is estimated by determining the complexity of the problem, the resources required to find a solution and the value transferred to the client company. The solutions submitted by online “solvers” are also initially dealt with by InnoCentive, who decide whether ideas meet the challenge criteria before passing winning solutions on to their client.

Intellectual property (IP)

Although some areas of Open Innovation involve free exchanges of information (for example, with open source computer software), most commercial companies aren’t prepared to hand over their money unless they can have some legal control over it. InnoCentive provides the logistic and legal framework for maintaining control over any intellectual property (IP). For a start, only InnoCentive and the seeker that posted the problem can see proposed solutions. Secondly, both the seeker and the solver must sign agreements protecting confidential information. All communication and submitted solutions remain confidential.

This also works both ways. When a solver submits a solution, what’s to guarantee that the seeker won’t simply take the solution without paying up? To prevent solvers being ripped-off, InnoCentive says that it forces its “seekers” to agree to IP audits. This means that once a solution is provided to the company, it guarantees that the solver’s IP is not used by the company unless it

awards the prize. Furthermore, it says it can force the seeker company to award the solution if it considers the requirements of the challenge have been met.

Multiple challenges

Challenges are initially presented in just a few lines. If you want full details, you have to register online and agree to the “challenge-specific agreement”. However, at one page long, even full challenge descriptions are relatively brief. In effect, InnoCentive carefully repackages their seekers’ problems in order to provide the key elements without revealing any compromising commercial secrets. However, they say that their “science experts” are also there to provide feedback for “solvers”, to better explain the terms of challenges as well as provide hints for improving submitted solutions that are not quite good enough.

InnoCentive have structured their challenges into four types, each of which has different requirements and IP implications:

1. Ideation – This might be considered the simplest type. An Ideation challenge is a broad question formulated to obtain access to new ideas, similar to a “global brainstorm” for producing a breakthrough idea for a new product line, or a new commercial application for a current product. Solvers can submit their own ideas, information considered in the public domain, or third party information they have the right to use, but they should not reveal any confidential information. As a guideline, only about two written pages are expected. Meanwhile, seekers receive a non-exclusive, perpetual license to use all submissions.

Usually, these Ideation Challenges are followed by another challenge type to further develop ideas and gain IP protection once the concept has been well-defined.

2. Theoretical challenge – here solvers must meet requirements for detailed solutions. In most cases, when a solution is

chosen and an award is given, the IP rights transfer from the solver to the seeker. Each challenge statement spells out the specific IP requirements. Although a theoretical challenge requires only a written proposal, it’s more than just a literature review. The proposed solutions should provide the seeker with “freedom to practice”, i.e. there should be no patents or patent applications that could prevent commercial use of the proposed solution. A recent example asks solvers to detail “non-destructive methods of molecular detection in cells”, for which the seeker was prepared to pay \$35,000.

3. RTP = Reduction To Practice challenge. This is when things get more difficult.

An RTP challenge is a prototype that proves an idea. This means that in addition to a high level of detail, the solver must also submit a validated solution, either in the form of original data or a physical sample. Furthermore, the seeker is allowed to test the proposed solution.

With so much information at stake, IP is always transferred. Recent examples of RTP challenges include “a validated protocol for maintaining and expanding fully differentiated human primary renal proximal tubular epithelial cells”, for which you can win \$30,000, or “How to Transform *Agrobacterium Tumefaciens* Bacteria with Large Plasmids” (partial award of \$15,000). And the current jackpot: up to \$1,250,000 in return for “identifying and sourcing novel insecticidal proteins, or genes encoding insecticidal proteins”, with possible solutions ranging “from bioinformatics-based approaches up to clones expressing proteins with experimentally-validated activity”.

4. eRFP = electronic Requests For Proposals challenge.

This is more of a call for collaboration and doesn’t attract a specified cash prize. With their Requests for Proposals, seekers are looking for partners or suppliers to pro-



vide materials or expertise to help solve a business challenge. In addition to individual solvers, InnoCentive say their global solver community includes groups, such as contract research organisations and technology companies. The seeker evaluates eRFP responses to determine which solvers to contact for further business discussions. The solver must not provide any confidential information in the eRFP response. If selected, you directly negotiate the terms of the contract (including the scope of the

(Dortmund), who responded to a challenge from the pharmaceutical giant, Johnson & Johnson. They were developing a new tuberculosis drug but were stuck with a reaction that generated two stereoisomers. How could they modify the reaction to produce just the isomer that interested them? Hedberg said that when he saw the challenge, "I just smiled" because he knew how to solve it directly, it being just the kind of problem he worked on in the lab. "It took me three evenings to write it up." However, Hedberg

challenges, Spradlin said these organisations were promoting InnoCentive. At Russian universities, for example, a solver's academic department can now get 10% of any award. He also noted that although large numbers of Chinese and other Asian solvers register to look at challenges, they are much more reluctant to submit answers than Russian colleagues.

Spradlin also joked about how one solver in India had assembled his own team of scientists and engineers – he merely manages the submission of answers. InnoCentive discovered this outsourcing, which is perfectly legitimate, because the Indian solver was so much more prolific than anyone else. In fact, InnoCentive has itself capitalised on this idea and now encourages "Team-based Proposals": "We value the diverse nature of the solvers in our network, and are now encouraging you to strengthen your proposals by recruiting team members to work on this challenge." On their website, you can now enter into a virtual "Team Project Room". This is a secure online workspace that allows a group of solvers to securely collaborate on certain InnoCentive challenges. The hope is that by encouraging solvers to work together, there will be an improvement in the quality and quantity of solutions to the more complex or multidisciplinary challenges.



photo: Photocase/real-entico

When pharma and academia pull together, progress is made a lot faster.

work, tasks and duration) with the seeker. Although this challenge type does not require IP transfer, IP arrangements are often necessary before a partnership is formed. An example of an eRFP calls for "Novel Detection Technologies for Cellular Metabolites". Here, they're looking for partners to help develop "a novel technology platform for the analysis of cellular metabolites. The technology should be reagent-based and not require the use of mass spectrometry".

Successful solvers

Who actually succeeds in solving these challenges? The company claims to have around 200,000 registered solvers from 175 countries. In addition to researchers with science PhDs, there are engineers, technicians and students but no formal restrictions – anyone can have a go at solving a problem.

Details of successful solvers are provided as an incentive for others to have a go. For example, there's Christian Hedberg, a postdoc in chemical biology at the Max Planck Institute of Molecular Physiology

cannot give any details of his solution since he transferred IP rights to Johnson & Johnson. But he did admit to being surprised that such a challenge had been posted, "I think it's strange that a major pharma company cannot solve this kind of problem."

Another postdoc, Laurie Parker, at the University of Chicago, said it took her less than a day to write a submission for an InnoCentive challenge seeking new ways to make polypeptide libraries. Working in an organic synthesis lab, this problem was a "perfect fit" for her background. She duly won \$5,000. She has only twice submitted an answer but has examined more than 200 challenges.

Nevertheless, the financial incentive means more to some solvers than others. In 2008, Dave Spradlin, CEO of InnoCentive, told *Science* magazine that already more than 50% of registered solvers came from India, Russia and China. To facilitate matters, InnoCentive had even signed agreements with the Chinese and Russian national science academies. Now, instead of preventing their scientists from answering

Curiosity and pride

But not all problems are solvable. Solutions were found for only about 35% of the first 600 challenges posted by InnoCentive from 2001-08. Nevertheless, Spradlin insists that the "prize-based model can be better, faster and cheaper" than traditional in-house research efforts because it expands the knowledge base of its clients, often resulting in existing solutions being applied to a new problem. For example, a pharmaceutical company posted a challenge for scaling-up production of a key molecule. Within three weeks, a Russian protein crystallographer sent the company a solution that was already in the public domain and, hence, free of any IP restrictions.

Harvard Business School has performed a formal analysis of InnoCentive's open innovation model. Karim Lakhani sifted through the company's data on 166 challenges listed by 26 companies – 80,000 scientists from 150 countries reviewed these challenges and 49 of them had been solved. An online survey of solvers, both those who had winning proposals and those who did not, revealed that about 40% of those who registered to see challenge summaries had

PhDs. These solvers claimed that curiosity and pride motivated them as much as the potential prize money.

Trying to understand why certain problems got solved, Lakhani found that the more diverse the pool of solvers, the greater the odds of a solution. After surveying winning solvers, his group concluded that the further a challenge was from a person's field of interest, the more likely they were to solve it. "You really need to have a different perspective," said Lakhani, who suggests that InnoCentive's crowd-sourcing approach might reflect a broader trend of democratization in science because more people "now have the skills and talents to solve science problems".

Non-profit initiatives

InnoCentive branched out in 2006 when it signed an agreement with the Rockefeller Foundation to add challenges from the 'non-profit area', designed to generate science and technology solutions for pressing problems in the developing world. Here, challenges are presented for non-gov-

ernmental groups and enterprises that have identified needs in developing countries. The cost of posting and assessing the value of submitted solutions is borne by the Rockefeller Foundation.

An example is the challenge: "Reducing Risk of Malaria with a Solar-Powered Device", from the enterprise, SunNight Solar. The \$40,000 prize was won by Tom Kruer, a US engineer. Unusually, his six-page winning solution has been posted online in order to stimulate further innovation in the field (<http://blog.innocentive.com/2009/02/05/solution-revealed-solar-powered-mosquito-repellant/>). It presents his design for a low-technology cone that acts as a heat store when set in the sun during the day. Indoors, during the night, the stored heat attracts mosquitoes by evaporating human sweat – the mosquitoes are subsequently trapped "in a simple tortuous path container", where they eventually die of dehydration. Tests on prototypes are currently underway.

In 2007, InnoCentive also associated with medical charities seeking cures for

rare diseases or ones that are not lucrative enough for 'Big Pharma'. The Prize4Life foundation put up a \$1 million award for anyone who could find a biomarker that measures progression of the disease, amyotrophic lateral sclerosis. ALS is a neurodegenerative disease resulting in death within two to five years of diagnosis. Ironically, Prize4Life was founded by students from Harvard Business School who decided to put the open innovation model to the test when one of them was diagnosed with the disease. ALS has no known cure but, with a biomarker that reliably tracks disease progression, the time and cost of ALS clinical trials could be reduced, encouraging companies to test potential therapies and "accelerating the rate at which treatments and a cure are found".

Harvey Arbesman, a dermatologist and professor of clinical epidemiology at the University at Buffalo (New York), decided to have a go. He read everything he could find on ALS and soon came across the observation that ALS patients, when immobilised during the end stage of their disease,

rarely develop bedsores, even though similarly paralysed people, such as stroke victims, almost always do. Based on this observation, Arbesman submitted a proposal for monitoring skin changes in ALS patients and won a \$15,000 prize for the concept.

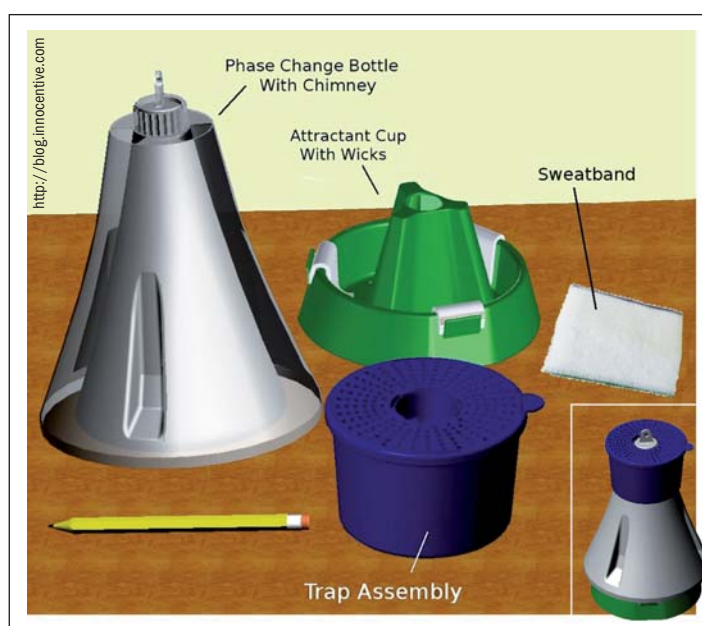
The \$1 million prize

But to win the \$1 million prize, he needed to find a validated bio-marker. So, Arbesman set up a collaboration with researchers from Columbia University's Neurology and Dermatology departments. Adapting a technology used in the cosmetic industry, the Cutometer, they non-invasively measured skin elasticity of ALS patients to test whether it really did correlate with disease progression. In 2009, he won another \$50,000 for his ongoing research. "If this Challenge hadn't been issued, there is little chance I would have even pursued this idea," said Arbesman. At that stage, Prize4Life said they received 12 submissions from seven countries. The latest phase of the Prize4Life ALS Biomarker Challenge closed in October 2010. Will Arbesman win again?

Which brings us back to *Nature* Publishing Group's association with InnoCentive. Although there is nothing on the Open Innovation Pavilion to indicate that *Nature* has any real input beyond hosting the website, they nevertheless agreed to sponsor a challenge from the "Drugs for Neglected Diseases initiative (DNDi)", offering a \$10,000 prize. The idea behind DNDi is to find target-based approaches to drug discovery for kinetoplastid infectious diseases (including African Sleeping Sickness, Leishmaniasis and Chagas Disease, affecting 30 million people worldwide). The challenge sought proposals highlighting molecular targets and associated small molecule compounds that could be used as leads in the drug discovery process. In January, 2010, *Nature* announced a winner – Sandip Bharate, a post-doc in biomedical and pharmaceutical science at the University of Montana. He sent them an extensive, 46-page review of the scientific and patent literature, including a list of 33 chemically validated targets along with 86 small molecules that have been shown to specifically affect these targets. DNDi said Bharate had "unearthed some

very interesting new leads which we look forward to exploring."

By now, you may be wondering how much money InnoCentive makes from maintaining its website, posting its challenges and vetting submitted solutions. Well, for a start, it charges clients an annual fee of up to \$100,000 for managing their challenges. It also earns a percentage of the prize money, sometimes equal to the award itself. The company has, so far, awarded about \$3 million for 200-plus solutions, most coming within two to four months of a challenge being posted. Their Open Innova-



The \$40,000 prize winning mosquito trap designed by Tom Krueer. According to Krueer, the total manufactured cost was estimated to be roughly \$5.00 of material with assembly labour of an additional \$1.25.

tion Pavilion site with *Nature* has featured at least 44 Challenges, 17 of which provided satisfactory solutions for a total prize money to the solvers of \$225,000.

Obviously, it pays for them to win new clients and retain old ones. Hence, in addition to "teaming-up" with *Nature*, InnoCentive has also gained prominence through a similar venture with the *Economist* magazine, featuring their own joint challenge, this time for solutions to climate change.

Open innovation elsewhere

Inspired by InnoCentive's model, other companies are competing to offer their own open innovation services, some of them with a decidedly national flavour.

From Switzerland, we have "Atizo". Apart from offering cash prizes in Swiss Francs, Atizo also claims to be "the largest virtual brainstorming platform with thou-

sands of creative thinkers" (all from Switzerland?). Many of their challenges come from Swiss companies and have a Swiss flavour, sometimes literally – Nestlé were offering CHF3,000 in their recent challenge to create "the next generation of fruit yoghurts" (<https://www.atizo.com/>).

The Spanish "Innoget" (based in Barcelona) also presents challenges with cash prizes for solutions. In addition, it has its "IBox-in" and "IBox-out" processes – these are restricted-access forums, where companies can describe the kind of thing they're looking for (in the in-box) or technology snippets they already possess, which might be of interest to someone else (in the out-box). Basically, it's a way of providing information as a starting point for future collaborations.

In France, there's the open innovation site, "Presans". This was launched by former students of the Ecole Polytechnique (<http://www.presans.com/>). In November 2009, Presans received public support from the French Ministry of Research and Education. The minister, Valérie Pécresse, proclaimed that open innovation was the way to go in French R&D. However, most of the Presans website seems to consist of a succession of articles that are either advocating open innovation as the 'obvious' future for French research or are bitterly complaining about the lack of interest being shown by un-

lightened French industry and academia. It's not like Presans has many challenges on offer. In fact, the only one they discuss entails a "novel approach, leveraging a proprietary Expert Search Engine, to find experts". It seems that if solvers won't come to them, then they are prepared to actively go out and find them. Armed with a challenge from the defense industry to find someone to write a review on high-power microwaves, they tracked down a US academic and gave him the €12,000 "award" in return for a "40 page report on this topic he knows perfectly". But since when was such 'headhunting' considered to be a part of open innovation?

Cut-out the middle men

In fact, something similar was first proposed in Australia in 2003: "The InnovationXchange (IXC)". Its non-profit model

is based on acting as a “trusted intermediary”, helping companies and organisations to solve their technology problems by finding potential partners and facilitating their interactions. In effect, they provide a confidential service for clients jumpy about their IP rights. They claim that their own disinterest in profit-making means they remain politely impartial. This Australian model has since sprouted subsidiaries across the world, for example, in the UK (<http://ixc-uk.com/>). Two examples of their activity: helping a UK university to license some of its technological discoveries, they found a company willing to pay out £10,000 for pilot tests of a new corrosion-resistant coating. And organising a strategic review for a medical products’ company of its main product, it turned out that the company’s distributors were hindering access to clinical practitioners. Solution: cut-out the middle men by directly liaising with hospitals, saving the company £200,000 and giving it direct access to practitioners’ demands for product improvements.

Meanwhile, in India, which InnoCentive has already discovered to be filled with potential ‘solvers’, “Innovator X” has been launched by the Centre for Innovation, Incubation and Entrepreneurship at IIM Ahmedabad with support from the Indian government’s Department of Science and Technology. This is an “endeavour to create a platform to bring together all stakeholders in the innovation ecosystem – bridging a gap which currently exists in India” (<http://innovatorx.com/>).

Something completely different

Finally, there’s “Idea Connection”, which modestly claims to be “the world’s largest open innovation intermediary using teams of experts led by world-class facilitators”. They even provide you with a chance to assess their relative merits since their site contains links to most of the other open innovation websites, together with extensive documentation. Their challenges seek to “build on the genius of others” and they claim their solvers have received “av-

erage earnings of \$5,500 per award”. Furthermore, in addition to posting all of their own challenges, Idea Connection also happily posts challenges from other groups, the so-called “3rd Party Innovation Contests”. These include some major challenges with big prize money, like the “\$1.4 million oil spill prize” from the “X prize foundation”, who want to find new ideas for cleaning-up large oil slicks; or the \$1,000,000 “In Vitro Meat Challenge” from the “People for the Ethical Treatment of Animals (PETA)”, who want to encourage the development and offering for sale of *in vitro* chicken meat in commercially significant quantities (<http://www.ideaconnection.com/contests/contest/>).

So, there you have it. If nothing else, these online open innovation challenges provide an opportunity for restless research minds to have a think about something completely different. Who knows, you may even be rewarded for your efforts.

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