The man who refused the Fields Medal may also refuse a million dollars

The Fields Medal is awarded by the International Mathematical Union to recognize outstanding mathematical achievements for existing work and for the promise of future achievements. It is often referred to as the Nobel Prize of mathematics and carries a monetary award of US$ 15,000. Only mathematicians below the age of 40 are eligible for this award and it is awarded every four years on the occasion of the International Congress of Mathematicians (ICM). At a time, the medal is awarded to between two and four mathematicians. Awarded first in the year 1936, it has been awarded periodically since 1950. Forty eight mathematicians have received this very prestigious medal so far.

For the first time in the history of the medal, at the 2006 ICM at Madrid, the medal was turned down by one of the awardees. Russian mathematician Grigori Perelman, one of the four awardees of 2006, declined to accept the Fields Medal. Why he did so is largely a mystery. He is reputed to have said at the time, 'It was completely irrelevant for me... Everybody understood that if the proof is correct, then no other recognition is needed'. (Perelman was referring to the proof of the Poincaré Conjecture which he worked on). Always a reclusive person, being offered the Fields Medal seems to have motivated Perelman to further withdraw from the world of mathematics.

Perelman was born to Jewish Russian parents on 13 June 1966 in St Petersburg, Russia. His father was an electrical engineer and his mother taught mathematics at a technical institute. His unauthorized biographer Masha Gessen reports that it was apparent very early that Perelman was a prodigy. As a high school student at the age of 16, he won first place at the International Mathematical Olympiad in Budapest in 1982 with a perfect score. His extraordinary capabilities were recognized and nurtured well within the Soviet system. Even as a school student Grigori was a loner and although not unfriendly, always preferred his work over human company. His other passion is that of opera. Love of opera was inculcated in him by his mother who first took him to a performance when he was six

years old. Perelman is also said to be a talented violinist. Currently Perelman is unemployed and leads an isolated life interacting only with his mother whom he lives with.

After completing his doctoral education in the Soviet Union, Perelman spent a few years in the United States of America. Sylvia Nasar and David Gruber interviewed Perelman and in their article, published in the *New Yorker* in 2006, they report that Perelman's colleagues and friends have attested to his living very simply during his time in the United States. Apparently, his apartment was very sparsely furnished and he lived on a diet of Russian bread, cheese and milk. One peculiarity often commented on were his long fingernails which he did not see the need to cut. In 1995, he turned down job offers from several very prestigious American schools and returned to live and work in Russia at the Steklov Institute. Masha Gessen alleges that Perelman was unhappy that none of the job offers in the United States were tenured positions – they were merely tenure-track. At the Steklov Institute he could work without teaching responsibilities or publishing requirements. Gessen reports that 'he showed up infrequently and generally kept to himself for almost seven years'.

Perelman's most famous achievement in the world of mathematics has been solving of one of the most complex problems of the century – the Poincaré Conjecture. First posed in 1904 by Henri Poincaré, the conjecture had been the preoccupation of many brilliant mathematicians over the last century. The problem was one of the seven complex mathematical problems identified by the privately funded Clay Mathematics Institute as the Millennium Prize Problems in 2000.

Gessen explains the century old problem thus in an interview: 'Much of topology is concerned with things that are essentially the same as other things, even if at particular moments in time they happen to look different. For example, if you have a blob that can be reshaped into a sphere, then the sphere and the blob are essentially similar, or homeomorphic, as topologists say. Poincaré asked, in

essence, whether all three-dimensional blobs that are not twisted and have no holes in them are homeomorphic to a three-dimensional sphere. It took more than a hundred years to prove that yes, they are.' A seven million dollar prize fund was set up by the Clay Institute to reward those who solve the problems with a million dollars allocated for each of the problems. Incidentally, the conjecture was proven for dimensions greater than three (Generalized Poincaré Conjecture) earlier on in the 20th century. For proving the conjecture in dimensions greater than four, the mathematician Stephen Smale was awarded the Fields Medal in 1961. In 1986 Michael Freedman received the same honour for proving the conjecture in four dimensions.

Grigori Perelman's proof of the conjecture was ready in 2002 and he went about the job of letting his results be known in a most unusual manner. Most researchers with new and exciting results would rush to have them published in well-known peer-reviewed journals thereby ensuring due credit to themselves. However Perelman, obviously very confident of himself and the quality of his work – never did publish his results. All he did was to submit his proof to the open arXiv preprint server and e-mail the abstract of his paper to several other mathematicians working in the same field. He followed this up by lecturing on his proof at the most prestigious universities in the United States in 2003 but since then has communicated less and less with the outside world.

Three different groups of experts working independently studied Perelman's results for more than two years and declared them to be accurate in 2006. In December 2006, the journal *Science* hailed his results as the 'Breakthrough of the year'. By not publishing his results in a peer-reviewed journal, Perelman originally did not qualify for the Clay Prize. However, on 18 March this year, the Clay Institute took the decision to award him the prize as his proof has successfully undergone review by his fellow mathematicians. The press release issued by the Clay Institute concludes with these words: 'Perelman's proof of the Poincaré and geometrization conjec-

tures is a major mathematical advance. His ideas and methods have already found new applications in analysis and geometry; surely the future will bring many more'. (http://www.guardian.co.uk/world/2010/mar/23/grigory-perelman-rejects-1m-dollars)

Perelman does not answer his phone or responds to e-mail. He has been informed of the Clay Prize but has indicated no interest in collecting the prize so far and has refused all requests for interviews. Apparently he told the one reporter who managed to reach him on his mobile phone 'You are disturbing me. I am picking mushrooms'. His one and only interview was the one to Sylvia Na-

sar and David Gruber mentioned above. He told them repeatedly that he had given up mathematics and expressed disillusionment with the field of mathematics and mathematicians, 'It is not people who break ethical standards who are regarded as aliens. It is people like me who are isolated'. He also appears to have felt that by accepting the Fields Medal he would be conforming to standards he disapproved of. 'As long as I was not conspicuous, I had a choice', Perelman explained. 'Either to make some ugly thing' (a fuss about the math community's lack of integrity) 'or, if I didn't do this kind of thing, to be treated as a pet. Now, when I become a very conspicuous

person, I cannot stay a pet and say nothing. That is why I had to quit'.

1. Manifold Destiny, Interview by Sylvia Nasar and David Gruber published in New Yorker, August 2006.
2. Excerpts from Perfect Rigor: A Genius and the Mathematical Breakthrough of the Century, Masha Gessen.
3. Interview with Masha Gessen; www.failuremag.com

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MEETING REPORT

Barter system, biodiversity and livelihoods of tribal communities: cultural diversity and conservation in eastern Himalaya, Arunachal Pradesh*

Arunachal Pradesh, being the largest state in eastern Himalayan region, has unique biodiversity and diverse cultural resources. The state is the homeland of five ecosystems and 26 major tribes. The livelihood security of tribal communities is determined by terrestrial and aquatic indigenous bioresources. Economy of tribals living in far-flung areas is subsistence in nature and is governed by barter system. The barter system has been playing a considerable role among tribal communities for generations to secure livelihoods and sustain bioresources in remote villages and harsh ecosystems. Looking at the importance of barter system, a series of location-specific village cum regional workshops have been organized. Altogether 28 village workshops were organized during the period from March 2003 to March 2009. From 2003 to 2007, workshops were held among *Monpa* tribal dominating villages, viz. Bomdila, Dirang, Namsu, Lish, Chhung, Yang, Rama-camp, NagaGG and Thembang (West Kameng). Further, from 2005

to 2007 three workshops were conducted at Lumla (near Bhutan border) and other nearby villages of Tawang. From 2004 to 2008, four workshops were organized among *Galo* tribe dominating villages of Koyu. From 2004 to 2009, nine village workshops were held in *Adi* dominating villages, viz. Sille-Oyan, Boleng, Pangin, Mebo, Damro and Maryang (East Siang district); Yingkiong (West Kameng district); Dambuk and Roing (Lower Dibang Valley). Three workshops were held with *Memba* tribe of Tuting (West Siang district); *Mishmi* tribe of Teju (Lohit district) and *Galo* and *Adi* tribes of Along (West Kameng district).

The objective of organizing workshops was to understand the role of barter system in exchange of bioresources among various tribes and its mechanism in influencing learning process on biodiversity conservation and subsistence livelihood of tribal communities. In each location, groups of women and respective institution(s) involved in barter system were invited to participate in the workshop. Customary chiefs and their subordinate members of villages were special invitees. The key members and women, who participate in barter system of each tribe, were consulted through the participatory

rural appraisal (PRA) tool – called focus group discussion (FGD) to learn the ways and means by which they collect, grade, process and assign the values to the bioresources used during barter system.

It was concluded that barter system is practised by a large number of tribal communities in remote villages with the objective to exchange bioresources and related knowledge about biodiversity-based food products, ethnomedicines, handicrafts, etc. In barter system women have a special role to play in collecting, grading and making packages of bioresources to be used as medicines, food items, cultural items, etc. These resources are primarily collected from forests, home gardens, aquatic resources and Jhumlands. These could be both plants as well as animals (*mithun* (*Bos frontailis*), fishes, prawn, shrimps, insects, rat, squirrel, hunted meats of mammals by male folk, etc.). While accomplishing these practices, women form institutions based on the kin and relationship to reduce drudgery, manage time and minimize the labour cost. Barter system forms network of social learning on foods and ethnomedicines in the mountainous terrain. During the barter, the homogeneity of one tribe with another is the deciding