*Svenska Matematikersamfundet*

# MEDLEMSUTSKICKET

**15 november 2010**

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## UTSKICKET

utkommer tre gånger per år I Januari, Maj och Oktober. Manusstopp är den första i respektive månad

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## SVENSKA MATEMATIKERSAMFUNDET

är en sammanslutning av matematikens utövare och vänner. Samfundet har till ändamål att främja utvecklingen inom matematikens olika verksamhetsfält och att befordra samarbetet mellan matematiker och företrädare för ämnets tillämpningsområden.

*För att bli medlem betala in avgiften på samfundets* `plusgirokonto 43 43 50-5.`
Ange namn och adress på inbetalningsavin (samt om Du arbetar vid någon av landets institutioner för matematik).

### *Medlemsavgifter ( per år)*

Individuellt medlemsskap, *200 kr*
Reciprocitetsmedlem *100 kr.*
(medlem i matematiskt samfund i annat land med vilket SMS har reciprocitetsavtal):
Doktorander gratis under två år
Gymnasieskolor: *300 kr.*
Matematiska institutioner: *Större 8 000 kr, mindre 3 000 kr*
(institutionerna får sälva avgöra om de är större eller mindre).
Ständigt medlemsskap: *2 500 kr (engångsinbetalning)*

Man kan även bli individuellt medlem av EMS genom att betala in 250 kr till Samfundet och skriva EMS på talongen.

## HEMSIDA: `http://www.swe-math-soc.se`

Här återfinnes bl.a. protokoll från möten

## STYRELSE:

# Detta Nummer

Jo det blir ett nummer till. Utskicket fortsätter om än lite haltande. Jag fick inte den entydigt uppmuntrande respons som jag hade hoppats på vid årsmötet uppe i Umeå den 4 juni. Tyvärr var jag inte förmögen att bevista mötet och därmed sattes ingenting på spets. Jag förväntas fortfarande att vara redaktör och tänker göra min plikt. Livet går vidare. Dessutom så länge pappersupplagor på eget initiativ trycks på vissa institutioner anser jag att tidningen fortfarande existerar fysiskt. Vi får se vad nästa årsmöte kan ge för framtida riktlinjer.

Haltande eller inte, detta nummer kommer att bli det tjockaste som någonsin utgivits. Det har som uppenbart tema ICM i Hyderabad. Jag presenterar ambiansen (d.v.s. Indien och Hyderabad) och låter några deltagare komma till tals. Jag presenterar även Fieldsmedaljörerna, samt hoppas att några svenskar känner sig föranledda att skriva närmare om dem, speciellt Stanislav Smirnov med tanke på hans svenska anknytning, i något kommande nummer. Torbjörn Lundh rapporterar om GA (General Assembly) som enligt traditionen ägde rum ett par dagar innan ICM. Denna gång förlades det mötet till närbelägna Bangalore. Jag intervjuar Guillermo Curbera, i hans egenskap som nybliven kurator för ICMs arkiv, samt Ragni Piene som är avgående medlem av Executive Committe. Jag låter även den del deltagare komma till tals och dela med sig av sina erfarenheter. Bill Casselman, associate editor of AMS Notices samt den som är ansvarig för dess omslag, skriver om problemen med plenarföreläsningar. IMU har även tagit initiativet till att bemöta den växande trenden om automatisk evaluering av artiklar via 'impact-factors'. Detta är etablerat inom vetenskaperna, men är det egentligen så rättvist när det gäller matematiken? Vi har en annan kultur. Jag har fått tillåtelse av Douglas Arnold att pre-publicera hans artikel 'Nefarious numbers' i vilken han påpekar hur dessa så populära citeringsmått kan manipuleras. Denna artikel kommer att officiellt publiseras av Notices[1]. Jag hoppas att den skall provocera fram några synpunkter bland läsarna som kan framföras till författaren inför den slutgiltiga publiceringen. Jag har även via Nils Denckers omsorg kommit över ett referat av en paneldebatt på temat, transkriberat av John Ball och tänkt att utkomma i the Proceedings of ICM i Hyderabad, och fått de berördas tillåtelse att publicera. Transkriberingen blir ganska lång. Slutligen skriver Yves Meyer om elitutbildningen i Frankrike. Detta är en del av en kommande intervju som skall publiceras i EMS Newsletter. Visserligen kan man tycka att detta inte har något med ICM att göra, och det kan stämma. men å andra sidan fick Meyer för övrigt mottagai Hyderabad det prestigefyllda Gauss-priset som delas ut i samband med Fieldsmedaljerna sedan Madrid 2006.

Men numret är inte uteslutande ägnat ICM. Jag är alltid glad när läsarna självmant inkommer med artiklar. Gustaf Söderlind har läst den enkät om

[1] March 2011,58:3

vad en matematiker bör kunna som iordningställt av David Mumford och Philip Davis vid brown University, och som jag lät publicera i Utskicket i februari. Han riktar sig speciellt kritiskt mot mitt eget bidrag i denna enkät. Jag skall i sinom tid bemöta denna kritik. Jag är under tiden mycket tacksam för att Utskickets artiklar läses och provocerar. Jag har även varit ute och rest på NCMs uppdrag till Warwick University för att träffa den produktive popluärmatematiske författaren Ian Stewart. Jag har ju i tidigare nummer intervjuat både du Sautoy och Devlin. Intervjun med Stewart avslutar treklövern. Denna intervju är specellt lång eftersom jag spenderade en hel dag konverserande honom.

Ulf Persson (redaktör) Göteborg 15 november 2010

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## Titelsidans Illustration

Titelsidan visar en bild från ett tempel i Tiruchchirappalli. Det är till skillnad från de andra omslagsbilderna ingenting matematiskt intressant med denna. Dock varför måste det alltid vara det? Mera specifikt, kortet är taget från muren som omgärdar Sri Ranganathaswamy templet i ovannämnda stad. Mitt på dagen, observera de korta skuggorna, och stekhett. Speciellt uppe på muren. I hinduiska tempel går man barfota, skodon får man lämna utanför, oftast mot en liten symbolisk avgift. Solbelysta golv blir synnerligen stekheta, och uppe på denna mur hoppar man fram på säckar man tar med sig. Notera säckväven i bildens högra sida.

Templet är stort, i själva verket utgör komplexet nästan en liten stad. Sådana tempelkomplex är speciellt vanliga i södra Indien. Där återfinner man inte bara tillbedjare och objekten för deras tillbedjan, men även allehanda djur som getter, kor, kameler, och i förekommande fall elefanter. Hinduiska tempel är byggda runt ett inre sanktum. Dit har inte icke-hinduer något tillträde. Men hur visar man att man är hindu? Ras och klädsel. En indier i tradionell dräkt har väl inga problem, men en konverterad västerlänning? Skall man klara en frågetest? I så fall skulle de flesta hinduer bli diskvalificerade.

# Barcelona och SMT-sponsring

*Tobias Ekholm*

Sedan förra numret har vi hunnit avverka både vårmöte i Umeå och höstmöte i Barcelona. Vårmötet blev en lyckad tillställning. Temat för mötet var PDE med föredrag av John Andersson (Warwick), Vladimir Kozlov (Linköping), Kaj Nyström (Umeå) och Lars-Erik Persson (Luleå). Utöver detta presenterade Torsten Ekedahl årets Abelpristagare John Tate och Bo Berndtsson årets Wallenbergpristagare Robert Berman som också emottog själva priset. Stort tack till Umeå för utmärkt organisation.

Första svensk-katalanska matematikkonferensen ägde rum i centrala Barcelona vid Institut d'Estudis Catalans 16-18/9. Konferensen hade sex parallelsektioner var och en med ett plenarföredrag och två pass med åtta halvtimmesfördrag vardera. Det var ett intensivt program med många intressanta föredrag som sträckte över en lång rad av matematikens områden. Konferensen innebar förutom kontakter mellan svenska och katalanska matematiker även att svenska matematiker fick träffa varandra. Mötet föll väl ut och det vore värdefullt för samfundet att organisera liknade evenemang i framtiden, också på hemmaplan. Jag vill här rikta tack till alla sektionsorganisatörer, till GS Magnussons stiftelse för generöst resebidrag och till Milagros Izquierdo som administrerat detta bidrag samt sist men inte minst till det katalanska samfundet för stor gästfrihet och för all lokal organisation.

Samfundets höstmötet hölls som ovan nämnts i samband med Barcelonakonferensen. Mötet dominerades av information om sponsringsavtal för skolornas matematiktävling. Mer om det följer nedan, men först bör nämnas att Wallenbergkommittén fått ny sammansättning. Här ersätts Björn Gustafsson efter tre förtjänstfulla år av Nils Dencker.

Den möjlighet till sponsring av skolornas matematiktävling som jag nämnde i juninumret av utskicket är nu en realitet. I slutet av augusti ingick SMS ett treårigt samarbetsavtal med Brummer och Partners (B&P). B&P ger samfundet bidrag om 150kSEK, 250kSEK och 250kSEK år ett, två och tre. Utöver detta satsar B&P omkring 1000kSEK på ny hemsida för tävlingen, PR (affischer, brev, annonser) samt ett Brummerpris (i form av ett slags pokal och en inspirationsresa) till segraren i tävlingen. Dessa siffror ska ställas i relation till en årsbudget för tävlingen som tidigare varit ungefär 130kSEK. Tävlingskommittén har nu den angenäma uppgften att bestämma hur årets bidrag ska användas. Diskussionerna med B&P har genomgående varit mycket positiva och företaget anser sig ha stort behov av en fungerande stark matematikkultur i Sverige. Från första kontakten har B&P gjort klart att man vill se samarbetsavtalet långsiktigt och mycket tydligt uttryckt intentionen att förlänga samarbetsavtalet efter de första tre åren. PR-statsningen har lett till ökad uppmärksamhet kring tävlingen, samfundet och matematiken, förutom annonskampanjer i skolorna har tävlingen

diskuterats i TV4:s morgonsoffa den 28/9 och på en helsida i Dagens Industri den 1/10. I samband med detta vill jag tacka Dag Jonsson, Warwick Tucker och Paul Vaderlind som alla på olika sätt hjälpt till med avtalet och dess implementering.

Avslutingsvis vill jag ta tillfället i akt att här gratulera Stanislav Smirnov (medlem i SMS) till Fieldsmedaljen 2010.

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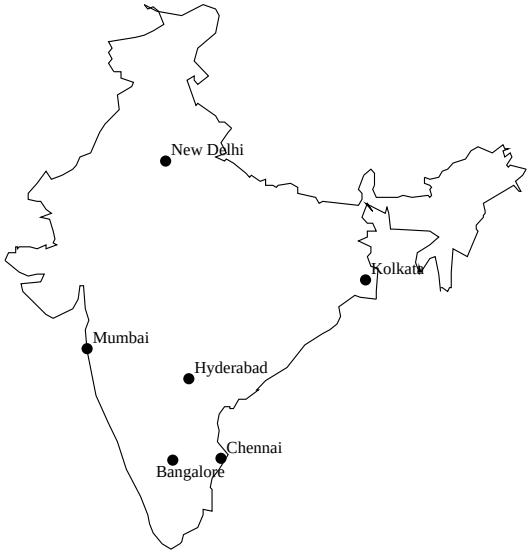
# ICM Hyderabad

*Ulf Persson*

'Allt vad man säger om Indien är sant. Allt vad man säger om Indien är falskt'. Dessa var de inledande orden vid öppnandet av den 26:e ICM som ägde rum i Hyderabad i augusti i år. Analogin med ett motsägelsefullt axiomsystem är slående. Med detta i bakhuvudet kan jag med gott samvete skriva vad som helst om Indien med vetskapen om att det kommer att vara både sant och falskt.

## 1 Indien - geografi, historia och religion




Indien är ett vidsträckt och tättbefolkat land med en miljard invånare[1]. Hälften av dessa är 25 år eller yngre. På 50 år har dess befolkning mer än fördubblats. När man reser i Indien tenderar man således att stöta på folk vart man än sig vänder. En stor del av denna befolkning är mycket fattig, men med ett sådant befolkningsunderlag översätts även små relativa tal till stora absoluta och man kan även peka på en välmående medelklass på 50-100 miljoner människor, och en växande sådan, med de miljömässiga konsekvenser en sådan oundvikligen kommer att innebära. Kina och Indien är de enda stora länder där majoriteten av invånarna fortfarande bor på landsbygden. I fallet Indien rör det sig om 70 procent. Den större delen av den fattiga befolkningen återfinnes där och är därmed mer eller mindre osynlig för den västerländske turisten som har nog sjå med att förhålla sig till den fattigdom som möter denne på gatan ('You ain't seen nothing yet').

Den värld som möter besökaren i Indien är kakafonisk. Man bokstavligen översköljas av sinnesintryck. Det må vara av syn, hörsel, lukt och inte att förglömma - smak. Trafiken är kaotisk, och turister uppmanas på det bestämdaste att inte hyra bil i Indien, såvida inte en inhemsk chaufför ingår. (För de flesta av oss i västerlandet är en sådan lyx otänkbar, i Indien dock

[1] $1.18 \times 10^9$ enligt en uppskattning i april 2010

en lockande möjlighet.). Begreppet 'Road rage' existerar inte i Indien, ty anledningar till sådana dyker upp ett dussin i minuten, följdaktligen intar man en något fatalistisk attityd när man färdas i landet. Att vänstertrafik gäller sluter man av att ratten sitter på höger sida. Om man i väst möter en bil i fel riktning på motorvägen ringer man polisen som ögonblickligen ger sig ut på ett helikopteruppdrag. I Indien skakar man knappt på huvudet, uppenbarligen har trafikanten goda skäl för sitt beteende. På en indisk landsväg trängs bussar, lastbilar, och enstaka bilar med tre-hjuliga autorickshaws, motorcykligar, cyklar, oxdrivna kärror och fotgängare. Kors och tvärs mot trafiken finner man kor och getter. Det råder en obönhörlig hierarki. Ett fordon väjer inte för ett annat, såvida detta inte är större, och i så fall endast högst motvilligt och i sista stund. Att tuta är något vi i västerlandet har vant oss av vid. I den indiska trafiken är tutandet något som ständigt pågår och uppmuntras och utgör närmast något slags ekolodningsystem liknande fladdermössens. Tre saker är mycket viktiga för att överleva i den indiska trafiken, nämligen 'Good horn, good brakes, and good luck'.

Gatuscen i Madurai, Tamil Nadu

I västerlandet är sinnesintrycken sparsamma. Välordnade och förutsägbara. Det moderna livet syftar till att förenkla och begränsa dem. Räta linjer, rena ytor. Den informationsmängd vi får tillfälle att tugga i oss är måttlig. Alltför lite sinnesintryck och vi drabbas av 'sensory deprivation' och börjar hallucinera. I Indien finns ingen anledning att hallucinera. Den indiska vardagen är sin egen påträngande hallucination. Den överväldigande majoriteten av våra sinnesintryck är de visuella. Det är därför vi upplever

tanken på blindhet så mycket mera skrämmande än dövhet. Indien bjuder på ett överflödande ymninghetshorn av visuella upplevelser. Den indiska kvinnan, förutsatt att hon är hindu, går oftast klädd i sari, något som i väst ser något elegant för att inte säga affekterat ut, men som i sin allerstädesnärvaro ser väldigt naturligt ut på den indiska gatan. Den bärs inte bara av de välsituerade utan även av tiggarna.

Kvinnor i sari, Tiruchchirappalli, Tamil Nadu

Dessa dräkter har en enhetlighet i formen, men tillåter en outtömlig färgmässig variation. De utgör en av de mera visuellt behagliga intrycken. Mindre behagligt är de gräll a reklamskyltarna och butiksannonseringar som attackerar ens ögon. Fallfärdiga hus med mögelfläckade fasader, täckta av avflagnande pappersaffischer. Det finns få om ens några rena ytor, allt är ett 'klotter' och går in i varandra, typiskt nog saknas ofta avgränsningen mellan gångbana och körfält. Trafikens kakafoni av allehanda ljud har jag redan berört, till dessa kommer böneutropen från minareter, musiken från templen. Ringklockor och allehanda mekaniskt skrammel blandas med bräkande getter och högljudda samtal. Näsan får även sitt lystmäte, men som bekant vänjer man sig ganska snabbt. Stinkande avlopp och skräphögar noterar man knappast. Ej heller mänsklig och animal avföring. Maten är starkt kryddad av tradition (och nödvändighet?) men för den smått äventyrlige är inte detta ett problem utan snarare tvärtom. Faran för magbesvär i Indien är starkt överdriven. I själva verket är denna risk betydligt mindre vid gatuståndet eller den enkla syltan än den lyxigare restaurangen med mindre omsättning.

Indien är inte bara tättbefolkat det är även vidsträckt, och fortfarande finns det vildmark tätt intill bebyggelse[2]. Tigrarna för dock en tynande

[2]I norra delarna av Bombay finns det vilda leoparder, ibland måste kampuset på IIT (Indian Institute of Technology) stängas på grund av strövande leoparder

tillvaro utsatta för tjuvskyttar och försvinnande habitat. Bara några tusen återstår i Indien och snart lär de vara bara ett minne blott i sitt vilda tillstånd[3] även om nu den hårdföre Putin har engagerat sig i dess bevarande. Men det finns fortfarande vilda elefanter uppe bland bergen, inte bara i norra Indien utan även nere i Kerala och Tamil Nadu vid Indiens sydspets. För en turist är Indien en guldgruva i och med sin stora variation geografiskt och kulturellt. Och turisten försvinner i allmänhet i mängden och kan därmed lätt upprätthålla illusionen att denne i själva verket är en upptäcksresande. I norr gränsande mot Pakistan och Kina återfinner vi Himalayas snötäckta klippor. Dessa utgör födelsekällorna till Indiens heliga flod Ganga som skapat en vidsträckt slätt och rinner ut i ett delta vid Bengaliska viken. I väst finner vi öknar och torra stäpper (och en liten spillra av det asiatiska lejonet).

Teodlingar Top Station, norr om Munnar, Kerala

I dess mitt högplatåer, i sydväst västra Ghaternas välvda kullar med sina teodlingar och i syd-Kerala med sina 'Backwaters', palmkantade kanaler och laguner. Det bjuds på myllrande städer, Mumbai (Bombay) landets kommersiella centrum, Delhi med sitt muslimska arv. Tempelstäder med tungvrickande namn som Tiruchchirappalli i Tamil Nadu. Alla känner till Taj Mahal detta moghulmasoleum, som behandlades utförligt i ett tidigare Utskick. Till skillnad från de flesta upphaussade turistattraktioner gör denna en inte besviken när man äntligen besöker den. Därtill finns ett otal levande hinduiska tempel, alltifrån gigantiska komplex med tempelelefanter till små 'helgeskrin' närmast i gathörnen. Chennai (Madras) är en mångmiljonstad, men en stor del av den upplevs som en byar på landet, med den skillnad

[3]För hundra år sedan fanns det omkring 50 000 och tigerjakt var ett populärt nöje. Det finns i själva verket numera fler tigrar i världen i fångenskap än i fritt tillstånd. I Texas lär det vara ett populärt husdjur.

att alla ligger intill varandra. Indien är för att använda en sliten klyscha, kontrasternas land. Detta kan tolkas bokstavligt. I Mumbai kan man finna uthungrade hundar och småbarn söka föda på en avskrädeshög näst intill moderna skyskrapor.


Tågkupé i Indien

Hur färdas man runt i Indien? Detta beror givetvis på sträckan. Inrikesflyget har under de senaste åren utökats kraftigt. Mumbais flygplats som var ganska ruffig när jag först anlände 2004 har nu moderniserats. Hyderabads flygplats är minst lika lyxig som Arlanda. Det finns i Indien ett antal olika lågprisbolag, inklusive Kingfisher ursprungligen känt för sitt öl. (Vem skulle våga flyga med ett danskt bolag - Tuborg, som drivs av ölfabrikanten? Får piloterna dricka så mycket öl som de vill?). Men att flyga är knappast romantiskt. Det moderna flyget har tagit det mesta av romantiken ut ur resandet. Att resa skall vara äventyrligt.Vem vill vara med om en äventyrlig flygresa?

Nej i Indien skall man åka tåg på längre sträckor. Den indiska järnvägen som förstatligades 1951 utgör en av de största arbetsgivarna i världen med 1.6 miljoner anställda (d.v.s. närmare en på åtta hundra indier arbetar vid järnvägen). Järnvägsnätet är det största i världen efter USA, Ryssland och Kina. Drygt 60'000 km räls. 20 miljoner passagerare dagligen, och 2 miljoner ton frakt. 8000 lokomotiv, 50'000 passagerarvagnar, 200'000 fraktvagnar. De indiska järnvägarna stammar från mitten av 1800-talet och byggdes av britterna. Tågen är långa, två dussin passagerar vagnar eller mer är inte ovanligt. I de stora metropolerna är pendeltågen oumbärliga. Folk får inte rum i vagnarna utan hänger utanför i klasar. Många faller av och dör. Detta är ingenting för turisten att smaka på. Tågpendling mellan förort och centralort är sällan romantiskt. En riktig tågresa skall vara en långfärdsresa. Den hugade resenären kan välja mellan ett antal olika klasser. De två högsta klasserna är luft-konditionerade, lägre klasser har galler för fönstren istället för (smutsigt) glas. Detta har sina fördelar. Av första klass har jag ingen erfarenhet, men misstänker att denna har olika kupeer. Andra klass och lägre är öppnare utan dörrar och därmed även luftigare, precis som på den 'hårda' klassen på kinesiska tåg. Varje avdelning har sex eller fyra transversala bäddar, men dessutom finns det längsgående bäddar på andra sidan korridoren. Servicen är utmärkt, fria tidningar och måltider ingår i de lite lyxigare biljetterna. Annars genomkorsas tåget ständigt av järnvägens försäljare. Det rör sig om 'chai' (te), soppor och allehanda 'snacks'. Vissa

ambitiösare rätter serveras i aluminiumformar, som tyvärr ogenerat kastas ut genom fönster. Som turist känner man inga betänkligheter att utnyttja det varierade utbytet. Dock de högre kasterna i Indien har med sig sin egen mat. Detta är inte 'rasism' utan djupt inrotad vana. När Nehru åkte tåg i Indien hade han med sig sin egen restaurangvagn i vilken maten tilldelades enligt alla brahminernas 'kosher'regler. Tågen är i allmänhet på tid. Det finns alltid många förbindelser, och som utlänning kan man även utnyttja en speciell kvota. Att köpa biljett på egen hand vid en station kan vara nog så komplicerat och förvirrande, med långa köer, trängande människor, mycket skrik, och mycket pappersarbete. Men det är inte omöjligt. Jag och min fru har väl åkt drygt tusen mil på indiska järnvägar. Tågresor reserveras och ofta blir man satt på reservplats, men detta betyder i praktiken att man kommer med. På de indiska järnvägsstationerna vimlar det av män i röda tröjor. Dessa är mer eller mindre halvofficiella bärare. Har man en sovvagnsreservation är det bara att söka upp rätt vagn och där få sin plats bekräftad, ty i Indien klistras datautskrifterna på traktorsmatat papper på vagnens utsida. Jag vet inte hur lång denna tradition är, men den var redan iscensatt när jag var i Indien första gången januari 2004. Återigen en illustration av denna blanding av det ålderdomliga och traditionella och det moderna. Behöver jag tillägga att det är mycket billigt att åka tåg i Indien.


Kailasanatha tempel, Kanchipuram, Tamil Nadu

Indien kan inte förstås utan Hinduismen. Detta är en uråldrig religion, långt äldre än de andra världsreligionerna, och inte bara begränsad till Indien, utan var långt tidigare innan den muslimska erövringen även utspridd i nuvarande Indonesien[4]. Det är en tolerant och allomfattande religion som har en tendens att suga upp och assimilera andra religioner. Den fungerar även på många olika plan. Vi har dels den konkreta manifestationen i ett stort antal gudar till vilken man kan offra och utföra allehanda ritualer. Men även den förment enkle mannen som tillber en gudom har en ganska god uppfattning om innebörden i dessa akter. Den har även en mera sofistikerad sida med anknytningar till försokratisk filosofi och Parmenedis lära om alltings enhet. Platonismen grundar sig naturligt i dess mylla. Detta vimmel av gudar som bara är sinnenas manifestationer av en allomfattande princip. Ja även ateismen kan lätt beredas husrum inom hinduismen, som ekonomipristagaren Amartya Sen fick erfara som ung man när han diskuterade hinduismen med sin farfar som skrev en känd bok om just den religionen. Intimt förknippade med den hinduiska religionen är de episka berättelserna om det tidiga Indien - Ramayana och

[4]Påpekas skall dock att Bali ät fortfarande huvudsakligen hinduiskt.

Mahabaratha, författade på Sanskrit. Nutida filmatiseringar och TV-serier (med en aldrig sinande ström avsnitt) baserade på dessa mytologier bemöts fortfarande med ett enormt intresse hos den indiska allmänheten. Och Bollywood, världen största filmindustri, drar mycket av sin inspiration från dessa gamla sagor. Ja, mycket av den sagovärld vi konfronterades med som barn [5] lär ha sitt ursprung från Indien, som fortfarande kan upplevas som en saga bortom tid och rum. Det har spekulerats om i huruvida Aesopius (och därmed även la Fontaines) fabler kan härledes till indiska källor. Förresten upptäckten av Sanskrit och dess oväntade snarlikhet med västerländska språk gjordes under slutet av 1700-talet av den engelske domaren William Jones[6] och blev upptakten till den moderna filologin. För att återvända till religionen, har även kristendomen uråldriga anor i Indien, långt längre tillbaka i tiden än i Skandinavien. Enligt mytologin utvandrade aposteln Thomas till Indien på 50 talet e.Kr. Klart är att en kristen kyrka ha funnits i södra Kerala sedan femte århundradet. Kerala, känt för den högsta medellivslängden och den högsta läskunnigheten i Indien utan för att den skulle ha den högsta medelinkomsten, och för att under en lång tid varit kommunistiskt styrt[7], är kanske också den delstat som har högst procent kristna i hela Indien. Åtminstone fann jag förekomsten av kyrkor betydligt vanligare där än i andra delar av landet[8]. Det är symptomatiskt att de jesusfigurer och madonnor man träffar på i indiska kyrkor är något hinduifierade. Omvänt kan man se madonnadyrkan i katolska länder som en atavar av tidigare avgudadyrkan. Islam i Indien förtjänar ett eget avsnitt och jag återkommer till detta senare. Istället vill jag som hastigast beröra vissa avknoppningar från Hinduismen. Buddhismen är den mest kända och vanligt förekommande, men dock inte så vanlig i själva Indien (se nedan). Sikhismen är mera specifik för Indien. Detta är en uppenbarad monoteistisk religion som stammar från 1600-talet och Punjab-distriktet i norra Indien. Sikherna igenkännes på sina turbaner. De återfinnes över hela Indien ofta såsom taxichaufförer[9] De

[5] Åtminstone i min generation och äldre. Senare fruktar jag att barnen utsattes för torra och politiskt korrekta pedagogiskt utformade berättelser. Inga kungar och drottningar, inga magiska andar, inga halshuggningar.

[6] (1746-94) var son till en matematiker med samma namn, känd för att ha introducerat symbolen $\pi$. Jones kom till Indien 1783 såsom medlem av högsta domstolen i Bengalen. Han grundlade 'the Asiatic Society' året därpå, och skrev med den allätande aptit som fortfarande var möjlig på den tiden om indisk kultur, rättsväsende, botanik, litteratur och musik. Men det är hans insatser i filologin som gått till eftervärlden.

[7] Det finns två stora politiska allianser i keraliansk politik UDF (United Democratic Front) lett av Kongresspartiet och LDF (Left Democratic Front) styrt av det kommunistiska och marxistiska partiet i Indien (CPI(M)). För närvarande har LDF makten i Kerala.

[8] I själva verket är kristendomen den tredje största religionen i Indien, med 2.3 % av befolkningen. Detta lilla relativa tal översätts till 24 miljoner, varav den stora majoriteten är katoliker. Min observation stämmer till en del, den högsta andelen kristna i Indien återfinner man dock i Assam, i extrema nordöstra Indien dit få turister far.

[9] En kollega vid Chicago/Tata berättade att sin barndom var samtliga taxichaufförer

anses vara driftiga och tar vara på varandra. Man ser aldrig en sikh som tigger[10]. Jainiterna slutligen utgör en extrem sekt. De är emot tagande av allt liv; det må så vara insekters. Man kan se dem gå med en duk för munnen för att inte ofrivilligt svälja någon insekt. De har ofta en klocka för att varna djur. På tal om djur är kon fortfarande helig i Indien, åtminstone för hinduen. Dessa magra djur som oftast tycks lämnas helt åt sitt öde, strövar obekymrat omkring i den tätaste trafik, och alla väjer (hindu som icke-hindu).

Det vore något ambitiöst att redogöra för Indiens historia på ett litet utrymme, låt mig bara påminna om att det moderna Indien är en skapelse som formades ur det brittiska kolonialväldet i slutet av 40-talet. Detta innefattade inte bara nuvarande Indien utan även Pakistan, fram till 1971 uppdelat i ett väst och ett öst, det senare numera känt såsom Bangladesh. Därtill nuvarande Burma och vad vi förr i tiden kallade Ceylon, men numera Sri Lanka. Indien är inget buddistiskt land, även om den religionen uppkom i Indien för 2500 år sedan och hade till en början stor spridning. Buddistiska artefakter utgör en betydande del av vad den indiska arkeologin kan uppbjuda i fråga om museala skatter. Buddismen återfinner man numera i Tibet och Sri Lanka, liksom i större delan av Sydostasien. Även Kina och Japan har som bekant influerats av Buddismen. 80 procent av alla indier är hinduer, medan muslimerna utgör den i särklass största minoriteten. Som alla vet, eller bör veta, splittrades Indien upp i två delar vid självständigheten 1947, och en omfattande etnisk omflyttning och rensning ägde rum. Fortfarande bor det dock mera muslimer i Indien än i både Pakistan och Bangladesh (dock ej sammanlagt). Relationer mellan hinduer och muslimer är intim, därav både hjärtlig och mördande. Hinduer och muslimer firar ofta varandras festligheter för att då och då råka i luven på varandra och skära av varandras halsar. På senare år, i takt med den ökade globaliseringen av Indien, (dess ekonomi liberaliserades på 90-talet, vilket vi har anledning att återkomma till, med både spektakulära och skrämmande konsekvenser), har även en hinduisk patroism växt sig mycket stark och bland annat brutit det politiska maktmonopol kongresspartiet tidigare har utövat[11]. Indien är som bekant ett kast-samhälle. Dessa traditioner är uråldriga. Som bekant talas om fyra huvudkaster, präster, krigare, köpmän och bönder (i viss mening återspeglar detta den svenska ståndsriksdagen), därtill de kastlösa ('beneath contempt'). Prästerna, eller brahminerna, utgör den översta kasten, men inte nödvändigtsvis den rikaste eller mäktigaste. Brahminer är vegetarianer

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sikher.

[10] Jag har sett många! De vill ofta spå i handen mot betalning enligt min erfarenhet. `[korrekturläsarens anm.]` Men det senare är inte att tigga! `[red.anm]`

[11] Det nya partiet BJP (Bharatiya Janata Party - indiska folkets parti) grundades 1980 och är nationalistiskt, marknadsliberalt och försvarsvänligt och hade makten 1998-2004. Många av de namnbyten på indiska städer Bombay → Mumbai, Madras → Chennai, Calcutta → Kolkata, Trivandrum → Thiruvananthapuram, härstammar från den tiden.

och håller sig borta från allt vad som luktar kött. I det moderna Indien är de ofta de intellektuella och vi återfinner bland dem de flesta, men inte alla, internationellt kända indiska matematiker. Ramanujam är givetvis det kanoniska exemplet. Indiens förste nobelpristagare i litteratur - bengalen Tagore, var (självklart) brahmin, liksom dess senaste litteraturpristagare - Naipaul, bördig från Trinidad. De kastlösa däremot, eller Dalit (guds barn) som Gandhi kallade dem, återfinnes fortfarande bland dem som gräver i latriner. Den indiska konstitutionen främjar de kastlösa och många av dem har både uppnått politisk makt och rikedom, men en rätttrogen brahmin aktar sig noga för att deras orena skuggor skall falla på honom, även bokstavligen. Kastväsendet är djupt rotat i det indiska samhället, och förkastligt som det må vara, är det även naturligt. Kast är inte bara en form av social hierarki utan även en mera neutral klassificering. Kaster skall ses som yrkesgrupper underförstått att fäders yrken ärvs av söner. Kasten ger därmed en individ en identitet och ett förutbestämt system för att umgås. Det är knappast underligt att arrangerade giftermål fortfarande är mycket vanliga i Indien. Rasera allt detta och samhällets struktur bryter samman. En naturlig fråga som ställer sig för den nyfikne är hur det hinduiska kastsystemet kan leva sida vid sida med den muslimska världsåskådningen vilken i likhet med dess systerreligion den kristna inte erkänner sådana skrankor, ty inför Gud är vi ju alla lika. Jag har aldrig kunnat hitta någon explicit förklaring till detta. Vad som framförts är att en stor del av muslimerna utgöres av kastlösa. Detta verkar mycket rimligt. Men å andra sidan är detta en mycket förenklad förklaring, ty muslimerna utgör ingen underklass. I själva verket existerar det social kastsystemet även bland muslimer utan att nödvändigtsvis sanktioneras av religionen. Den enda kraft stark nog att kunna rasera dessa arkaiska strukturer är globaliseringen. Om det är en gud vi alla tycks tillbe lika passionerat tycks det vara Mammon.

Hinduismen är uråldrig i Indien medan islam är en senare import. Dess storhetsperiod inneföll under Moghulerna som härskade i landet från början av 1500-talet till början av 1700-talet. Dock skall man hålla i minnet att detta var inte den första muslimska invasionen av subkontinenten; ett flertal sådana hade inträffat tidigare under vår egen medeltidsepok. Moghulerna var ursprungligen ett centralasiatiskt turkiskt/mongoliskt folk, som civiliserades av perserna, och följaktligen blev persiskan dess hovspråk som skrevs sirligt i det arabiska alfabetet. Turkarna är nomader med ursprung just i centrala Asien. En del av dem vandrade västerut och erövrade Arabien och grundade det osmanska riket, andra gick österut mot Kina och grundade dess sista kejsardynasti. Moghulerna kan ses som dess södra gren. Moghulernas historia är färgrik och misstänker jag föga känd bland svenskar. Sex stora moghulhärskare bör man lägga på minnet. Babur, den ursprunglige erövraren, dennes son Hamuyan, sonsonen Akbar (den store), samt efterföljande Yahangir, Shah Jahan (som lät bygga Taj Mahal), och slutligen Aurangzeb som vi skall få tillfälla att återkomma till. Dessa äktade vanligen

hinduiska prinsessor och, som så många andra indiska erövrare, assimilerades de av ursprungsbefolkningen. Inga trän växer upp till himlen som bekant och Moghulernas välde blev för stort och det framväxande hinduiska imperiet Maratha i söder satte stopp för den expansion som tenderade till att lägga under sig hela subkontinenten.

Vilken roll spelande europerna under denna tid? En högst marginell. Mogulernas imperium var ett mäktigt rike som i sin materiella lyx nog kunde mäta sig med vilket samtida europeiskt land som helst. Varifrån kommer egentligen begreppet - Österns rikedomar? Portuguiser, holländare, engelsmän och fransmän höll sig till kustsstäder och sysslade med handel. Ingen människa lär vara så oskyldigt sysselsatt som när hon tjänar pengar. De europeer som sökte närmare kontakt med den indiska civilizationen underordnade sig den, ty vad hade de för val? De intog även en mycket tolerant hållning gentemot många av hinduismens mera extrema sedvänjor, såsom änkebränning och rituella mord på främlingar. Under 1800-talet stärktes det engelska inflytande, både kommersiellt och militärt, utnyttjande den indiska splittringen och mogulimperiets svaghet. England hade vid den tiden hunnit marginalisera Frankrike (vars galliska relikt - Pondicherry, forfarande återstår söder om Chennai) och representerades av dess ostindiska kompani, som gradvis tillskansat sig större och större befogenheter och vuxit ur sin roll som ett rent handelsbolag. En kritisk vändpunkt var det så kallade Sepoy upproret 1857.

Gandhi staty i Pondicherry

Indierna vände sig mot engelsmännen och massakerade en hel del av den vita europeiska befolkningen. Den engelska hämnden var oproportionerlig, som så ofta i krig, och dessutom utpräglat rasistisk[12]. Det gamla moghulimperiet, som hade reducerats till en formalitet och en esoteriskt hovkultur där poesin flödade, krossades fullständigt, och Delhi lades i ruiner. Den siste moghulens familj mördades inför hans ögon och själv försmäktade han i förödmjukande fångenskap. Därefter tog den engelska nationen över Indien, den blev den juvel i drottning Viktorias krona, som den engelske premiärminsitern Disraeli kunde förära sin tysktalande monark. Den engelska överheten - the British Raj, skulle vara för evigt, men varade knappt hundra år. Den indiska frihetsrörelsen under första halvan av 1900-talet känner vi alla till.

Gandhi är dess obestridde portalfigur. Den bild vi förknippar med honom

[12]Jan Myrdsal skriver (i 'Indien väntar') att inte ens bödlarna inom SS ådaglade sådan entusiasm i sitt slaktande som de brittiska officerarna gjorde. Dock tilläggas skall, att indiska trupper stred på bägge sidor. Speciellt de legendariska Gurkhas var hela tiden lojala med Britterna.

- den magre asketen i ett höftskynke som sitter och spinner vid sitt hjul, är givetvis en konstruktion. Gandhi i unga år var verksam i London och Sydafrika. Han var då en prydlig ung man i kostym. Jämte honom hade vi Nehru, en annan brahmin, som blev det självständiga Indiens första president (en självständighet som förmörkades av det samtida bildandet av Jinnahs[13] muslimska seperatistiska stat) och som uttalade de ofta citerade orden om när midnattens timma har slagit kommer Indien att vakna upp till sin självständighet. Nehru hade utbildats vid Oxford och var en typisk representant för den Anglo-Indiska eliten. Hans far hade spelat en framträdande politisk roll och när sonen växt ur sina playboylater trädde han in i sin faders parti - Kongresspartiet[14] som under den engelska tiden spelat en liknande roll som den som ANC spelade i Sydafrika under apartheid (och även därefter)[15]. Nehru var följdaktligen fängslad under ett par omgångar under sina första år som självständighetskämpe. Kongresspartiet var under de första decennierna av den efterföljande självständigheten det dominerande partiet i Indien med en klart antisekterisk profil (d.v.s. inriktat på att motarbeta etnisk profilering och nedmontera kastväsendet) dedikerad till att lyfta de fattiga massorna ur sitt armod och genomföra en industralisering av landet[16]. Som förebild vände sig Nehru mot Sovjet och under den första tiden initierades femårsplaner. Men Indien blev ingen diktatur av sovjetiskt snitt, Nehru gjorde en klar åtskillnad mellan ekonomi och politik, och trots de stora spänningarna i landet har det överlevt som en fungerande demokrati i kontrast till militärdiktaturernas Pakistan. Indien hade dock under hela kalla kriget goda förbindelser med Sovjet, medan USA typiskt nog satsade på Pakistan som sin häst. Nehru spelade under sina år som premiärminister en mycket aktiv internationell roll och hävdade de

Oxar i Vellore, Tamil Nadu

[13]Muhammad Ali Jinnah (1876-48) var ledaren för den 'muslimska ligan' sedan 1913 och formade i början av 40-talet idén om en muslimsk stat, inte nödvändigtsvis en territoriell sådan. Planerna på en bona-fide fysisk separation tog dock gradvis form under decenniet.

[14]Den minnesgode läsaren associerar Nehru med en vit tygmössa. Denna kan man fortfarande se i Indien. Den refereras till såsom kongressmössan.

[15]Indian National Congress (eller 'Congress party') är en av de äldsta demokratiska partierna i världen och grundades 1885 av medlemmar i det occulta sällskapet 'Theosophial Society'. ANC är en efterapning från 1923 men går tillbaka till en tidigare akronym SANNC (South African Native National Congress) från 1912

[16]En begynnande industrialisering av Indien hade begynnt redan i början av 1800-talet, främst inom textilindustrin, men denna hade kvävts av engelsmännen

alliansfria staternas roll mellan supermakterna. Han brottades med stora problem dock. Framförallt Kashmirkrisen, som ännu inte är löst har utgjort ett öppet sår i över sextio år. Detta var ett arv från den famösa partitionen. Kashmir med hinduisk kung har en huvudsakligen muslimsk befolkning. Men även förhållandet med Kina, som ledde till kinesiska erövringar uppe i Himalaya, var åtminstone vid den tidpunkten potentiellt mycket allvarliga. Fortfarande är gränsdragningarna kontroversiella. Kashmir ledde så småningom till ett antal militära konflikter mellan Indien och Pakistan som ett par gånger utmynnade i regelrätta krig, framför allt strax efter Nehrus död (1964). Det sista, hösten 1971, har vi redan refererat till, och inträffade under hans dotter Indira Gandhi regeringstid. Relationen mellan de två numera kärnvapenbestyckade rivalerna är fortfarande mycket spända. Visserligen ägde en markant uppmjukning rum i början av 2004 och hopp tändes om en varaktig normalisering. Indiska myndigheter anklagar dock Pakistan för att delaktighet i den terroristmassaker som inträffade i Mumbai hösten 2008.

Elefant i Devarajaswamitemplet, Kanchipuram Tamil Nadu

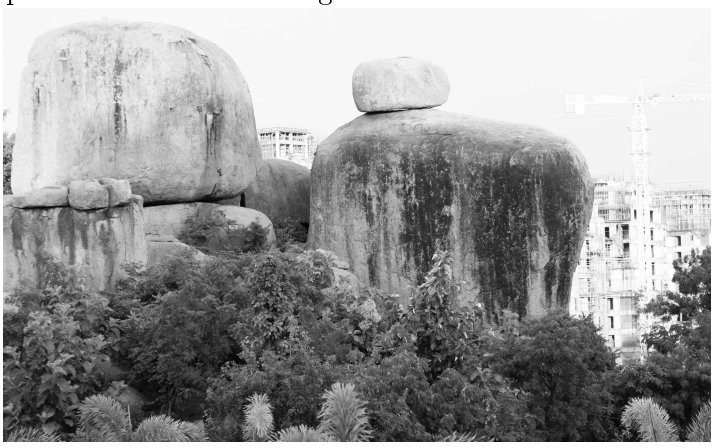
Till de mindre problemen för Nehru under de första åren hörde en konsolidering av den indiska staten, vilket innebar dels det fullständiga inlemmandet av Hyderabad[17] och dels det oblodiga övertagandet av Goa fån portugiserna. Det senare väckte vissa sarkastiska kommentarer när det begav sig, men är nu helt bortglömt. Nehru efterträddes så småningom av sin dotter Indira Gandhi (ingen relation till Mahtma Gandhi) vars järnhårda hand och undantagslagar under 70-talet fick en del ögonbryn att lyftas. Ett mycket impopulärt projekt var den mer eller mindre frivilliga steriliseringen, som dock inte ha kunnat stävja den befolkningsutveckling vi inledningsvis berörde. Indira Gandhi mördades som bekant hösten 1984 av sina sikhiska livvakter, vilket reulterade i en slakt på sikher i New Delhi den närmaste tiden därefter. Sedan dess har en av hennes söner Rahiv Gandhi varit premiärminister, och även han mördades, denna gång vid ett självmordsattentat på en valturne i södra Indien 1991. Sonen Gandhi är annars aktuell i samband med Boforsskandalen, vilken satte Sverige på kartan för de flesta in-

[17] Hyderabad var aldrig formellt del av den Brittiska överheten och valde vid självständigheten att inte gå med i Indien utan föredrog att antingen vara självständigt eller gå med i Pakistan, ty Nizamen som styrde var muslim. Nehru ansåg detta vara strategiskt oacceptabelt och ett inbördeskrig stod snubblande nära, detta avvärjdes dock genom en effektiv blokad och redan 1948 blev Hyderabad en del av den indiska unionen.

dier. Mordet hade dock inget samband med detta, utan var snarare relaterat till det pågående inbördeskriget i Sri Lanka, som först på våren 2009 fick ett (mycket blodigt) avslut. Klanen Gandhi är ännu inte uträknad i den indiska politiken, efter de bägge sönernas död[18] har fanan burits vidare av en av svärdöttrarna - Sonia Gandhi, en italienska. Barnbarnen har nu börjat växa upp och så försiktigt prövat sina vingar. Den nuvarande premiärministern - sikhen Manmohan Singh[19] medlem av Kongresspartiet initierade under sin tid som finansminister i början av 90-talet en liberalisering av den indiska ekonomin, som har inneburit något av en revolution, åtminstone för medelklassen. En ung indisk kollega till mig berättade att man alltid sett på sitt land som stagnerat och där ingenting hände, men att under senare år har denna syn radikalt förändrats. Denna utveckling har, som jag antytt sina baksidor, en annan ung indisk matemaiker jag träffade vid Tata institutet hösten 2008 ondgjorde sig över att professorer nu har bilar. Det hade varit otänkbart förr i tiden.

## 2 Hyderabad

Hyderabad är en mångmiljonstad i Södra Indien, placerad på en subkontinentens höjdplatå, ungefär halvvägs mellan Chennai och Bombay. Det är Indiens sjätte stad till folkmängd och utgör huvudstad i delstaten Andra Pradesh. Näst till Bangalore anses det var den ledande IT-staden i Indien. Det omgivande landskapet är säreget, torrt och dominerat av stora runda klippblock som även söker sig in i staden.



Invanderande klippblock

Jag besökte Hyderabad första gången i januari 2004. Jag tog tåget från Chennai upp till Mumbai och passade på att göra ett par dagars uppehåll i denna stad med historiska anor. Chennai och Bombay har korta historier och relaterar huvudsakligen till Indien som handelsplats med västerlandet, Hyderabad är annorlunda, även om dess historia, säg jämfört med Delhi

[18] En äldre son omkom i en privatplans flygolycka medan modern ännu levde.
[19] Alla sikher heter Singh i efternamn. 'Singh' betyder lejon.

och Uppsala för den delen är ganska kort. Den grundlades i slutet av 1500-talet Jag anlände under en av Indiens tre nationella helgedagar - Republic Day. Till synes allt var stängt. Plåtjalusier neddragna överallt och någon karta över staden stod inte att uppbringa. Jag irrade omkring i hettan och kom så småningom ner till Musi floden som ringlar sig igenom staden. Jag korsade en bro, övervältigades av ammoniumstanken från en nedkissad mur och blev därefter erbjuden lift av en snäll och fet farbror i en Autorickshaw. Han förestod en antikvarisk bokhandel och undrade om jag hade författat någon bok (vilket gav mig dåligt samvete). När den puttrande autorickshawn svängde runt ett par gathörn uppenbarade sig ett par väldiga portaler, en enorm folksamling, och jag tyckte mig ha hamnat mitt i Tusen och en Natt. Den snälle farbrorn bjöd på skjutsen och jag gick av. Detta är 'Gamla Stan' i Hyderabad, dominerat av 'landmärket' Charminar. 'Char' betyder fyra på hindi, och 'minar' refererar uppenbarligen till 'minaret'.


Charminar, Old Town Hyderabad

Fyra minareter står såsom hörn i en upphöjd kvadratisk byggnad[20]. Givetvis klättrar man upp efter att ha betalat en icke försumbart antal rupier, ty utlänningar betalar betydligt mer än de inhemska, ett förfarande som sprider sig runtom i tredje världen, inklusive Ryssland. En trång spiraltrappa leder upp till mittinsatsen. Härifrån har man en utsökt utsikt över marknaden nedanför. Jag vandrade omkring ett par timmar i vimlet och fascinerades av alla dessa kvinnor med nikab. Heltäckta sånär som en springa för ögonen. Jag fann detta på den tiden exotiskt och i överenstämmelse med den allmänna Tusen och en Natt atmosfären. Hyderabad är pärlornas stad. Det är tydligen vad man skall handla här. En annan sevärdhet i Hyderabad förutom Charminar är Golconda Fort, som anlades i samband med grundandet av staden. Detta fort är nu en ruin, en gång i tiden omringad och belägrad och slutligen intaget och reaserat av samme Aurangzeb, vars namn jag bad läsaren hålla i minnet i det föregående avsnittet. Detta fort inspekterade jag givetvis vid ett senare tillfälle under min tre dagar långa vistelse. Däremot de olika mausueler som inhyser kropparna till de avlidna inom Qutb Shah dynastin som grundade Hyderabad hoppade jag då över. Istället besökte jag stadens förnämliga djurpark, kanske Indiens främsta.

[20] En bild på denna återfinnes i ett tidgare nummer av Utskicket 2006:1 vill jag minnas.

Drygt sex och ett halvt år senare befinner jag mig ånyo i Hyderabad. Denna gång åter med tåg men från Bangalore och med min fru som sällskap. Det är tidigt på morgonen, det är mörkt och förhållandevis folktomt. Vi vet inte var någonstans denna tågstation befinner sig i staden. När vi kommer ut ur stationen omringas vi av allehanda påstridiga chaufförer. Jag ger dem namnet på hotellet - Walnut hotell, och ett pris överenskommes mellan min tuffare fru och chauffören och vi stuvar in oss i den trånga auto-rickshawn, något som under vår tre veckor långa tur i södra Indien hade blivt en invand rutin. Denne stannar dock till lite senare och begär att få mera uppgifter och skakar sedan på huvudet. Det är för långt. Min fru får honom att köra till närmaste busstation och där lyckas vi fråga oss fram till rätt buss. Det ligger sannerligen långt borta. Gryning hinner bli dag innan vi plötsligt, närmast ute på vischan, far förbi just ett hotel med namnet Walnut. Kan det verkligen vara rätt? Det ser ganska obetydligt ut, och framför allt isolerat. Vi stiger av vid nästa busshållplats och efter att ha förgäves försökt få en färd tillbaka för hyggligt pris med taxi eller rickshaw, hoppar vi på första bästa buss i motsatt rikting. Det visar sig vara det rätta hotellet. Det billigaste jag hade funnit på listan.

Registration desk, HICC

ICM i Hyderabad 2010 äger således rum i vad som närmast kan beskrivas som en hangar långt utanför stadskärnan. Det refereras till som HICC (Hyderabad International Convention Center). Att ta sig dit med allmänna kommunikationsmedel är omöjligt, med taxi eller autorickshaw förhållandevis dyrt, återstår endast den shuttle service de indiska arrangörerna har ordnat. Detta betyder att man isoleras, och kontrasten med Beijing 2002 är slående. Då hade vi alla delegater fria pass på bussar och tunnelbanor, det var bara att visa sin namnskylt som dinglade på bröstet. Hela Beijing låg öppet för ens fötter. Inte Hyderabad. Man skulle lika gärna ha kunnat hålla

till på Månen. Av den omgivande indiska verkligheten märker man knappast ett dyft. Och de delegater som var inhysta i det lyxiga hotellet i anslutning till hangaren, skulle, om de inte var initiativrika, inte uppleva något annat av Indien än transporten mellan flygplatsen och hangaren. Detta var en besvikelse, men tydligen var denna hangar den enda plats i hela Indien som stod att uppbringa, stor nog att kunna inhysa alla de delegater man förväntade sig vara närvarande under öppningsceremonin.

Venuen, HICC

Vad består en matematisk konferens av denna storlek av? Jag menar om man skall anlägga ett rent logistiskt perspektiv. Först och främst måste man transportera deltagarna från sina spridda husrum till kongressvenyn. Detta fungerade även om det var kaotiskt och man brukade förtvivla till sista stund[21]. Sedan måste man utfordra dem. Detta däremot fungerade utmärkt. Maten var knappast spännande, men den distribuerades snabbt utan långa köer, men skulle man sitta så var det på golvet, annars fick man stå vid bord. Te och kaffe fick man även vid uppvisande av kupong, men på kakor kunde man få sitt lystmäte gratis. Sist men inte minst, måste deltagarna slussas in och ut ur föreläsningssalar. Bortsett från den jättelika salen, fanns det även ett antal andra. Dessa var lätta att finna och var kompakt belägna. I tillägg till detta fanns det 'helpdesks' och ett väl tilltaget cyberkafé. Det var lite si och så med kontakter på väggarna, men jag hade inga större problem med min 'laptop'. Det trådlösa nätverket fungerade för det mesta.

Annars slogs man av de rigorösa säkerhetsrutinerna. Att man utsätts för flygplatskontroll vid invigningar är numera något man räknar med. När allt kommer omkring brukar dessa bevistas av statsöverhuvuden[22]. Nytt var dock i Hyderabad att skyttelbussarna kontrollerades vid infarten, och vid själva ingången till venyn, fick man gå igenom en kontroll av sina väskor ibland med lite kroppsvisitering som följd. Man kan i viss mån förstå detta med tanke på den massaker som ägde rum i Mumbai november 2008. Men skall det även bli framtidens melodi?

[21] En indisk delegat anmärkte syrligt att hade detta inträffat i Kina, hade den ansvarige skjutits.

[22] Ett stort säkerhetspådrag i samband med presidentens ankommande ägde rum i hela Hyderabad. Jag väcktes mitt i natten av att det knackade på dörren. Naken gläntade jag på densamma för att finna ett par beväpnade soldater utanför. Trots deras mundering intog jag en ganska irriterad attityd och de lommade så småningom iväg.

# 3 ICM

Huvudpunkten, och kongressens klimax, är öppningsceremonin. Därefter må cynikerna säga att det går nedför. Inget annan tilldragelse under en kongress samlar så många åhörare och åskådare. Med tanke på de rigorösa säkerhetsbestämmelserna hade vi uppmanats att komma i god tid. Skyttelbussen från mitt hotell skulle inte dock fara förrän ganska sent, torts mina envetna försök att tidigarelägga avgången. Ivrig och orolig haffade jag därmed en autorickshaw ute på vägen utanför hotellet och kördes med vinglande fart till kongresscentret. Följaktligen fick jag sitta och vänta en lång tid på tilldragelsen.

Indiens president är en kvinna - Prathiba Patil, som har hållit denna position sedan 2007. Ett stort nummer görs av att hon är kvinna, och indiens första kvinnliga president därtill. Glömmer man inte då att under en lång tid var en kvinna Indiens mäktigaste 'man' - Indira Ghandi. Hon, Patil, anlände så småningom med sitt entourage, under det att alla stod upp när den indiska nationalsången spelades. Bland hennes entourage märktes en man som bar en liten låda med handtag. Vad innehöll denna låda? Koderna för avfyrningen av den indiska känrvapenarsenalen? Den amerikanske presidenten har alltid dessa tillgängliga, men den indiska presidenten har en enbart ceremoniell roll. 'Master of ceremonies' var en kvinna, som höll en ypperlig presentation av Indien, och vars inledande ord jag har som sagt låtit mig inspireras av. Efter henne blev det plågsamt att lyssna på alla de tal som hölls av varjehanda luminarious på podiet, inklusive presidenten själv. Endast en av dessa hade vett att hålla mun, och det var Louis Nirenberg. Vad hade han förresten på podiet att göra?

Vad den månghövdade publiken sitter och väntar på är snarare presentationen av Fieldsmedaljörerna än talen. Denna gång var det återigen fyra utvalda, den lille vietnamesen Ngo Bao Chau, vår egen ryss Smirnov (som nästan en gång i tiden var svensk), israelen (den förste) Lindenstrauss, samt den extremt välklädde fransmannen Villani, skrudad i vad som såg ut som en vecklad haklapp. Närmare presentation av dessa står att finna annorstädes i Utskicket. De fick sina medaljer ur presidentens hand, och säkert blåstes det fanfarer, men om detta kommer jag inte ihåg. Eftersom prisutdelningen är en sådan succé, kan det inte skada med lite andra priser dessutom. Nevanlinna-priset är etablerad sedan ett antal år. Det ges till en yngre förmåga inom datalogin, och en sådan kan nästan känna sig som fieldsmedaljör. Gauss-priset däremot delades ut för första gången 2006 i Madrid. Här gäller inga åldersgränser. I Madrid var pristagaren Kiyoshi Ito 91 år gammal och fick representeras av sin dotter, I Hyderabad hade däremot den ungdomlige (70+) Yves Meyer inga problem med att själv ta emot priset. Meyer bidrager till Utskicket med en liten essä om elitutbildningen i Frankrike[23]. Och i år

[23]Detta är en liten del av en längre intervju jag håller med honom, och som skall

hade ytterligare ett pris till minne av Chern instiftats. Dess förste recipient var Louis Nirenberg. (Detta förklarar delvis hans närvaro på podiet.) Efter utdelningen så tågade Indiens första dam ut under förväntad pomp, och mannen med den hemliga lådan försvann likaså i hennes kölvatten (och då behövde vi inte bekymra oss som den lådan mera).

Efter ceremonin anordnades en presskonferens med pristagarna dit jag smög mig in i min egenskap av journalist. Det var mera välbesökt än motsvarande i Madrid, då ändå Perelmans frånvaro hade gjort ett visst eko utanför den matematiska världen. Pristagarna ansattes av ett antal trevande och förvirrade frågor på vilka det var knappast möjligt att svara vältaligt och engagerat. Efter spektaklet bjöds det på stående buffetlunch, kulinariskt överlägsen vad som annars var tillgängligt. Pristagarna skrevs sedan upp i var sin spalt i 'Reflexions', kongressens eget nyhetsblad som sedan skulle utkomma varje dag tryckt på glättat papper och tillgängligt i dingnande högar vid föreläsningssalen eller vid 'help desk'. På eftermiddagen gavs de sedvanliga 'laudations' om Fieldsmedaljörernas arbeten. Inget av dessa föredrag var minnesvärda, somliga var under all kritik i fråga om så elementära saker som synkronisera overheaden med det muntliga framförandet. Jag skall inte nämna några namn, även om det är ett som jag speciellt har i åtanke. Bill Casselman, omslagsredaktören för Notices, inkommer på annan plats med en rapport om eländiga föredrag. Slutligen gavs sent på eftermiddagen den första 'Abel Lecture', naturligt nog av probabilisten Varadhan, indier och tillika Abelpristagare 2008.

En 'Congress' av detta slaget bjuder även på ett antal sociala begivenheter. En gemensam middag anordnades, och efter mycket om och men lyckades hungriga deltagare bussas dit. Maten tog däremot slut ganska snart, och enligt rykten började vatten sprutas på upprörda middagsgäster för att lugna ner dem. Jag var tidigt ute och missade den påstådda dramatiska avslutningen, dock inte maten. I tillägg även några kulturella program, som indisk dans och musik. En teaterpjäs 'A disappearing number' uppfördes av ett ambulerande brittiskt teatersällskap på en närbelägen teater i Hyderabad. Denna föreställning vände sig till allmänheten, men ICM hade reserverat två kvällar. Pjäsen handlade om mötet mellan Ramanujam och Hardy och berättades med flashbacks och rörliga bilder projicerade på bakväggen. Den var allmänt suggestiv och tycktes ha uppskattats, även om en del indier finner att Ramanujam och hans liv står dem upp i halsen. Ett stort nummer ges av Ramanujams identitet

$$1 + 2 + 3 + 4 + \cdots = -\frac{1}{12}$$

som man måste vara ett geni för att inte skratta åt.

Världsmästaren i schack heter numera Viswanathan Anand och är indier. Han sattes att spela simultanschack mot 40 matematiker (John Ball, f.d.

publiceras i EMS Newsletter

IMU president fick förmodligen kalla fötter och lät i sista stund sin son överta hans stol). Alla matematiker förlorade utom en viss Srikar Varadaraj som lyckades erhålla remi.

Indiskt schack (och matematik?) geni

Denne indier är endast fjorton år gammal, och, misstänker man, något av ett matematiskt underbarn dessutom. Hur är det, är schack och matematik så närbesläktade? De som organiserade hela spektaklet var tydligen av den åsikten, och Anand själv tycktes instämma. Han hade, enligt en intervju i 'the Hindu' varit någorlunda intresserad av matematik när han gick i skolan, men sedan tog schacket all hans tid i anspråk. Dock så fann han Steven Strogatz krönikor i matematik i NYT intressanta och beklagade att dessa tydligen nu gjort ett uppehåll. Anand, och därmed även ICM, blev nationellt uppmärksammad under uppträdandet, ty han och David Mumford, hade blivit utvalda att bli hedersdoktorer vid Hyderabad University. En byråkrat hade emellertid dragit i nödbromsen och hävdat att ingen av dem var indiska medborgare. Detta fördröjde ärendet och ceremonin inställdes. Anand var upprörd över att hans indiska medborgarskap betvivlades och vägrade att ta emot utmärkelsen. Detta uppmärksammades av medierna och en kväll utgjorde detta topp-nyheten på TV. Anand jämfördes med en idrottsman och Indiens oförmåga att uppskatta sina sportstjärnor beklagades. Det hela illustrerades med vignetter från kongressen. Mumford nämndes inte på TV, däremot i de nationella tidningarna som rapporterade.

Allt som äger rum på en ICM står inte i det officiella programmet. Kanske det mest spännande händer 'off-stage'. Små partyn hålles i största hemlighet, dit man inte har tillträde såvida man inte är officiellt inbjuden. Av förklarliga skäl har jag därmed inte så mycket att förtälja från dessa, förutom att jag i min oförvägne kollega Osmo Pekonens sällskap lyckades tränga mig in ibland, hävdande att jag hörde till pressen. Tack vare detta kunde jag njuta av en överdådig fyra rätters bankett som den Sydkoreanska delegationen anordnade. Sydkorea kommer nämligen att anordna ICM 2014, och man fick intrycket att de tänker överglänsa alla tidigare ICM. Av banketten att döma verkar detta inte helt otroligt. Detta löfte kan utgöra en naturlig slutpunkt för denna rapport.

**Lästips**

Den unge skotske historikern William Darymple har skrivit mycket om Indien. *'The White Mughal'* och *'The Last Mughal'* relaterar till Mogulperioden. Han har även i *'The City of Djinns'* skrivit om sitt år i New Delhi.

V.S.Naipaul har i sin trilogi bestående av böckerna *'An Area of Darkness'*, *'India: A Wounded Civilization'* och *'India: A Million Mutinies Now'* rapporterat om sina möten med Indien. Dessa är skrivna under respektive 60-,70- och 80-talet.

Boken om hinduismen är författad av K.M.Sen och har titeln 'Hinduism'.

Mogulen Babur har skrivit en mycket uppskattad självbiografi som är tillgänglig i engelsk översättning i Penguin.

S.Mehta har skrivit om Bombay *'Maximum City'*.

Som tidigare nämnts besitter Indien en mycket rik sagoskatt. De episka verken *Ramayana* och *Mahabaratha* överträffar åtminstone i omfång Homeros, Bibeln och de isländska sagorna sammantagna. Det är däremot svårt att finna fullständiga engelska översättningar. För att 'förstå' Indien bör man dock ha en viss förtrogenhet med dem.

Gudom, Sri Meenakshi templet, Madurai, Tamil Nadu

# Fieldsmedaljörerna

*Ulf Persson*

Som bekant initierades Fieldsmedaljen av den kanadensiske matematikern John Charles Fields (1863-32) vid kongressen i Toronto 1928. De två första medaljerna delades ut i Oslo 1936 till Lars Ahlfors och Jesse Douglas. Sedan kom andra världskriget emellan, men sedan 1950 har det delats ut medaljer vart fjärde år. Till en början med var antalet sådana begränsade till två, dock efter 1966 har upp till fyra medaljer getts ut. Under årens lopp har det därmed hunnit bli en del, och jag tvivlar på att alla (om ens någon) läsare på rak arm är förmögen att ge en komplett lista av medaljörer. Det totala antalet är i och med årets kvartett uppe i 52 stycken. Precis som med Nobelpriset i litteratur innehåller listan ett antal uppenbara luckor, huruvida det även i likhet med det famösa litteraturpriset innehåller ovärdiga kandidater skall vi inte spekulera om[1]. Många av pristagarna är så kallade 'hushållsnamn' och kända av alla matematiker. Jag tänker på namn som Schwarz, Serre, Atiyah, Grothendick och andra (varje matematiker har väl sin lista över vilka som är allmänt välkända). Ingen norrman har väl undgått att känna till att Selberg (50) fick medaljen, liksom varje svensk är väl medveten om att Hörmander (62) likaså är en medaljör. Finnarna var dock först. Serre är fortfarande den yngste matematiker som blivit hedrad; han var ännu inte fyllda 28 vid tiden för utdelandet. Jag misstänker att hans rekord kommer att bli svårt att slå. Av Fieldsmedaljörer kommer 13 från USA. 11 från Frankrike och 9 från Ryssland. Storbrittanien har sex, Japan har tre och lilla Belgien två (Deligne och Bourgaine.) Inga andra länder har mer än en. Anmärkningsvårt är att Tyskland bara har en (Faltings). Detta är givetvis en följd av att Fieldsmedaljen började först på allvar att utdelas under andra halvan av 1900-talet. I slutet av artikeln ges ett fullständigt facit över samtliga medaljörer, samt för den intresserade ytterligare statistiska uppgifter av tvivelaktigt värde.

Fieldsmedaljen, som nu myntats i över 50 kopior (jag vet inte om någon myntades för Perelman, och i så fall var den nu återfinnes) består av guld. Den har designats av den kanadensisk-amerikanske skulptören Robert Tait McKenzie (1867-38). På ena sidan finner man ett porträtt av Arkimedes på andra sidan en latinsk inskription. Medaljens kant har ägarens namn inristat. För att läsaren skall få en känsla för medaljen som ett rent fysiskt objekt kan vi nämna att dess diameter är 63.5 mm och dess tjocklek 2.5 mm, samt att den väger 160 g. Jag är Cedric Villani mycket tacksam för att efter

[1]Enligt rykten skulle det även i Vancouver 1974 ha delats ut fyra medaljer, men den ryske medlemmen i priskommitten inlade sitt veto mot Manin och Arnold. Ryssarna visste minsann vilka som var de värdiga ryska kandidaterna. Man noterar att på grund av andra världskriget så försvann två ICM och fyra potentiella medaljörer som sedan föll för fyrtioårs strecket. Det står var och en fritt att spekulera i vilka som skulle ha kunnat hedras.

begäran ha utfört dessa mätningar och vidarebefodrat dess resultat till mitt och läsarnas fromma. Den naturliga frågan är huruvida medaljen är av rent guld. Problemet är att medaljen är ingen ren cylinder, som min sagesman påpekar, den redan nämnda Arkimedes reliefen (vems relief kunde ha varit bättre lämpad i samband med denna fråga?) lägger till en utbuktning, som Villani uppskattar till mellan en fjärdedel och en tredjedel av den renslipade cylinderns volym. Den förväntade vikten blir då enligt dennes uträkningar mellan 191 g och 204 g. Guldets renhet räknas som bekant i karat. En karat är en tjugofjärdedel, så rent guld är 24 karat. Karat tar ingen hänsyn till de andra legeringsmetallerna. Dessa är typiskt silver eller koppar, ibland spetsat med en knivsudd zink eller två för hårdhetens skull. Om vi nu betecknar med $G$ guldets densitet och $C$ den andra metallens densitet och $\alpha$ bråkdelen av den förvänade vikten, samt antar att volymen är additiv vid legeringar finner vi lätt att antal karat beräknas enligt formeln (vi talar om viktdelar)

$$24(\frac{\alpha G - C}{\alpha(G - C)})$$

Om legeringsmetallen är koppar kommer karaten att ligga mellan 20 och 18.3, medan om den är silver kommer det att röra sig om mellan 18.45 och 16.15. Jag misstänker att medaljen är 18K (en standard guldlegering) vilket betyder att vi har 120 g äkta guld (samt även silver). Guldpriset rör sig om cirka 40 dollar per gram, så vi talar om närmare 5000 dollar i guldvärde. I tillägg till medaljen får vinnaren 15 000 dollar i kontanter. Inte att förakta men i prissummesammanhang symboliskt.

Följande matematiker fick Fieldsmedaljer i Hyderabad.

**Elon Lindenstrauss** (Hebrew University, Israel)
*for his results on measure rigidity in ergodic theory, and their applications to number theory.*

**Ngô Bao Châu** (Université Paris-Sud, Orsay, Frankrike)
*for his proof of the Fundamental Lemma in the theory of automorphic forms through the introduction of new algebro/geometric methods.*

**Stanislav Smirnov** (Université de Genève, Schweiz)
*for the proof of conformal invariance of percolation and the planar Ising model in statistical physics.*

**Cédric Villani** (Institut Henri Poincaré, Paris, Frankrike)
*for his proofs of nonlinear Landau damping and convergence to equilibrium for the Boltzmann equation.*

Nedan följer korta biografiska beskrivningar av var och en av pristagarna samt deras arbeten. I slutet bifogar jag deras svar på förfrågan huruvida

de var överraskade över att få medaljen. Dessa svar utgör inledande delar av längre intervjuer jag gjort med dem och som kommer att publiceras i decembernumret av EMS Newsletter (och möjligen något senare i Notices of the AMS).

Foto: Ulf Persson

**Elon Lindenstrauss** Född i Jerusalem 1/8 1970. Son till den kände israeliska matematikern Joram Lindenstrauss (f.36). B.Sc. i matematik och fysik 1991, M.Sc i matematik 1995, Ph.D 1999. Samtliga examina vid Hebrew University. Hans handledare var Benjamin Weiss, och titeln på hans avhandling *Entropy Properties of Dynamical Systems* Han har varit medlem av IAS (Institute for Advanced Study) 99-01, Szegö Assistant Prof vid Stanford 01-03, gästforskare vid Courant Institute 03-05 och professor vid Princeton 04-10. Sedan 2008 innehar han en professur vid Hebrew University.

Han har fått ett otal medlajer och utmärkelser sedan år 2000 och jag nöjer mig med att nämna Clay Mathematical Institute Long Term Prize Fellow (03-05), Salem priset 03 samt EMS Prize 04.

Han arbetar inom ergodteori med tillämpningar inom talteorin. Han har gjort framsteg på Littlewoods förmodan (1930) att $\liminf_{n\to\infty} n\|n\alpha\|\|n\beta\| = 0$ för två godtyckliga reella tal $\alpha\beta$ och där $\|x\| = |x - [x]|$ genom att tillsammans med Einsiedler och Katok att visa att undantagsmängden av trilskande par $(\alpha, \beta) \in \mathbf{R^2}$ har hausdorffdimensionen noll.

Littlewoods förmodan kan omformuleras i termer att finna minima av produkten av tre linjära former i tre reella variabler på en icke-trivial punkt i ett gitter (Cassels, Swinnerton-Dyer 1955) vilket i sin tur följer av en allmänn hypotes som i sin tur kan omformuleras i termer av algebraiska grupper, mer specifikt: Om $D$ är delgruppen av diagonala matriser i $G = SL(n, \mathbf{R})$ med sin diskreta delgrupp $\Gamma = SL(n, \mathbf{Z})$ gäller att för varje $g \in G/\Gamma$ sådan att $Dg$ är relativt kompakt i $G/\Gamma$ att $Dg$ är sluten.

Denna sista omformulering som i sin tur är ett specialfall av en förmodan av Margulis för allmänna Liegrupper, ger en ganska god bild av smaken på Lindenstrauss matematik, åtminstone som den presenteras i allmänna föredrag. (En sådan formulering är otvivelaktligen elegant och enkel och de involverade begreppen är också enkla att definiera. Men å andra sidan associerar formuleringen osökt till de typer av påståenden som kommer direkt efter bevis, och är antingen triviala eller fel.)

Han har vidare (tillsammans med Bourgain) löst Peter Sarnaks arit-

metiska kvantumunika ergodicitetsförmodan, samt tillsammans med Venkatesh studerat distributionen av torusperiodiska banor i några aritmetiska rum och generaliserat klassiska resultat av Minkowski och Linnik.

> *I knew that I was a candidate, though I did not expect to get the medal. When I got an e-mail from Lovasz about a pending phone call, I more or less suspected what was in store. I certainly hope that it will not change my life. Probably I should try to devote a bit more time to try to increase math awareness, e.g. by giving public talks or come to schools. I fear that getting the medal may also have the side-effect that I be saddled with a bit more administrative duties, such as writing letters and sitting on committees.* - EL.

Foto: Ulf Persson

**Ngô Bao Châu** Född den 28/6 1972 i Hanoi. Hans far är professor i fysik vid ett nationellt institut för mekanik. Efter avslutade gymnasiestudier i Vietnam flyttade han till Paris och studerade vid ENS (Ecole Normale Supérieure). Under Gérard Laumons ledning erhöll han sin doktorsgrad vid Université Paris-Sud 1997. Sedan 2005 har han varit professor vid Paris-Sud, medlem av IAS samt professor vid Hanoi Institute of Mathematics. Han har nyligen accepterat en professur vid University of Chicago. Under gymnasietiden vann han två konsekutiva guldmedaljer vid de internationella matematiska olympiaderna i Sydney/Canberra (88) och Braunschweig (89). Andra priser innefattar Clay Research Award 04 samt Oberwolfach Prize 07.

Chau arbetar inom något som benämnes Langlandsprogrammet. Detta stammar från den kanadensiske matematikern Robert Langlands (f.36) som under 60 och 70 talet formulerade en serie förmodanden med syfte att finna fundamentala och förenande principer för en hel räcka problem som rör automorfa former, Galois representationer och L-serier. En elementär ingångsport utgöres av den välkända kvadratiska reciprocitetsatsen som generaliserades av Emil Artin i sin reciprocitetssats inom algebraisk talteori som utgjorde en partiell lösning till Hilberts nionde problem. Vi talar konkret om abelska utvidgningar av de rationella talen och de tillhörande talringarna och

deras primideal. Legendre symbolen t.ex. ersättes av den lokala Artin symbolen. Artinska L-serier uppkommer med kopplingar till Dirichlet L-serier konstruerade via Hecke karaktärer. Langlands var intresserad av att generalisera allt detta till det allmänna icke-kommutativa fallet, vilket ledde till automorfa representationer. Denna formalism har geometriska tolkningar och därmed vittförgrenade ramifikationer. Den läsare vars nyfikenhet må ha blivit väckt av detta 'cocktail-party svammel' är givetvis välkommen att 'forska' vidare.

Langlandsprogrammet kan jämföras med Grothendieck programmet som hade sin glansperiod under 60-talet. Symptomatiskt nog blomstrar (och blomstrade) bägge programmen i Frankrike. Man kan spekulera i huruvida detta belyser det franska intellektuelle kynnet, vars avarter som Derridas dekonstruktivism har förpestat humanioran världen över. Grothendiecks program var helt dominerat av Grothendieck själv som inte bara var visionär utan även tekniskt överlägsen alla andra (med möjligt undantag av Deligne). Hans program strävade efter största möjliga generalisering och abstraktion och sjösatte en formidabel apparat och dokumenterades närmast encyklopediskt. Det hävdas ibland elakt att detta program ruinerade en hel generation franska algebraiska geometriker (och härvidlag är liknelsen med dekonstruktivism inte så långsökt) som förleddes till torra och meningslösa generaliseringar. Ett sådant påstående taget bokstavligt är dock både missvisande och ärekränkande. Faktum är dock att Grothendieck hoppade av matematiken omkring 1970. Enligt honom själv så förlorade matematiken mening och han drog sig undan världen[2]. Om det inte hade rört matematik, hade programmet kollapsat. Men matematiken går som bekant utöver de enskilda matematikerna. Visserligen innebar 70-talet en naturlig reaktion mot Grothendieck-programmet i den meningen att konkreta geometriska problem återigen fick en renässans och allt behövde inte längre formuleras i de mest allmänna schema-teoretiska termer. Detta var en nyttig och mycket fruktbar utveckling och personligen fann jag detta betydligt mera i min smak. Att syssla med mycket abstrakt matematik kan lätt bli torrt och meningslöst om man inte har en djup förståelse över vad man egentligen siktar på. Det är i ljuset av detta man skall tolka mitt inledande påstående. Men det innebar inte på något sätt att Grothendieckskolan dog ut. Traditionen fördes vidare av en serie av framstående franska matematiker - Illusie, Raynaud etc, och dess resultat är ovärderliga även för konkret syftande geometriker. Den har även inspirerat och lagt grundvalen för den abstrakta ryska skolan (Drinfeld, Beilinson, Voevodsky, Kotsevich.). Det utgör om något en illustration av

[2]Då och då återvände han som hastigast till sin gamla passion, men utan uthållighet. Man kan spekulera i orsakerna till detta. Ett mentalt sammanbrott eller en närmast religiös omvändelse vars närmare natur är förborgad. Litteraturen om Grothendieck som person är omfattande, och han har skrivit en lång självbiografi 'Récoltes et Semailles' , i vilken han både gör upp med sitt förflutna samt ådagalägger en icke föraktlig litterär talang.

matematikens platonska natur. Som jag kommer att påpeka nedan, utan dess landvinningar hade Langlandsprogrammet gått i stå.

Langlandsprogrammet är annorlunda, åtminstone i en sociologisk mening. Langlands dominerar inte på samma sätt som Grothendieck gjorde. Han står visserligen för det visionära men hans tekniska skicklighet är inte i paritet. Programmet är också mera fokuserat och involverar högst konkreta objekt, såsom $GL(n)$. Dess syfte är inte generaliseringar för sin egen skull utan för att finna underliggande förklaringar till ett stort antal till synes orelaterade fenomen centrala inom den rena matematiska traditionen.

Chaus insats inom Langlandsprogrammet har varit i bokstavlig mening fundamental. Ett viktigt lemma (känt som 'the Fundamental lemma') som Langlands tillsammans med sin student Diana Shelstad formulerade på ett tidigt stadium och förväntade att det kunde ganska rutinässigt verifieras visade sig vara en betydligt hårdare nöt att knäcka. (Som Siegel, en smula sarkastiskt har observerat, ett problems svårighetsgrad låter sig inte värderas förrän det blivit löst). Först visade Chau lemmat tillsammans med sin handledare i ett specialfall, senare löste han det allmänna fallet på egen hand. Signifikansen av hans bedrift belyses av det faktum att många resultat har bevisats modulo lemmat och så att säga varit på lån, nu är skulden betalad. Beviset för lemmat möjliggjordes tack vare att Chau introducerade nya algebra-geometriska metoder (och Grothendieck är här inte oväsentlig, matematiken hänger som bekant ihop) samt även metoder som inspirerats av matematisk fysik (Hitchin-fibreringar). Time Magazin lär ha listat hans bedrift som en av de tio största vetenskapliga bedrifterna under 2009. Nu skall man inte ta Time alltför allvarligt, men man får trots allt en liten vink om den uppmärksamhet detta måste ha föranlåtits i den matematiska världen för att kunna inspirera till en sådan lobbyverksamhet som måste ha varit nödvändig.

> *It was not a complete surprise because I have seen rumors circulating about me getting the medal. But when I was officially announced by Prof. Lovasz, I was completely overwhelmed. Of course, I'm proud about the medal but I also know it is going change my life significantly. A citizen of the third world winning such a prestigious prize would and in fact did generate a considerable enthusiasm. This means a lot for the development of mathematics and fundamental sciences in Vietnam but this also means that I would have to bare a certain amount of responsability. I took me some time to get prepared for this idea.* - **NBC**.

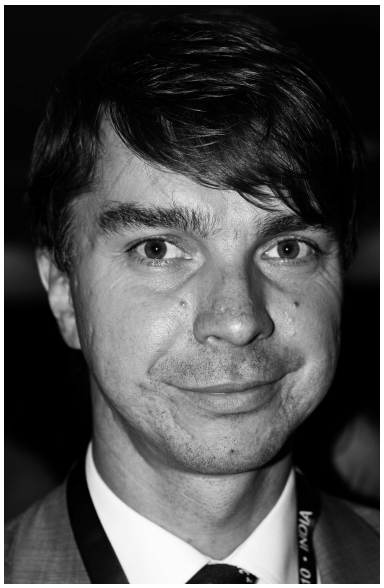


Foto: Ulf Persson

**Stanislav Smirnov** är född i Leningrad den 3/9 1970. Han var en elev i den berömda 239:e matematiska skolan fram till 1987. Han var sedan student i vad som senare skulle kallas St.Petersburg State University, där hans lärare var Viktor Havin. Han doktorandstudier påbörjades 1992 vid Cal Tech, där hans doktorerade 1996 med Nikolai Makarov som handledare. Efter att under några år varit Gibbs Instructur vid Yale University kom han till KTH 1998 som forskarassistent. Han blev professor där 2001. Sedan 2003 är han professor vid University of Geneve.

1986 och 87 erhöll han guldmedaljer vid olympiaderna i Warszava och respektive Havanna. Han har sedan dess erhållit ett antal priser. Nämnas kan Clay Research award, Salempriset samt Göran Gustafsson stipendiet, alla år 2001. Liksom Lindenstrauss fick han även EMSpriset 2004.

Jag skall endast kortfattat beröra hans forskning, eftersom jag hoppas att Michael Benedicks kommer att skriva utförligare om honom i ett kommande nummer av Utskicket med anledning av hans svenska anknytning. Nykelorden är perkolation och konform invarians. Mera specifikt under sin tid i Stockholm bevisade han Cardys formel för triangulära gitter. Dessa är nu väl förstådda tack vare honom. Han har även studerat den 2-dimensionella Isingmodellen i statistisk mekanik och visat konformalitet.

*I was not totally surprised since many colleagues said that it was a possibility. But mathematics is going through very exciting times nowadays, with much progress in several areas, and there are many other worthy mathematicians. So I see it more as a recognition of the field I am working in, and it is nice to get attention from the outside. I do not think it has changed my life though, and I hope it won't. In one way it was nice having this six month buffer when no one else knew about it, so the life was proceeding as always, but I was surprised by the attention we received here. I hope it will soon subside. As to changing my life, I am not really sure what you mean.* - **SS**

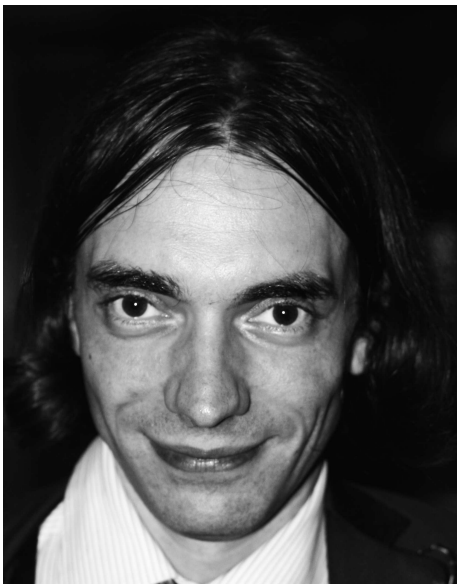


Foto: Ulf Persson

**Cédric Villani** Född den 5/10 1973 i Brive-la-Gaillarde (Frankrike). Han studerade vid ENS mellan åren 1992 och 1996 och fick sedan en junioranställning som professor vid samma institution. Han doktorerade 1998. Sedan 2000 har han varit professor vid ENS de Lyon. Han har gjort terminslånga besök i Atlanta (99), Berkeley (04) och Princeton (09). Sedan 2009 är han föreståndare för IHP (Institut Henri Poincaré) i Paris, och är även associerad till IHES (Institut des Hautes Etudes Scientifiques). Han har erhållit Jacques Herbrand priset av den franska vetenskapsakademin (07), EMS priset (08) och pris benämnda efter Poincaré och Fermat respektive i 2009.

Villani arbetar inom matematisk fysik och därmed är det förhållandevis lätt att relativt snabbt ge ett hum om hans verksamhet. Hans huvudområde är statistisk mekanik där han bland annat har beräknat hur fort det tar att uppnå den klassiskt kända statistiska ekvilibriumdistributionen inom Boltzmanns kinetiska gasteori. Hans arbeten inom icke-linjär Landau dämpning för kinetiska ekvationer inom plasmafysiken har även uppmärksammats stort. Han är en av pionjärerna inom optimal transportteori med kopplingar till differentialgeometri.

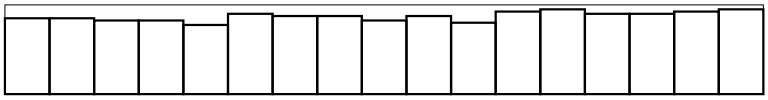
> *There certainly was some surprise but that was not the major emotion. True, at first I feared it might have been a joke, so I waited for confirmation before I felt I could really rejoice. It certainly was a emotional moment. On one hand I felt relief, because the acknowledgment of a Fields medal is something that can never be taken away from you. On the other hand I feel pressure, pressure to live up to the expectations that being a Fields medalist incur. It certainly has changed my life?* - **CV**

| **år** | medaljör | *nationalitet* | **ålder** | levnad |
|---|---|---|---|---|
| **1936** | Lars Ahlfors | *Finland* | **29** | 07-96 |
| **Oslo** | Jesse Douglas | *USA* | **39** | 97-65 |
| **1950** | Laurent Schwarz | *Frankrike* | **35** | 15-07 |
| **Cambridge,MA** | Atle Selberg | *Norge* | **33** | 17-07 |
| **1954** | Kunihiko Kodaira | *Japan* | **39** | 15-97 |
| **Amsterdam** | Jean-Pierre Serre | *Frankrike* | **27** | 26- |
| **1958** | Klaus Roth | *Storbrittanien* | **32** | 25- |
| **Edinburgh** | René Thom | *Frankrike* | **34** | 23-02 |
| **1962** | Lars Hörmander | *Sverige* | **31** | 31- |
| **Stockholm** | John Milnor | *USA* | **31** | 31- |
| **1966** | Michael Atiyah | *Storbrittanien* | **37** | 29- |
| **Moskva** | Paul Cohen | *USA* | **32** | 34-07 |
| | Alexander Grothendieck | *Frankrike* | **38** | 28- |
| | Stephen Smale | *USA* | **36** | 30- |
| **1970** | Alan Baker | *Storbrittanien* | **30** | 39- |
| **Nice** | Heisuke Hironaka | *Japan* | **39** | 31- |
| | Sergei Novikov | *Sovjetunionen* | **32** | 38- |
| | John Thompson | *USA* | **38** | 32- |
| **1974** | Enrico Bombieri | *Italien* | **33** | 40- |
| **Vancouver** | David Mumford | *USA* | **37** | 37- |
| **1978** | Pierre Deligne | *Belgien* | **33** | 44- |
| **Helsingfors** | Charles Fefferman | *USA* | **29** | 49- |
| | Grigory Margulis | *Sovjetunionen* | **32** | 46- |
| | Daniel Quillen | *USA* | **38** | 40- |
| **1982** | Alain Connes | *Frankrike* | **35(36)** | 47- |
| **(1983)** | William Thurston | *USA* | **35(36)** | 46- |
| **Warszava** | Shing-Tung Yau | *USA1* | **33(34)** | 49- |
| **1986** | Simon Donaldson | *Storbrittanien* | **29** | 57- |
| **Berkeley,CA** | Gerd Faltings | *(Väst)Tyskland* | **32** | 54- |
| | Michael Freedman | *USA* | **35** | 51- |
| **1990** | Vladimir Drinfeld | *Sovjetunionen* | **36** | 54- |
| **Kyoto** | Vaugham Jones | *Nya Zealand* | **37** | 52- |
| | Shigefumi Mori | *Japan* | **39** | 51- |
| | Edward Witten | *USA* | **38** | 51- |
| **1994** | Jean Bourgain | *Belgien* | **40** | 54- |
| **Zérich** | Pierre-Louis Lions | *Frankrike* | **38** | 56- |
| | Jean-Christophe Yoccoz | *Frankrike* | **37** | 57- |
| | Efim Zelmanov | *Ryssland* | **38** | 55- |
| **1998** | Richard Borcherds | *Storbrittanien* | **38** | 59- |
| **Berlin** | Timothy Gowers | *Storbrittanien* | **34** | 63- |
| | Maxim Kontsevich | *Ryssland* | **33** | 64- |
| | Curtis McMullen | *USA* | **40** | 58- |
| **2002** | Laurent Lafforgue | *Frankrike* | **35** | 66- |
| **Beijing** | Vladimir Voevodsky | *Ryssland* | **36** | 66- |
| **2006** | Andrei Okounokov | *Ryssland* | **37** | 69- |
| **Madrid** | Grigori Perelman | *Ryssland* | **40** | 66- |
| | Terence Tao | *Australien* | **31** | 75- |
| | Wendelin Werner | *Frankrike* | **38** | 68- |
| **2010** | Elon Lindenstrauss | *Israel* | **40** | 70- |
| **Hyderabad** | Ngo Bao Chau | *Vietnam* | **38** | 72- |
| | Stanislav Smirnov | *Ryssland* | **39** | 70- |
| | Cédric Villani | *Frankrike* | **36** | 73- |

**1Ursprungligen från den brittiska kronkolonin Hong Kong**

Vi kan betrakta denna lista och göra några statistiska anmärkningar. Den äldste Fieldsmedaljören någonsin, och den ende som är född på 1800-talet är Jesse Douglas. Av förklarliga skäl kommer detta rekord att aldrig slås. Ahlfors var för över trettio år den äldst levande Fieldsmedaljören (31 mot 29 för Douglas) ett rekord som endast teoretiskt kan slås.

Av de 52 medaljörerna är nu 7 döda (varav tre dog 2007). De senare har avlidit i en medelålder av 82 år. Den äldste nu levande Fieldsmedaljören är Klaus Roth (f. 1925) följd av Serre(26), Grothendieck(28) och Atiyah(29). Dessa är de enda fyra som är födda på 1920-talet. Man kan även göra en dellista som består av Ahlfors(14), Selberg(4), Serre(8), Milnor(4), Cohen(4), Baker(4), Bombieri(4), Fefferman(8), Donaldson(12), Kontsevich(4), Lafforgue(4) och Tao(8?). Dessa kan ståta med att en gång i tiden varit den yngste i församlingen.(Parantesen anger antal år de haft denna position. Ahlfors bedrift må vara svårslagen även härvidlag, Tao har en teoretisk chans att komma upp i tolv.) Fyra personer var fyllda fyrtio när de mottog medaljen (mottagandet skall inte tolkas för bokstavligt, ty Perelman är bland dessa). Endast fyra personer har fått medaljen innan de fyllde trettio, nämligen Ahlfors, Serre, Fefferman och Donaldson, medan 23 personer fått den vid 35 eller tidigare. Av förklarliga skäl har medelåldern på pristagarna tenderat att bli högre och högre (se bild nedan).



Getter i Kochim, Kerala

# Den internationella matematiska unionens generalförsamlingsmöte 2010

*Torbjörn Lundh*

Mycket tidigt på morgonen den 16 augusti, speciellt för vissa av oss i den svenska delegationen bestående av ordförande Michael Passare, Nils Denker, Ulla Dinger och undertecknad, öppnades generalförsamlingen i Bangalore på ett lyxigt hotell med anmärkningsvärt sexistiska `http://www.chancerypavilion.com/pavilion/`på hemsidan. Ordförande `http://www.cs.elte.hu/ lovasz/` startade det hela lite trevande med att hälsa oss välkomna och säga att vi hade ett långt program framför oss med många svåra beslut att ta. Sekreteraren `http://www.zib.de/groetschel/`tog sedan över och drev agendan framåt båda dagarna med stor auktoritet och inte helt utan humoristiska kommentarer.


*Halva den svenska delegationen ser laddade och förväntansfulla inför mötet till vänster. Bilden till höger är tagen några timmar senare när valdramatiken och därmed engagemanget ökat ytterligare några snäpp.*

> *En mer knapptryckarvänlig version av denna artikel, i själva verket den ursprungliga, är upplagd på nätet, med något annorlunda lay-out och med något annorlunda beskärning av bilder, som dessutom är i färg. Men framför allt, i denna version kan läsaren (tittaren?) direkt trycka på länkarna.* `[red.anm.]`

Jag måste erkänna att jag kände mig mäkta stolt när jag klev in i salen och tillslut fann min plats med mitt namn på en skylt som representant för Sverige.


Denna stolthet hade kvällen innan fått sig en törn efter att vi landat på flygplatsen i Bangalore och jag ställde mig i kö till passkontrollen och de frågade mig vad jag skulle göra i Indien. Jag svarade inte då frimodigt: "Jag är en av fyra representanter som ska föra Sveriges talan i den stora internationella matematiska unionens möte." Istället kom det fram ett snabbt (alltför snabbt kanske?): "I am on vacation. I am a tourist." Det kändes som om passkontrollanten såg igenom mig och jag verkade säkert ännu mer mystisk. Varför ljög jag? Jo, jag hade fått insidertipset att söka turistvisum var en mycket enklare, snabbare, billigare och säkrare process än att söka det krångligare visumet för konferenser.

På IMU-bussen från flygplatsen berättade jag för en kanadensisk delegat om min nervösa entré och han var mer världsvan och sa att han alltid brukar köra turistversionen och tröstade mig med att vi faktiskt kommer att småturista lite då och då mellan varven. Vi provade olika svar man skulle ha gett i passkontrollen för att verka mer turistiga och fastnade tillslut för: "Hi, I am heading down to Goa to just hang around and maybe try some mind-expanding stimuli." Allt för att de inte ska misstänka att vi var matematiker på väg till den stora generalförsamlingen.

De fyra viktigaste uppgifterna på IMU-mötet var: besätta en ny "exekutiv kommitté", bestämma var nästa IMU och ICM-möte skulle vara och om IMU skulle skaffa sig ett permanent kontor och i så fall var det skulle ligga.

Den nya kommittén, inklusive sub-kommittéer, 2011 till och med 2014, kan man finna här
`http://www.mathunion.org/fileadmin/IMU/Leadership-2011-2014.pdf`
IMU:s nya ordförande blev Ingrid Daubechies som har sina rötter i Belgien och arbetar bla med wavelets vid Duke via Princeton. Hon firades dubbelt med allsång och tårta eftersom det passande nog var hennes födelsedag just den dagen. Martin Grötschel blev inte helt oväntat omvald till sekreterare. Christiane Rousseau från Kanada och Marcelo Viana från IMPA i Brasilien – som också spenderat viss tid på KTH – blev båda vice ordföranden. (Dessa tre namn ovan representerade lägligt nog också de tre huvudkandidaterna till det permanenta kontoret.)

Ordförande för valberedningen var David Mumford som sa några ord hur processen gått till och presenterade de som inte kunde vara närvarande - bland andra Wendelin Werner. Han tryckte starkt på vikten av att ha en kontinuitet i den exekutiva kommittén och se till att alla föreslagna nuvarande medlemmar valdes om. När också ordförande Lovász upprepade denna vädjan tror jag att många delegater valde att inte följa denna princip och mycket riktigt fick den nuvarande exekutiva medlemmen med den kanske mest självsäkra och oförberedda presentation inte förnyat förtroende. Kandidaterna fick komma fram till podiet, om det inte satt där redan som medlemmar i den exekutiva kommittén, för att hålla en kortare presentation av sig själva, vad de gjort och vad de ville göra. Vi i den svenska delegationen hade förberett oss inför detta val genom att läst den fördistribuerade informationen om kandidaterna och gjort våra egna listor. Kvällen innan hade vi också en litet möte där vi tog upp hur vi hade tänkt rösta och varför. Jag måste säga att den muntliga presentationen gav ett mycket bra komplement till den skrivna texten och deras CV, så efter lite snabba ändringar i listan hade vi bestämt oss och vi var i stort sett överens. Det var glädjande nog mötet i övrigt också och valresultatet överensstämde rätt väl med våra egna listor. Den enda skandinaviska representation blev matematikhistorikern Jesper Lützen från Danmark som valdes in till en ledarposition i International Commission on the History of Mathematics (ICHM).

Sedan kom frågan om var nästa möte ska äga rum om fyra år. Att arrangera möte för generalförsamlingsmötet men framförallt ICM veckan efter, har blivit ett allt för stort projekt för att kunna dras igång från början endast fyra år innan själva öppnandet, har gjort att detta val bara var en formalitet. En liten exklusiv grupp ur den exekutiva kommittén hade redan avgjort frågan till Sydkoreas fördel. Vilket närmare bestämt betyder att ICM 2014 kommer att äga rum i Seoul i slutet av augusti och att generalförsamlingen samlas dagarna innan i staden Gyungju. Ledaren för den sydkoreanska gruppen presenterade städerna och hur arrangemangen i stort skulle se ut. Det var en viss förvirring i och med att han sa Korea hela tiden och jag hörde frågande röster i församlingen, "North or South?". Det visade sig att faktiskt Nordkorea kommer att vara värd för en satellitkonferens, så det kan ju blir hur spännande som helst. De kommande arrangörerna hade en stor delegation med sig som framförallt skulle följa Hydrabads arrangemang av ICM för att se och lära sig så mycket som möjligt.

En fråga som auktaliserades efter vi kom hem var hur många representanter från sverige som kommer att åka på generaförsamlingsmötet i Gyungju. KVA supportrar deltagande av en delegat, men VR har nyligen beslutat sig för att inte längre stödja denna verksamhet, vilket vi förstås tycker var en tråkig utveckling. Vi tackar matematikinstitutionerna i Göteborg och Stockholm (SU) som gick in och stödde detta års svenska delegation.

Den mest heta frågan i Hydrabad var utan tvekan var det permanenta kontoret skulle ligga. Det var för det första inte klart att det skulle ligga

någonstans överhuvudtaget, men den norska exekutiva medlemmen Ragni Piene förklarade pedagogiskt och lugnt att den tiden var förbi när kontoret enkelt och smidigt kunde flytta med sekreteraren.

Det bestämdes tillslut att det skulle bli ett permanent kontor. Frågan var bara var. Det fanns tre slutkandidater: Fieldsinstitutet i Toronto, IMPA i Rio de Janeiro och Weierstrassinstitutet i Berlin Broschyrer delades ut, väloljade presentationer genomfördes. De olika instituten toppade varandra i hur mycket pengar och personal som skulle satsas på detta och det lobbades hej vilt i pauserna och IMPA toppade med en professionellt gjort reklamfilm-av det allmänna sorlet att döma efter den häftiga filmsnutten var den kanske för reklammässig för att falla de hårdkokta delegaterna på läppen, snarare fick den motsatt effekt. Vi i svenskgruppen hade läst materialet innan och diskuterat ihop oss. Vi tyckte helt enkelt att det tyska alternativet var bäst. Sedan vore det förstås ingen nackdel om kontoret hamnade i Europa kom vi också fram till. Vi kände oss tillslut så övertygade att vi också började snacka runt lite, främst bland våra nordiska kollegor, se bild 2. Såhär med lite perspektiv på mötet, tror jag att denna lobbyverksamhet var mycket viktigare än själva våra egna röster, och en spännande del av den demokratiska processen. Ett muntligt argument för IMPA hördes cirkulera runt: "I Rio skulle man till och med få en privatchaufför". Vilket kontrades med: "Ja, men det är för att man måste ha en kombinerad chaufför och livvakt där".

*I pausen innan omröstningen vart det permanenta kontoret skall ligga lobbades det för fullt. Ryggtavlan av vår egen ordförande Michael Passare kan skymtas i mitten på bilden.*

Vinnarna blev tillslut Weierstrass Institute i Berlin (`http://www.wias-berlin.de`). Det var en mycket nöjd grupp av Berlinare som slog sig ned i lobbybaren efter dagens slut och började korka upp champagne, se bild 3. Och man

kan förstå dem; det är förstås ett stor presigevinst att få vara värd åt IMU:s kontor och på så sätt bli ett fast nav i matematikvärlden. Detta var det förstås andra som såg som mindre roligt. En engelsman ställde sig upp dag två och menade att detta kontor måste bli osynligt.

*Tyskt återhållsamt firande i lobbyn. Ulla kollar in drinklistan eftersom vi inte blev bjudna på bubbel, trots Nils eleganta och subtila påpekande att alla svenska röster hade gått till Berlin.*

Montenegro röstades in som en ny IMU-medlem medan Kambodja, Moldavien, Nepal och Oman blev associerade medlemmar. Dessutom stadfästes en `http://www.mathunion.org/fileadmin/CEIC/bestpractice/bpfinal.pdf`. Samtidigt drogs den informella valkampanjen för arrangörsskapet 2018 igång. Ett stalltips är att det kommer att stå just mellan Toronto och Rio de Janeiro.

International Commission on Mathematical Instruction, `http://www.mathunion.org/icmi/about-icmi/`, presenterades av ordförande Bill Barton från Nya Zeland. Han tog bland annat upp ett program som de driver: `http://www.kleinproject.org/`. (Felix Klein var ICMI:s första ordförande.) Bill Barton berättade målande att detta gick ut på att i Felix Kleins anda, och speciellt efter hans bok "Elementarmatematik vom höheren Standpunkte aus", skapa en modern version av denna klassiker. Det har i samband med det målet också arrangerats små konferenser där matematiker och gymnasielärare får träffas. Detta har hittills varit mycket lyckat där matematiker och gymnasielärare "inte bara pratar med varandra – de lyssnar också". Michael Passare och jag blev såpass entusiastiska att vi på stående fot frågade Barton efteråt om det skulle kunna gå att tänka sig att vi i Sverige anordnade ett sådant möte? "Yes, absolutely. That would be great, but you have to talk to Bengt first", blev svaret. Veckan därpå i Hydrabad

pratade vi med Bengt Johansson från http://ncm.gu.se/och mailade även Anders Björner. Så nu är planerna att det kommer att bli ett sådant möte på institut Mittag-Leffler några dagar strax efter midsommar i ett samarrangemang av http://www.math.chalmers.se/ torbjrn/SKM/index.shtmloch http://www2.math.su.se/nk/

En annan mycket entusiasmerande föredragshållare var Douglas Arnold som pratade om en undersökning han gjort om ISI:s Impact Factor. Ett mått som blir mer och mer avgörande i olika sammanhang. Han talade med en väckelsepastors lidelse om hur han börjat intressera sig för detta nummer och frågat sig hur bra det egentligen var som kvalitetsmått. Han har tillsammans med en bibliotikarier författat ett preprint, http://arxiv.org/abs/1010.0278, som är mycket läsvärt och som kan ge oss matematiker ammunition när det gäller att hävda vårt ämne gentemot andras. Efteråt beslöt mötet att tillsätta en grupp som skulle undersöka och föreslå bättre rankningssytem. Sanningen är nog att vi går mer och mer mot bibliometriska mått av kvalitet, så vi kan inte bara klanka ned på de mått som används idag, utan vi måste ge bättre alternativ.

Som ett resultat av detta inlägg bildades den 19 oktober följande grupp: Working Group on Journal Ranking and Pricing (WG-JRP) under ledning av Nalini Joshi från Sydney.

En annan trevlig och användbar nyhet var att följande länk presenterades http://www.mathunion.org/ICMdär man kan finna alla ICM proceedings från 1893 till 2006 där man kan tex kan läsa in Otto Frostmans sammanfattande
http://www.mathunion.org/ICM/ICM1954.1/Main/icm1954.1.0552.0553.ocr.pdfom den svenska gymnasiematematiken 1954. Femton år senare blev Frostman sekreterare för IMU.

Glada Gänget vid Golconda Fort, Hyderabad

# Autorickshaw

*Ulf Persson*


Autorickshaw
Kanchipuram
Tamil Nadu

Tre hjul, två takter, en chaufför. Denna lilla motoriserade skapelse kan man knappast undvika när man reser omkring i Indien, och utgör en viktig del av turistens vardag. Den finns inte bara i Indien, utan i hela syd-ostasien, så dessa horder av skandinaver som drar till Thailand, bör vara väl bekanta med dem, även om de där lär vara mera kända under namnet 'tuk-tuk'. Och inte bara i södra Asien, utan även i Afrika och Syd-Amerika, finner man den. Ursprunget lär vara italienskt, där Piaggio Ape (Piaggios bi) såg dagens ljus i slutet av 40-talet, baserad på en annan surrande insekt, nämligen vespan. Intentionen var att skapa en lastbil, med plats för en förare. Konstruktionen är enkel, vespans bakhjul ersättes av två för större stabilitet, medan styret är kvar, ty någon ratt har inte detta fordon. Tvåtaktsmotorn startas med en lång spak som dras fram och tillbaka ett par gånger. Fordonet är lätt, har låg max-fart 50 km/h och marschfart på en 35 km/h (och därvidlag jämförbart med en entusiastisk cyklist) och är följaktligen ganska bränslesnål - 35 km per liter. Förarkabinen är liten, och bör teoretiskt sett, knappt förmå härbärgera en enda person, men i praktiken kan det ibland sitta både en och två assistenter vid sidan om föraren. Dessa hänger bokstavligen i luften. I passagerarutrymmet kan man pressa in sig tre, men med lite fantasi och motivation kan man lätt öka detta antal betydligt. Bak passagerarna finns ett litet utrymme för bagage om man nu reser med synnerligen lätt packning. I princip avgörs priset av avstånd baserat på taxameter, men jag har aldrig suttit i en autorickshaw med påslagen taxameter. I praktiken kommer man överens om priset innan färden, vilket alltid är betydligt högre än det formellt angivna. Turisten prutar ner nästan till hälften, chauffören suckar och stönar

och ser plågad ut men kör ändå. Turisten är nöjd över sin bedrift, och chauffören ler i mjugg. För kortare turer i staden kan man räkna mellan 20-30 rupier, d.v.s. ungefär en femma. Ofta kan man promenera denna sträcka, förutsatt att man hittar vägen. När man hittar vägen blir man ständigt antastade av auto-rickshawer som saktar farten och undrar vart man är på väg. Det tycks inte passa sig att välbeställda västerlänningar går och slösar bort sig längs den (obefintliga) trottoaren till ingens nytta. När man väl behöver en, kan de däremot vara svårare att finna.

Autorickshawen är trots sin bränslesnålhet inte speciellt ekologisk. De för oväsen och spyr glatt ut avgaser. I New Delhi har den gamla modellen mer eller mindre med våld via ett domstolsbeslut ersatts av en annan som går på ett förment grönare bränsle (Compressed Natural Gas (CNG)). I södra delarna av Mumbai är de bannlysta, istället ser man små svarta taxi-bilar med gult tak köra omkring på gatorna. Dock längre norr upp i Mumbai där slummen tar över, återbördas gatubilden till den mera typiska indiska. Den gamla cykeldrivna rickshawn är emellertid inte helt utrotad, och jag fann den inte alls speciellt ovanlig i Agra.

Obehagliga som man kan finna dessa tingestar bävar jag för konsekvenserna av vad som kommer att hända när dessa ersättes av bilar. Motortrafikstockningar, som troligen var helt okända i Indien, för ett par decennier sedan, har nu blivit vardagsmat. Att korsa en gata är en bedrift man utför med fara för livet. Men detta bör inte komma som en överraskning.

Cykelrickshaw, Pondicherry

# The good, the bad, and the ugly —judging the talks at the ICM in Hyderabad

*Bill Casselman*

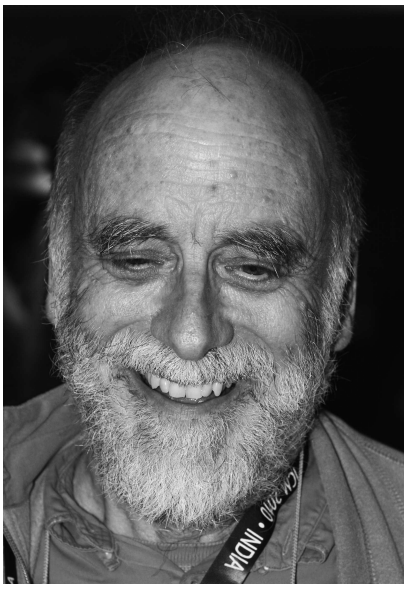



Foto: Ulf Persson

The invited lectures at an International Congress of Mathematicians are a rare opportunity for a lecturer to address an unusually dsitinguished audience, and for a listener to hear distinguished lecturers. On would expect that the lectures are carefully prepared, and that everything that could be done to make the lectures clear and interesting would be done. This does not seem to be the case, and was not universally true at the recent ICM in Hyderabad. Fault must be shared between the speakers and the organizers.

I do not pretend that I am capable of explaining how to fix the problems. My intention in writing this note is mostly just to point out what the problems are. However, I do have a few ideas of what can be done to start to deal with the difficulties. In the main body of this note I'll try to give some idea of what was wrong and what was right with the lectures I attended, and at the end suggest a systematic way to go about improving things. But what I mostly want to do is to stimulate mathematicians to think more seriously about what they should expect from lectures at an ICM, and judge for themselves what qualifies as good, bad, or ugly.

The lectures come in two sizes, small and large. After some brief remarks about the 'small' lectures, I'll discuss the 'large' ones. They are really the main topic of this note. The ideal way for me to do what I want to would be for you and me to sit down next to each other while I show segments from various talks that I think are particularly good or bad, and we discuss what we see. Unfortunately, this is not possible, so I face an obvious handicap. But you can at least get some idea of the lectures, because they were recorded, and you can see the results at

`http://www.icm2010.org.in/from-the-venue/online-streaming-archives`

There are still a number of obstacles, however, to seeing what the lectures were like by watching these videos. The first is minor—on this web page the videos are indexed by the date and time of day, rather than by speaker. I can offer an easy fix for this—I have posted my own web page

`http://www.math.ubc.ca/~cass/icm-2010/`

on which the videos are indexed in a more rational way.

The second obstacle is much more serious—the quality of videos is very poor, as you will realize when you watch them. One major problem is that although the speakers used computers for presentations, the camera does not consistently display the screens, and hardly ever shows the screens in a readable fashion, in high resolution or strong contrast. In fact, this leads to my first suggestion for improving the lectures:

> *Take seriously the task of making video productions of the 'large' lectures. Make speakers' slides available, simultaneously with the videos, maybe by putting the speaker in a small internal frame. Edit the videos and plan camera work carefully.*

One thing to keep in mind is that it is not normally very valuable to watch the speaker rather than hear him (or her) while watching the slides.

There are several advantages to this idea of taking videos seriously. The obvious one is that of making a record of some potentially great lectures. Wouldn't you like to be able to watch David Hilbert laying out the problems that played such an important role throughout twentieth century mathematics? But for my purposes the bigger advantage is seeing what goes wrong. This can be useful for both speakers and audience. These days lectures are often recorded, but they are rarely edited, and rarely are they of high quality. The ICM lectures are worth extra effort.

## 4 The small lectures

The 'small' talks are presumably intended for a relatively small audience of people particularly interested in a topic, and are given in small rooms. Although the audience for one of these at an ICM might be more expert and more receptive than those at an everyday talk, these are the sort of talks we give most of our lives. The only new development that one might criticize is that they are nowadays given with a computer rather than on a blackboard or with an overhead projector. This is not a clear improvement, but maybe unavoidable given the venues available for large conferences. The problem with lectures given with a computer is that the talk is predetermined—even though the audience is small and questions can be expected, no major change of plan is possible. It's a big drawback. It was clear in Hyderabad that using a computer in these talks noticeably inhibited some speakers. So here is my next suggestion:

> *The organizers of the small talks should think about how to make these talks less constraining. Maybe even make blackboard presentations feasible.*

I can add in support of this that there do not seem to be good universal conventions for computer-aided talks. Maybe computers are not in fact a

universal tool for lectures to a small audience.
One might ask, why are these lectures given at an ICM? After all, these days conferences abound, and specialists probably don't learn much that is new. My own view is that they do serve a group of mathematicians who do not quite qualify as specialists (and who do not attend conferences on the topic) but do have some interest in the field. This suggests that in planning these lectures one might keep this audience in mind, rather than address only experts.

## 5 The plenary lectures

The 'large' mathematical lectures are themselves divided roughly into two groups, those connected with the Fields Medal and other prizes, and the plenary lectures. In some ways there is no clear distinction between these two categories, but in some ways there are. I'll say something later on about the prize lectures that applies only to them.
As for the plenary lectures, it is not entirely clear to me on what basis the plenary speakers are chosen. Whereas it is quite reasonable for speakers of the small talks to be chosne for expertise and accomplishment, the purpose of the plenary talks is presumably quite different. A large part of the intention of these talks is surely to communicate mathematics to a large number of mathematicians. But the audience for these talks is almost entirely composed of non-specialists—a lot of them, in fact, since the average audience size at Hyderabad for these talks seemed to be between 800 and 1000. They were attended by a sizeable proportion of the people attending the Congress. (My English dictionary tells me that the word 'plenary' goes back to at least 1450, and that it refers to 'an assembly of all members'. I'd like to emphasize 'all'.)
So my initial suggestion here is

> *One major consideration in choosing plenary speakers ought to be their ability to communicate to non-specialists.*

The speaker at any of these talks was necessarily very far away from the majority of the audience, and a computer presentation, projected onto several screens, was obligatory. It is not unreasonable to expect that all the plenary talks, and perhaps all the talks given to such a huge audience, would have been well prepared with non-specialists in mind. Such was unfortunately not the case in Hyderabad. A few of them were really good, many more were merely mediocre, some were simply bad, and a few were so bad as to be called 'ugly'. In a moment I'll investigate some of the reasons for good and bad talks, and offer some suggestions for how to improve the way these talks are given. Very few of us will ever be called upon to give a mathematics talk to a thousand people, whether mathematicians or otherwise, but many of us will likely find ourselves in the audience of one. Besides, some of the problems that occurred with the plenary talks occur also in everyday talks.

There are roughly three components to a talk, of course—the speaker, the technology, and the audience. In offering my opinion on these matters I can speak mostly just for myself, but in fact I did often collect opinions from others. The technology is more or less given, and unchangeable, and the audience is also beyond control. *Therefore it is the speaker who must adapt to this situation, and in addition perhaps the speakers ought to be chosen with this in mind.*

First I'll give you the good news, and tell you about the talks I thought were very good, and what made them so. Then I'll go through a short list of ways to go wrong, with examples from the lectures.

I ought to mention that Tim Gowers has discussed in his well known blog all of the lectures about the work of the prize winners, as well as some of the talks from the first few days (he left the Congress early). They can be found on his web site:

`http://gowers.wordpress.com/2010/08/20/icm2010-lindenstrauss-laudatio/`

`http://gowers.wordpress.com/2010/08/30/icm2010-avila-dinur-plenary-lectures/`

It will be evident that his opinions are more optimistic than mine. I think there is a very simple reason for this—he himself is familiar with a very wide range of fields of mathematics, and in mnay cases comes close to qualifying as an expert. Whereas when I attend one of these large talks I am constantly trying to put myself in the place of the non-experts. This gives one a different point of view, and makes one aware of different things. Following a mathematics talk requires even at best a certain amount of hard work and concentration. I try to monitor this energy level around me. When people cease to follow, the relaxation is evident.

## 6 THE BEST TALKS

There were four talks I thought were very good, really excellent, and of these I thought two were exceptionally good. I list them according to my ranking, starting with the best.

Irit Dinur, *Probabilistically checkable proofs and codes*, (August 21, 10:15-11:15).

This was really an exceptional talk in the opinion of almost everybody who heard it. It started with a handicap, since when it began the number of people previously acquainted with the subject must have been very small. She introduced the problem very gently, and did an excellent job of giving you an intuitive feel for her own contribution to a solution. Her pictures (which were not drawn by her, but by a friend) were just right for the audience.

I considered this a nearly perfect talk. Only this and the next talk were comprehensible, at least in part, even to non-mathematicians. For Dinur's talk, there is solid evidence for this claim, because she was interviewed afterwards by Christoph Drösser, a science journalist writing for the German

weekly *Die Zeit*. The interview can be found at

`http://www.zeit.de/2010/35/Interview-Dinur`

Thomas J. R. Hughes, *Isogeometric analysis*, (August 26, 09:00-10:00).
I thought this also an exceptionally brilliant talk, and again perfectly designed for an audience largely unacquainted with the topic. The graphics in particular were spectacular. Both this and Dinur's talk were characterized throughout by a relaxed delivery with a very evident sense of humour. Hughes' talk was uniquely characterized by some great graphics jokes (for example, his leaking tea pot—a marvelous variation on a familiar theme in computer graphics—and the scans of his own internal body structure).
It is not just that the topic he was talking about was intrinsically suited to spectacular graphics. The topic of the lecture by Stanley Osher (August 25, 9:00 - 10:00) was similarly promising, but his talk was woefully badly prepared, (and might have been the worst at the ICM). Hughes' talk was great because he thought carefully about what he had to say, had a certain amount of skill at working with computers, and thought the occasion worth some effort.

Daniel Spielman, *Algorithms, graph theory and linear equations in Laplacian matrices*, (August 21, 13:45-14:45).
The speaker here had the advantage that almost everyone in the audience had some acquaintance with the problems he was discussing, and both they and his contribution could be explained in fairly elementary terms. Still, this was not a talk that a journalist writing for *Die Zeit* would write about. Many people have asked, is it a coincidence that three of the best talks were by people inhabiting both the world of mathematics and the world of computer science?

Kim Plofker, *Indian rules, Yavana rules: foreign identity and the transmission of mathematics*, (August 26, 11:30-12:30).
Again, nice graphics, and the mathematics was reasonably elementary. If I rank her talk slightly less than perfect it's because the ratio of talk to computer display was a bit high. All the plenary talks were delivered in English (was there any other possibility?), but of course that was the native language of only a small proportion of the audience. For this reason if for no other, it was extremely important that the talk be comprehensible by watching only the computer display. Plofker certainly took English problems into account. She spoke clearly and deliberately, but she could have had more content displayed on the screen.
The question arises naturally, *did all these good talks have something in common, something that was perhaps missing from the rest?* Sure. (1) The lecturers spoke clearly and with reasonable deliberation, so problems of interpreting English were minimized. (2) The talks were by and large comprehensible from slides alone. (3) Most took one basic idea, explained it well at the beginning, and then based the rest of the talk primarily on that one idea. My own theory of comprehensibility of mathematics talks is

like that of comprehensibility in music—subtle repetition with variation is a key ingredient. Or to put in another way, *comprehension is linked to the audience's ability to anticipate what is coming.*

These talks did not not try to say too much. One of the most difficult lessons mathematicians have trouble absorbing is: *Less is often more, and more is often less.* If you are giving a talk to an audience not previously acquainted with your subject, you cannot expect them to absorb more than a very limited number of unfamiliar ideas. In order for them to absorb the new ideas you do introduce, you must engage in a certain amount of repetition. But in order to maintain interest, the repetition should be carefully varied. No doubt about it, this is a hard task, not to be undertaken lightly. Just to rub my comments in, I'll repeat them:

> *When speaking English to an international audience, speak slowly and clearly, and if you are using a computer be sure that the talk is comprehensible by watching only the computer display.*
>
> *When introducing unfamiliar ideas, include careful repetition with variation. Give your audience a chance to become familiar with them.*

Along with these goes:

> *Do not introduce too many unfamiliar ideas.*

This was a major problem for many speakers.

# 7 THE REST

Instead of going through the remaining talks one by one, I make up a list of what I thought were frequent problems with talks, along with examples, as well as some suggestions for how to deal with them.

- *A talk to a huge audience in a large room does not allow feedback.*

This means that you cannot configure a talk in real time according to how it is being received, because during the talk you cannot tell how it is being received. What this means in practical terms is that you should give your talk,' ora t leasts hwo your slides, to someone who might represent a typical audience member. This is a delicate matter. I know of at least one plenary talk that was rehearsed before an audience that was far too friendly. It won't do. The talk was one of those I consider a disaster, but also, sadly, one that could have been redeemed by constructive but firm criticism.

> *All plenary speakers must realize that a talk to a large non-specialist audience is beyond their everyday experience, and cannot be prepared by everyday techniques.*

The worst outcome of a plenary talk is that 800 people are bored or confused, and everything possible must be done to avoid this.

• *A talk based on computer display follows a deterministic path*[1].

The most curious example of this problem occurs in the talk by Ingrid Daubechies, speaking on the work of the prize winner Yves Meyer. Her talk was generally carefully prepared, with lost of illuminating pictures and a clear deivery, but towards the end she realized that something important was not on her slides. Her way of dealing with this was to start drawing pictures in the air with her hands, which had no good effect at all. As with the earlier point, the solution to this is a suggestion that will probably provoke controversy:

> *All plenary talks should be rehearsed in some way before a critical audience.*

This might mean just that the slides be read critically by someone. Even those who generally give great talks should be humble in this respect.

• *One underestimated way to communicate ideas to non-specialists is with pictures.*

I don't think is a controversial idea, but the hard part is acting on it. Pictures are not easy to make. They don't have to be technically very sophisticated, however, as Irit Dinur's talk demonstrates. But some thought has to go into figuring out which are important. Here I suggest:

> *Pictures in a plenary talk should be edited just as carefully as text.*

## 8 The prizes

Here I just want to make one point—the first day of an ICM is the one day that a great deal of attention is focussed on the international community of mathematicians. For better or worse, the prizes have public appeal. The lectures on the work of the prize winners should take this into account, anbd these lectures should be given (and perhaps even especially edited) with this in mind.

[1] As Étienne Ghys writes: When I prepare a computer talk I always make it non-deterministic. The file I make is full of invisible buttons that I can click on to lead my talk along a different route, or to a shortcut if I am late, or to some extra pages if I am ahead of schedule, or to some optional examples. In other words, one should think of a computer talk file as a oriented graph. In an ICM talk, the thing should probably be more deterministic, but still not completely. In any case, I think that the use of computers for lectures will improve a lot in the near future, and we shall not be so severely constrained as we are now.

## 9 Organizing the plenary talks

Overall, what I am saying is that the plenary talks should really be considered more carefully by the people who organize them, even in selecting the plenary speakers.
There has been some attention paid to the problems they raise, but not enough. What I would really like to see is that these talks be considered along the lines of one of the expository journals such as the *Mitteilungen* of the Deutsche Math. Verein, or the *Notices* of the American Mathematical Society. I would like to see one person appointed as a kind of chief editor of the plenary talks, and I would like to see him (or her) be provided with the means to encourage better presentations (and discourage bad ones). One thing to keep in mind is that few mathematicians are very skillful at working with computers, and particularly inept at producing good graphics, so that they might well appreciate a certain amount of editorial advice and technical help. Think of it as a carrot, not a stick.

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### Kleinprojektskonferens på Institut Mittag-Leffler

*Torbjörn Lundh och Mikael Passare*

I Felix Kleins anda startade för några år sedan ett internationellt program, `http://kleinproject.org/`, vilket är skapat för att dels sätta ihop en ny bok om modern matematik för användning på gymnasier, men också verkar för en serie konferenser. Vi har nu fått möjlighet att arrangera en sådan konferens i Sverige. Den kommer att äga rum tre dagar strax efter midsommar på Institut Mittag-Leffler, där gymnasielärare och matematiker kommer att diskutera hur man kan ge glimtar av modern matematik till gymnasister. Det kommer inte enbart bli fråga om en envägskommunikation, utan förhoppningsvis en interaktion mellan lärare och forskare för att hitta exempel och medel att belysa aktuella matematiska frågor på gymnasiet. Vi tänker också diskutera de nya kursplanerna i samband med detta. Gymnasielärare från hela landet är välkomna att söka detta kostnadsfria, men starkt platsbegränsade, arrangemang i regi av Svenska Kommittén för Matematikutbildning och Nationalkommittén för Matematik. Preliminära datum är 27 till 29 juni. Se hemsidan så småningom för mer detaljer och ansökningsförfarande: `http://www.math.chalmers.se/~torbjrn/SKM/kleinprojektet.html`

# International Council for Industrial and Applied Mathematics (ICIAM)International Mathematical Union (IMU) "Working Group on Journal Ranking and Pricing"

## Terms of Reference

**Introduction**

One of the main current issues in mathematics (and other scientific disciplines) is the development of its scientific publication market and the role scholarly publications play. A particular problem is the use and misuse of citation data for the assessment of scientific research. The joint IMU/ICIAM/IMS Committee on Quantitative Assessment of Research discussed this issue at depth through its report 'Citation Statistics'. Despite the findings of this report, citation metrics such as the impact factor are increasingly used for the evaluation and ranking of journals, papers, individuals, projects and even whole departments. Hiring decisions, budget allocations, etc. are influenced by these numbers worldwide. In addition to the fact that the objectivity of these numbers is illusory, the magnitude of these numbers varies considerably between scientific disciplines, and this may hurt mathematics.

An additional aspect is that publication habits are beginning to change. Scientists rely increasingly on preprint servers which make current results much more quickly available than journals. Their value and the value of this service are frequently not considered by decision makers. One reason for the growth of 'open access publication systems' is also that, despite gains in efficiency through new technology, journal prices are rising and, due to static or decreasing budgets, access to the published mathematical literature is becoming increasingly difficult for many. Mathematics has to react to this situation. The current initiative was prompted by the paper *Nefarious Numbers* by D. N. Arnold and K. K. Fowler, the proposal *Thoughts about journals and the role of international mathematical organisations* by S. Mueller, and the questions by many *What actions should follow the findings of the Citation Statistics* report?

**The Charge**

- The working group is charged with the task of proposing ideas to ICIAM and IMU of how to actively react to the situation described above.
- Each proposed idea should be accompanied by an estimate of the efforts involved in establishing and maintaining an implementation of the idea in the long run.
- The working group is asked to comment on the possible effects of each proposal, in particular, on changes in the behavior of researchers, universities, funding agencies, publishers etc. Are these acceptable? May there be legal implications?
- One possible proposal could be a ranking system for journals created by the mathematical community. In addition, does it make sense to include preprint servers in such a ranking? If so, how? Is the work-load in establishing and maintaining a community based system acceptable? And will in practice sufficiently many mathematicians be prepared to be involved on a continuing basis? How can this process be organized?
- The working group is also asked to consider what other possible options there may be for protecting against the inappropriate use of impact factors and similar manipulable indices for evaluating research.

The Executive Committees/Boards of IMU and ICIAM intend to discuss the ideas presented by the working group in depth in order to decide which of the possible routes to follow. IMU has its next EC meeting on February 26 and 27, 2011. It would, thus, be very helpful to have the report by 18 February, 2011.

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Terms of Reference approved by the ICIAM/IMU leadership on October 19, 2010

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## Charminar

*Ulf Persson*

Charminar sett fr n den n rbel gna 'Masjiden'

Som bekant betyder det persiskt/-hindiska ordet 'char' fyra, och 'minar' refererar uppenbarligen till minaret, relaterat till det arabiska ordet 'manara' som betyder spira eller torn. Byggnaden uppfördes 1591 på uppdrag av Muhammed Quli Qutb Shah, den femte härskaren i Qutb Shahi-dynastin, i tacksamhet för att en pestepedemi i staden hade hejdats. Denna dynasti regerade över kungariket Golkonda (som för övrigt givet namn åt det närbelägna fortet som byggdes samtidigt som Charminar) och härstammade liksom Mogulerna från ett turkiskt nomadfolk, och var liksom dem muslimer. Dynastin krossades under den åttonde härskaren - Abul Hasan, av Mogulkejsaren Aurangzeb 1687 som lade fortet i ruiner.

Tornen är närmare femtio meter höga, och de utgör hörnen av en kvadrat med 20 meters sida. Byggnadsmaterialet utgörs av granit och kalksten, sammanfogat med murbruk. Enligt rykten även pulveriserad marmor. Man klättrar upp till andra våningen via trånga spiraltrappor i hörntornen, och har därifrån en slående panoramisk utsikt över marknaderna som omger byggnaden. De inhemska betalar en (för oss) spottstyver för att besöka, västerlänningar får punga ut med mera, men får i gengäld en lyxigare biljett. Som så ofta nu i världen måste man genomgå en säkerhetskontroll innan man blir insläppt. Detta förtar till en viss del romantiken.

# Nefarious Numbers

*Douglas N. Arnold and Kristine K. Fowler*[1]

**Introduction**

The impact factor has been widely adopted as a proxy for journal quality. It is used by libraries to guide purchase and renewal decisions, by researchers deciding where to publish and what to read, by tenure and promotion committees laboring under the assumption that publication in a higher impact factor journal represents better work, and by editors and publishers as a means to evaluate and promote their journals. The impact factor for a journal in a given year is calculated by ISI (Thomson Reuters) as the average number of citations in that year to the articles the journal published in the preceding two years. It has been widely criticized on a variety of grounds[2]:

- A journal's distribution of citations does not determine its quality.
- The impact factor is a crude statistic, reporting only one particular item of information from the citation distribution.
- It is a flawed statistic. For one thing, the distribution of citations among papers is highly skewed, so the mean for the journal tends to be misleading. For another, the impact factor only refers to citations within the first two years after publication (a particularly serious deficiency for mathematics, in which around 90% of citations occur after two years).
- The underlying database is flawed, containing errors and including a biased selection of journals.
- Many confounding factors are ignored, for example, article type (editorials, reviews, and letters versus original research articles), multiple authorship, self-citation, language of publication, etc.

[1]Douglas N. Arnold is McKnight Presidential Professor of Mathematics at the University of Minnesota and president of the Society for Industrial and Applied Mathematics. Kristine K. Fowler is mathematics librarian at the University of Minnesota. The authors gratefully acknowledge the assistance of Susan K. Lowry, who developed and supported the database used in this study, and Molly T. White.

[2]See e.g. P. O. Seglen, Why the impact factor of journals should not be used for evaluating research. BMJ 314 (1997), 498-502.

J. Ewing, Measuring journals. Notices of the AMS 53 (2006), 1049-1053.

R. Golubic, M. Rudes, N. Kovacic, M. Marusic, A. Marusic, Calculating impact factor: how bibliographical classification of journal items affects the impact factor of large and small journals. Sci. Eng. Ethics 14 (2008), 41-49.

R. Adler, J. Ewing, and P. Taylor, Citation statistics. Statistical Sciences 24 (2009), 1-14.

Despite these difficulties, the allure of the impact factor as a single, readily available number - not requiring complex judgments or expert input, but purporting to represent journal quality - has proven irresistible to many. Writing in 2000 in a newsletter for journal editors, Amin and Mabe[3] wrote that the "impact factor has moved in recent years from an obscure bibliometric indicator to become the chief quantitative measure of the quality of a journal, its research papers, the researchers who wrote those papers and even the institution they work in." It has become commonplace for journals to issue absurd announcements touting their impact factors, like this one which was mailed around the world by World Scientific, the publisher of the International Journal of Algebra and Computation: "IJAC's Impact Factor has improved from 0.414 in 2007 to 0.421 in 2008! Congratulations to the Editorial Board and contributors of IJAC." In this case, the 1.7% increase in the impact factor represents a single additional citation to one of the 145 articles published by the journal in the preceding two years.

Because of the (misplaced) emphasis on impact factors, this measure has become a target at which journal editors and publishers aim. This has in turn led to another major source of problems with the factor. Goodhart's law warns us that "when a measure becomes a target, it ceases to be a good measure"[4]. This is precisely the case for impact factors. Their limited utility has been further compromised by impact factor manipulation, the engineering of this supposed measure of journal quality, in ways that increase the measure, but do not add to - indeed subtract from - journal quality.

Impact factor manipulation can take numerous forms. In a 2007 essay on the deleterious effects of impact factor manipulation, Macdonald and Kam[5] noted wryly that - the canny editor cultivates a cadre of regulars who can be relied upon to boost the measured quality of the journal by citing themselves and each other shamelessly.- There have also been widespread complaints by authors of manuscripts under review, who were asked or required by editors to cite other papers from the journal; given the dependence of the author on the editor's decision for publication, this practice borders on extortion, even when posed as a suggestion. In most cases, one can only guess about the presence of such pressures, but overt instances were reported already in 2005 by Monastersky[6] in the Chronicle of Higher Education and Begley[7] in

[3] M. Amin and M. Mabe, Impact factors: use and abuse. Perspectives in Publishing 1 (2000), 1-6.

[4] This succinct formulation is from M. Strathern, 'Improving ratings': audit in the British University system, European Review 5 (1997), 305-321.

[5] S. Macdonald and J. Kam, Aardvark et al.: quality journals and gamesmanship in management studies. Journal of Information Science 33 (2007), 702-717.

[6] R. Monastersky, The number that's devouring science. Chronicle of Higher Education 52 (2005).

[7] S. Begley, Science journals artfully try to boost their rankings. Wall Street Journal, 5 June 2006, B1.

the Wall Street Journal. A third well-established technique by which editors raise their journals' impact factors, is by publishing review items with large numbers of citations to the journal. For example, the Editor-in-Chief of the Journal of Gerontology A made a practice of authoring and publishing a review article every January focusing on the preceding two years; in 2004, 195 of the 277 references were to the Journal of Gerontology A. Though the distortions these unscientific practices wreak upon the scientific literature have raised occasional alarms, many suppose that they either have minimal effect or are so easily detectable they can be disregarded. A counterexample should confirm the need for alarm.

**The case of IJNSNS**

The field of applied mathematics provides an illuminating case in which we can study such impact factor distortion. For the last several years, the International Journal of Nonlinear Sciences and Numerical Simulation (IJNSNS) has dominated the impact factor charts in the "Mathematics, Applied" category. It took first place in each year 2006, 2007, 2008, and 2009, generally by a wide margin, and came in second in 2005. However, as we shall see, a more careful look indicates that IJNSNS is nowhere near the top of its field. Thus we set out to understand the origin of its large impact factor.

In 2008, the year we shall consider in most detail, IJNSNS had an impact factor of 8.91, easily the highest among the 175 journals in the applied math category in ISI's Journal Citation Reports (JCR). As controls, we will also look at the two journals in the category with the second and third highest impact factors, Communications on Pure and Applied Mathematics (CPAM), and SIAM Review (SIREV), with 2008 impact factors of 3.69 and 2.80, respectively. CPAM is closely associated with the Courant Institute of Mathematical Sciences, and SIREV is the flagship journal of the Society for Industrial and Applied Mathematics (SIAM).[8] Both journals have a reputation for excellence. Evaluation based on expert judgment is the best alternative to citation-based measures for journals. Though not without potential problems of its own, a careful rating by experts is likely to provide a much more accurate and holistic guide to journal quality than impact factor or similar metrics. In mathematics, as in many fields, researchers are widely in agreement about which are the best journals in their specialties. The Australian Research Council recently released such an evaluation, listing quality ratings for over 20,000 peer-reviewed journals across disciplines. The list was developed through an extensive review process involving learned academies (such as the Australian Academy of Science), disciplinary bodies (such as the Australian Mathematical Society), and many researchers and expert reviewers.[9] This rating will be used in 2010 for the Excellence in Research Australia

[8] The first author is the current president of SIAM.

[9] Australian Research Council, Ranked Journal List Development, http://www.arc.gov.au/era/journal_list_dev.htm

assessment initiative, and is referred to as the ERA 2010 Journal List. The assigned quality rating, which is intended to represent "the overall quality of the journal," is one of four values:

- A*: one of the best in its field or subfield
- A: very high quality
- B: solid, though not outstanding reputation
- C: does not meet the criteria of the higher tiers

The ERA list included all but five of the 175 journals assigned a 2008 impact factor by JCR in the category "Mathematics, Applied." Figure 1 shows the impact factors for journals in each of the four rating tiers. We see that, as a proxy for expert opinion, the impact factor does rather poorly. There are many examples of journals with a higher impact factor than other journals which are one, two, and even three rating tiers higher. The red line is drawn

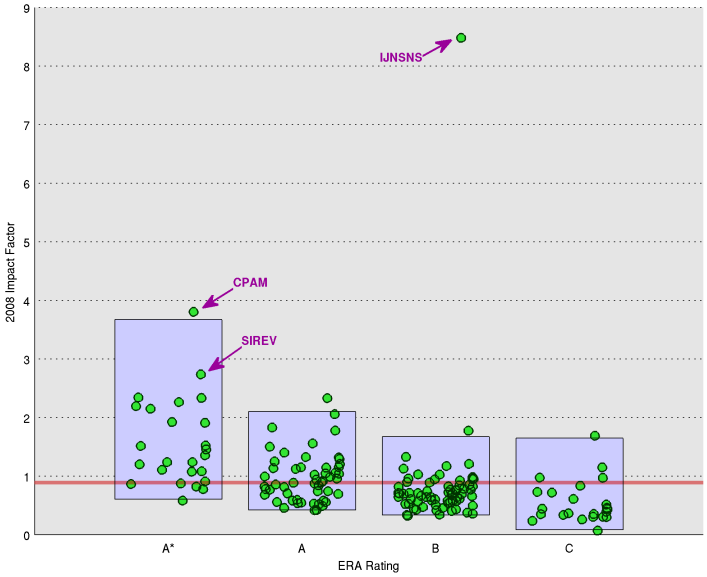


*Figure 1: 2008 impact factors of 170 applied math journals grouped according to their 2010 ERA rating tier. In ecah tier, the band runs from the 2.5th to the 97.5th percentile, outlining the middle 95%. Horizontal position of the data points within tiesr is assigned randomly to improve visibility. The red line is at the 20th percentile of the A* tier.*

so that 20% of the A* journals are below it; it is notable that 51% of the A journals have an impact factor above that level, as do 23% of the B journals and even 17% of those in the C category. The most extreme outlier is IJNSNS, which, despite its relatively astronomical impact factor, is not in the first or second, but rather third tier. The ERA rating assigned its highest score, A*, to 25 journals. Most of the journals with the highest impact factors

are here, including CPAM and SIREV, but of the top 10 journals by impact factor, two were assigned an A, and only IJNSNS was assigned a B. There were 53 A-rated journals, and 69 B-rated journals altogether. If IJNSNS were assumed to be the best of the B journals, there would be 78 journals with higher ERA ratings, while if it were the worst, its ranking would fall to 147. In short, the ERA ratings suggest that IJNSNS is not only not the top applied math journal, but its rank should be somewhere in the range 75-150. This remarkable mismatch between reputation and impact factor begs an explanation.

**Makings of a high impact factor**

A first step to understanding IJNSNS's high impact factor is to look at how many authors contributed substantially to the counted citations, and who they were. The top-citing author to IJNSNS in 2008 was the journal's Editor-in-Chief, Ji-Huan He, who cited the journal (within the two-year window) 243 times. The second top-citer, D.D. Ganji, with 114 cites, is also a member of the editorial board, as is the third, regional editor Mohamed El Naschie, with 58 cites. Together these three account for 29% of the citations counted towards the impact factor. For comparison, the top three citers to SIREV contributed only 7, 4, and 4 citations, respectively, accounting for less than 12% of the counted citations, and none of these authors is involved in editing the journal. For CPAM the top three citers (9, 8, and 8) contributed about 7% of the citations, and, again, were not on the editorial board.

Another significant phenomenon is the extent to which citations to IJNSNS are concentrated within the 2-year window used in the impact factor calculation. Our analysis of 2008 citations to articles published since 2000 shows that 16% of the citations to CPAM fell within that 2-year window, and only 8% of those to SIREV did; in contrast, 71.5% of the 2008 citations to IJNSNS fell within the 2-year window. In Table 1, we show the 2008 impact factors for the three journals, as well as a modified impact factor, which gives the average number of citations in 2008 to articles the journals published not in 2006 and 2007, but in the preceding six years. Since the cited half-life (the time it takes to generate half of all the eventual citations to an article) for applied mathematics is nearly 10 years[10], this measure is at least as reasonable as the impact factor. It is also independent, unlike JCRs 5-Year Impact Factor, as its time period does not overlap with that targeted by the impact factor.

[10] In 2010, Journal Citation Reports assigned the category 'Mathematics, Applied' an aggregate cited half-life of 9.5 years.

| Journal | 2008 Impact Factor with normal 2006-7 window | Modified 2008 "impact factor" with 2000-5 window |
|---|---|---|
| IJNSNS | 8.91 | 1.27 |
| CPAM | 3.69 | 3.46 |
| SIREV | 2.8 | 10.4 |

Table 1:*2008 impact factors computed with the usual two-preceding years window, and with a window going back eight years but neglecting the two immediately preceding.*

Note that the impact factor of IJNSNS drops precipitously, by a factor of seven, when we consider a different citation window. By contrast the impact factor of CPAM stays about the same and that of SIREV increases markedly. One may simply note that, in distinction to the controls, the citations made to IJNSNS in 2008 greatly favor articles published in precisely the two years which are used to calculate the impact factor.

Further striking insights arise when we examine the high-citing journals rather than high-citing authors. The counting of journal self-citations in the impact factor is frequently criticized, and indeed it does come into play in this case. In 2008, IJNSNS supplied 102, or 7%, of its own impact factor citations. The corresponding numbers are 1 citation (0.8%) for SIREV and 8 citations (2.4%) for CPAM. The disparity in other recent years is similarly large or larger.

However, it was Journal of Physics: Conference Series, which provided the greatest number of IJNSNS citations. A single issue of that journal provided 294 citations to IJNSNS in the impact-factor window, accounting for more than 20% of its impact factor. What was this issue? It was the proceedings of a conference organized by IJNSNS Editor-in-Chief He at his home university. He was responsible for the peer review of the issue. The second top-citing journal for IJNSNS was Topological Methods in Nonlinear Analysis, which contributed 206 citations (14%), again with all citations coming from a single issue. This was a special issue with Ji-Huan He as the guest editor; his co-editor, Lan Xu, is also on the IJNSNS editorial board. J.-H. He himself contributed a brief article to the special issue, consisting of 3 pages of text and 30 references. Of these, 20 were citations to IJNSNS within the impact-factor window. The remaining 10 consisted of 8 citations to He and 2 to Xu.

Continuing down the list of IJNSNS high-citing journals, another similar circumstance comes to light: 50 citations from a single issue of the Journal of Polymer Engineering (which, like IJNSNS, is published by Freund), guest-edited by the same pair Ji-Huan He and Lan Xu. However, third place is held by the journal Chaos, Solitons & Fractals, with 154 citations spread over numerous issues. These are again citations which may be viewed as subject to editorial influence or control. In 2008 Ji-Huan He served on the editorial

board of CS&F, and its Editor-in-Chief was Mohamed El Naschie, who was also a co-editor of IJNSNS. In a highly publicized case, the entire editorial board of CS&F was recently replaced, but El Naschie remained co-editor of IJNSNS.

Many other citations to IJNSNS came from papers published in journals for which He served as editor, such as Zeitschrift für Naturforschung A, which provided 40 citations; there are too many others to list here, since He serves in an editorial capacity on more than 20 journals (and has just been named Editor-in-Chief of four more journals from the newly-formed Asian Academic Publishers). Yet another source of citations came from papers authored by IJNSNS editors other than He, which accounted for many more. All told, the aggregation of such editor-connected citations, which are time-consuming to detect, account for more than 70% of all the citations contributing to the IJNSNS impact factor.

**Bibliometrics for individuals**

Bibliometrics are also used to evaluate individuals, articles, institutions and even nations. Essential Science Indicators, which is produced by Thomson Reuters, is promoted as a tool for ranking "top countries, journals, scientists, papers, and institutions by field of research." However, these metrics are primarily based on the same citation data used for journal impact factors and thus they can be manipulated just as easily, indeed simultaneously. The special issue of Journal of Physics: Conference Series which He edited and which garnered 243 citations for his journal, also garnered 353 citations to He himself. He claims a total citation count of over 6,800.[11] Even half that is considered highly noteworthy as evidenced by this announcement in ScienceWatch.com: "According to a recent analysis of Essential Science Indicators from Thomson Scientific, Professor Ji-Huan He has been named a Rising Star in the field of Computer Science... His citation record in the Web of Science includes 137 papers cited a total of 3,193 times to date.[12] Together with only a dozen other scientists in all fields of science, He was cited by ESI for the "Hottest Research of 2007-8" and again for the "Hottest Research of 2009."

The h-index is another popular citation-based metric for researchers, intended to measure productivity as well as impact. An individual's h-index is the largest number such that that many of his or her papers have been cited at least that many times. It too is not immune from Goodhart's law. J-H He claims an h-index of 39, while Hirsch estimated the median for Nobel prize winners in physics to be 35.[13] Whether for judgment of individuals or jour-

[11] This claim, and that of an h-index of 39, are made in the biographical notes of one of his recent papers ( Nonl. Sci. Letters 1 (2010), page 1).

[12] ScienceWatch.com, April 2008, http://sciencewatch.com/inter/aut/2008/08-apr/08aprHe/

[13] J.Hirsch, An index to quantify an individual's scientific research output

nals, citation-based designations are no substitute for an informed judgment of quality.

**Closing thoughts**

Despite numerous flaws, the impact factor has been widely used as a measure of quality for journals, and even for papers and authors. This creates an incentive to manipulate it. As we have demonstrated, it is possible to vastly increase impact factor without increasing journal quality at all. The actions of a few interested individuals can make a huge difference, yet require considerable digging to reveal. We primarily discussed one extreme example, but there is little reason to doubt that such techniques are being used to a lesser - and therefore less easily detected - degree by many journals. The cumulative result of the design flaws and manipulation is that impact factor gives a very inaccurate view of journal quality. More generally, the citations which form the basis of the impact factor and various other bibliometrics are inherently untrustworthy.

The consequences of this unfortunate situation are great. Rewards are wrongly distributed, the scientific literature and enterprise are distorted, and cynicism about them grows. What is to be done? Just as for scientific research itself, the temptation to embrace simplicity when it seriously compromises accuracy, must be resisted. Scientists who give in to the temptation to suppress data or fiddle with statistics to draw a clearer point are censured. We must bring a similar level of integrity to the evaluation of research products. Administrators, funding agencies, librarians, and others needing such evaluations should just say no to simplistic solutions, and approach important decisions with thoughtfulness, wisdom, and expertise.

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Munaqqabater - kvinnor med nikab, marknaden vid Charminar

Kvinnor som bär niqab utgör ett vanligt inslag i gatubilden i Hyderabad, med en stor stor andel muslimsk befolkning. Niqab är inte samma sak som burka, även om begreppen användes omväxlande. Burkan är heltäckande, medan niqaben lämnar en springa för ögonen. (Dock erkännas bör att det finns en heltäckande niqab, som bäres i staterna vid Persiska viken. Jag har inte sett någon sådan i Indien.)

*PNAS***102**(2005),16569-16572.

# Round Table: The Use of Metrics in Evaluating Research

*Transcription by J.M. Ball*

The use of metrics for evaluating research is a hotly debated issue. The IMU/ICIAM/IMS report on Citation Statistics [1] highlighted the dangers of uncritical use of impact factors, which play an increasing role in funding, promotions and library purchases. Are impact factors and other such indices good measures of journal quality, and should they be used to evaluate research and individuals? What can be done about unethical practices like impact factor manipulation? Is there a role for metrics in evaluating research? Are there better alternatives?

These were the topics of discussion at the ICM 2010 Round Table on Thursday, 26 August, between 6 and 8 p.m. It was chaired by John Ball, and organized by IMU's Committee on Electronic Information and Communication (CEIC).

This record of the Round Table consists of edited and shortened versions of the presentations by the panellists, together with excerpts from some of the contributions by participants in the discus- sion. A complete video is available at the IMU website `http://www.mathunion.org/publications/historic-material`.

**Introduction of the panellists**

John Ball. Good evening. I'm substituting for the IMU President, László Lovász, who is actually here but has some problem with his eyes that make it difficult to be in front of bright lights. This round table is a sequel to the 2008 Citation Statistics Report, which was a joint report of the International Mathematical Union, the International Council for Industrial and Applied Mathematics and the Institute of Mathematical Statistics. The writing group for that report was chaired by John Ewing, who was then Executive Director of the American Mathematical Society. This report had a very good reception and it drew attention to the dangers of uncritical use of the impact factor as a statistical measure of journal quality. We have a very interesting panel:

**Doug Arnold** is Professor of Mathematics at the University of Minnesota in Minneapolis and currently is President of SIAM.

**Malcolm MacCallum** is the Director of the Heilbronn Institute at the University of Bristol, and was a consultant on the United Kingdom Research Excellence Framework, which is going to be the next evaluation of research in the UK.

**Jos'e Antonio de la Pena** was Director of the Mathematical Institute at the National University of Mexico and is a former President of UMALCA, the Mathematical Union of Latin America and the Caribbean, and he is

currently Deputy General Director for Science at the National Council for Science and Technology, Mexico.

**Frank Pacard** is Professor of Mathematics at the Université Paris Est-Creteil, and is Scientific Advisor of Mathematics in the French Ministry of Higher Education and Research.

**Presentations by the panellists**

*Doug Arnold.* I will focus mostly on one research metric: the Impact Factor (IF), which is simply the average number of citations made in a given year to a journal's papers from the preceding two years. It is intended as an easily used journal quality measure, but, as I will demonstrate, it is fatally flawed. The Citations Statistics report found many failings in the IF design as a proxy for journal quality, but I am going to focus on something else: Goodhart's law and IF manipulation. Goodhart's law states that: 'When a measure becomes a target, it ceases to be a good measure'. An example used in economics is that if a nail factory in a centralized economy is judged on the number of nails produced, pretty soon they will figure out they should make lots and lots of tiny nails. If it is judged on the weight of the output, they will start making very big nails. The metric ceases to be an accurate proxy for the more complex attribute, say productivity, which was intended. How do people manipulate the IF? One way was demonstrated by an editor of Journal of Geron- tology A. Every January, he would write a review article citing all the articles of the preceding two years, and so acquire 200 impact factor citations, more than most math journals get altogether. Another approach is that "the editor cultivates a cadre of regulars, who can be relied upon to cite themselves and cite the journal shamelessly'. Such a bargain between authors and editors is difficult to detect. Citation pressure on authors is usually as well, but the editors of the Balkan Journal of Geometry and Applications put it in their instructions to authors: "[it] is advisable for each accepted paper to contain citations to articles published during 2006-2008 in our journals'. In order to determine to what extent such manipulation is actually damaging the IF, I compared it to expert opinion, for which I used a journal ranking carried out with broad and careful expert consultation as part of an Australian research assessment exercise. This study [2] demonstrates that many of the bottom class, B and C, journals have higher IF than a significant proportion of the journals that are judged by experts to be the best in their subfield. The grossest anomaly is The International Journal of Nonlinear Sciences and Numerical Simulations (IJNSNS), which has had the highest IF in all of applied mathematics by a large margin for the last four years running, although as a B-rated journal there are roughly a hundred journals in front of it according to the Australian rating. Working with librarian Kristine Fowler, I studied this case in detail. Which authors gave IJNSNS all those citations? It turns out that 30% of the citations were from just three authors, and these were the Editor-in-Chief, who cited his

own journal 243 times in the IF window, and two other editors. (For control we looked at high reputation journals in applied mathematics, and found it is rare to have more than a few citations come from a single author). As a second approach, I looked at the highest citing journals for IJNSNS. First place is a single issue of the Journal of Physics Conference series, which provided 294 citations. This was the proceedings of a conference that the IJNSNS Editor-in-Chief organised and controlled the peer review for. The next highest citer was a special issue of a different journal that was again organised by the Editor-in-Chief of IJNSNS. Similar issues arose with other highly citing journals, so that more than 70% of the citations were under the immediate control of the IJNSNS editorial board. A different sort of check is to look at the citations outside the IF window. With IJNSNS, 72% of their citations are in the two years that count for the IF and only 28% in all the other years. With SIAM Review, for example, it is the very opposite: only 8% fall in the IF window. Although I have been mainly concerned with journals, the people who make the IF say their citation database "can rank top countries, journals, scientists, papers and institutions'. Who do they think is the top mathematician? Ji-Huan He, the Editor-in-Chief of IJNSNS! He was named by them as a "Rising Star' in Computer Science; he had a "New Hot Paper' in Physics, another one in Mathematics; a "Fast Breaking Paper' in Engineering. And then in 2007-2008, they named 13 scientists in all of science as "Hottest Researchers of the Year', and he was the only mathematician, a performance he repeated the next year. To conclude, there is little doubt that IF is highly flawed as an indicator of journal quality. I showed how a journal which is roughly number 100 in applied mathematics moved itself up to number one. There are certainly many other cases in which journals manipulate the IF more subtly, moving themselves up (and so moving more honest journals down) five or ten places. We cannot expect an easy formulaic fix. If we agree to judge quality by counting citations, Goodhart's law indicates that we will fail. However, there is a need, e.g. for library purchase decisions, for an easily consulted indicator of journal quality. The IMU and ICIAM have discussed this and taken a big step forward this month by resolving to develop a plan for a joint ICIAM/IMU method of rating journals, based on expert opinion. This has the potential of providing truly useful information to those who need it, while returning the process of judgement to us, the experts.

*Malcolm MacCallum.* I think a lot of the discussion is going to centre on impact factors and citation indices. I want first to draw your attention to the other sorts of metric used, in particular in the UK Research Assessment Exercise (RAE). It had three headings: "Outputs', "Environment' and "Esteem'. "Outputs', essentially papers, and "Esteem' were assessed by peer judgement. In judging Environment, we had about 20 metrics presented to us, for example the number of Research Assistants per full time equivalent

members of staff. There was no sane way to use them all. Some of them were really input measures, and it is very hard to establish how effectively they had created output or knowledge transfer. My own suspicion is that the less income you have, the better you use it. Some are outside institutional control. Some are historical: you may be very attracted to where, say, Hardy worked although Hardy died long ago. In fact, I think too many of them are self perpetuating, rather than reacting to current research quality. Even if you accept them as valid, there are still various ways to use them. For example, in considering the total research income per person against the size of departments, do you reward the department that earned most or the one spectacularly effective with the number of people they have? Kenna and Berche [3] found that in almost all disciplines there is a critical size above which the research quality tails off. Unfortunately this isn't a very useful message for this assembly because while true for applied, it is not true for pure mathematics. In the UK, they plan to replace "Esteem' by "Impact', meaning economic, social or cultural but not scientific impact. That has to do with why a government should fund research at all, which is a very fair question. But I think the specific way that they are intending to answer it is not the right one. The Royal Astronomical Society and the UK Institute of Physics, concluded "we can't do it' and "we don't think it's doable' Fabian [4]. Now I want to come back to bibliometric measures. There has been a lot of research on citation data, and the many problems it has, such as consistency, coverage, nationality and gender biases, indexing, "obliteration', discipline size and citation practice etc. (see e.g. Blustin [5], and for fun [6]). In RAE we specifically did not use bibliometric data. But after I had read and assessed each paper, I looked up its citations. That caused me to change my opinion on only two or three of the 400 papers read. So citation information can be useful, but it has to be interpreted with a knowledge of the sociology of the discipline and an understanding of the mathematical content. For the Expert Advisory Group on the replacement for RAE, there was a pilot of looking at citations of individual papers. The resulting data was given to us to compare with our actual assessments. There was general agreement across all subjects that the bibliometric data could not have been used without some serious injustices. As a journal editor I find impact factors a useful measure of how we are doing against the competition. But I do not believe one can judge a paper by where it appears: thus I do not agree with Professor Arnold's proposals. In summary, I have two messages. 1. To bureaucrats: no metric is safe for use without human interpretation. You have to be very careful to realise that correlation does not imply causation. One of my colleagues claimed that the UK ranking of institutions was very tightly correlated with the number of gardeners they employed! 2. To those entirely opposed to metrics: they can be a useful sanity check, providing you don't try to use too many or make them too complex.

*Frank Pacard.* I wanted to say something about the situation in France concerning the use of citations and metrics to evaluate mathematical research, either by the government or by the universities. First of all, there have been some changes in the French higher education and research system and, to understand how citations and metrics are used, it is very important to understand how the money supporting research is now distributed. In France almost all the money for mathematics comes from the Ministry of Higher Education and Research but it travels through many different channels before it reaches mathematicians. As far as the assessment of research is concerned, the government has created some evaluation agency to this effect. So far, the evaluations from this agency are not based on the use of metrics and complicated impact factors, there is though a definition of an "active researcher' which depends on the number of publications. Therefore, everything seems to be going smoothly in France with a very limited use of statistics in the assessment of research. However, looking closer you find that there is also an institution whose work is to provide statistics based on the number of publications and citation. Even though these statistics are not used offcially to evaluate a research department, they are becoming more and more popular to measure for example the strength, weakness and evolution of the different fields in a given part of France (for example, all sciences in the south west of France). These data are also available to all actors of the research system. These statistics can be very precise and can cover very different scales : at a scale of a whole country up to the scale of a research department. For example, in my own university, statistics about the number of publications of the mathematics department (which is a small department) are received and, as you can imagine, interpretation of the data can be rather controversial at such a small scale. French universities are now autonomous and have more freedom in their scientific policy. In particular, to some extent, they can decide to give more support to department A rather than to department B and the government does not provide them with any guide on how to distribute the money among departments. As a consequence, there is more and more pressure to make use of metrics in order to distribute the money as best as possible, using possibly some very complicated mathematical formula. Even though French mathematics is very strong, it is fair to say it only corresponds to a very tiny subset of the French research system. What is true at a national level is also true at the level of a university where mathematics departments are now in direct competition with other departments of other sciences whose weights are much bigger and for which the use of metrics seems more natural. This is where I see that there is some danger for mathematics in France. My experience shows that there is a strong temptation to use metrics not necessarily coming from the top of the research evaluation system but also coming from the bottom of the evaluation system, because metrics are a rather quick and convenient way to compare people or departments from different fields! On the other hand, the use of metrics at a large

scale (say the scale of a country like France) is probably worth considering and, carefully analysed and complemented, can give some interesting insight on the strength and weaknesses of a given field. For example, the relative share of publications of French mathematicians in the world has decreased over the past years slightly faster than expected. This is an interesting piece of information but unfortunately, since there is no further analysis of this information, it might be improperly used. Also, people in charge of building the statistics based on publications are well aware that some indices used are not adapted to mathematics (for example, the number of citations in the two years after publication is not very meaningful in mathematics) and they would be very interested in having some more meaningful formula. To conclude, I would say that the situation concerning the use of metrics in France is still not completely clear. There is some pressure to use them and we have to be very careful in the next years to protect ourselves from improper intensive use.

*José Antonio de la Pena.* Citation indices, originally designed for information retrieval purposes, are increasingly used for research evaluation. The concern that the consideration of these indices is distorting the evaluation of the individual work has passed, in the last few years, from corridors to main stream journals. In the developed countries, at least since the second half of the 20th century, science is accepted as a social, cultural and economic asset. Although the relevance of scientific work has been evaluated from decades back, current evaluation practices have a recent history that respond not only to academic needs, but to conceptual changes of political, economic and social character. In evaluating scientific work, the criteria used are expected to have universal validity (as much geographic, as thematically), to be objective, to be simple to measure and to determine, as far as pos- sible, the quality of the work. The criteria used so far show many limitations and misinterpretations. Notably, the use of impact factor of journals as a measure of the quality of the science published and, still worse, the quality of the individual papers published in those journals, is an extended practice without a solid support. Even Eugene Garfield has warned against some abuses: "It is absurd to make comparisons between specialist journals and multi-disciplinary general journals like Nature'. To check the evaluation practices in Latin American countries, we asked friends from Argentina, Brazil, Colombia, Chile, Mxico and Venezuela. Here I quote just a few answers to illustrate the discussion:

Q1. *Are indices (such as number of papers, number of citations, impact factor of journals, h-number, etc) used for the evaluation of mathematicians in your country? If yes, which indices are prefered?*

Chile: In general no. Up to now the committees of mathematics agree on the quality of the journals to evaluate the research projects or CV. Sometimes they use, as complementary information in the analysis, some citation

indices.

Colombia: In the public universities, the salary of the professors depends on the numbers of papers.

Venezuela: Yes, in some cases. At research institutions, the tendency is to use all those indices to evaluate researchers, but not so much at universities.

Q2. *Who promotes the use of these indices (the administration, scientists in general, mathematicians in particular)?*

Everybody: the administration, in first place; scientists of other fields, as second.

Q3. *Is it considered that the use of indices provides a more: effcient, scientific, fair, objective way of evaluation? Who thinks so?*

Most: I guess that some groups of scientists look for effciency and some kind of "fairness'.

Q4. *In your opinion, what is the effect of the use of these indices?*

Most: I believe they do add value to the evaluation, if used carefully and in combination with other parameters.

Argentina: the use of indices is helpful to discriminate between real scientists and those who pretend to do scientific work but have no impact whatsoever.

Chile: I do not know the effect for all areas, perhaps in some of them the systematic use of indices could be useful (but, at the end the prevalence of indices would mean that the work of specialists is not necessary). A systematic use of indices in mathematics will constitute a big catastrophe for its development (an enormous deformation that could affect quality for a long time) . Q5. *Could you give an idea of the general feeling of (dis)satisfaction concerning evaluation among the scientists (in particular, mathematicians) in your country?*

Brazil: The general feeling is actually very positive, among mathematicians and among scientists in general. This is perhaps because the scientific community itself is directly in charge of the evaluation.

Chile: People that have been part of the local evaluation committees says that there is mutual dissatisfaction between mathematicians and other groups of scientists.

Comparing the use of impact factors to measure quality of research with the story of the measuring human intelligence by means of the IQ, we point out the misunderstanding of thinking that a person is intelligent because they have a high IQ. Similarly, we are pushed to believe that a scientific paper is good because it is published in a journal of high impact factor. This is my last argument: I would call it the mismeasure of science, to keep the parallelism with the situation described by Stephen Jay Gould. It is a complete misconception to transfer the value, whatever the impact factor measures, from journals to articles. It should be made in the converse way, after all, a journal is not more than a collection of papers. The only meaningful definition for the impact factor of a journal is the mean value of

the impact factor of the papers it publishes. If this is so, it is the impact of a scientific article which should be discussed: is it possible to give a sound definition?

**General Discussion**

*Doug Arnold.* While we're waiting for someone to pluck up their courage, let me respond to just one misimpression which may have arisen from Malcolm's talk. He said one cannot judge a paper by where it appears and for that reason didn't like my proposal. So I want to make clear that I agree 100% with Malcolm that one cannot and should not judge a paper by where it appears. In fact in some cases it might be wise to choose a lower impact journal for an excellent paper, for example to help strengthen the journal. My proposal to rate journals is in no way aimed at judging individual papers, and any report that comes out of it would clearly state that. It is a way to get a sense of a quality of a journal for reasons like library purchase decisions, helping the editorial board to know how their work is going and so forth.

*George Andrews,*[1] I'd like to ask Prof MacCallum, since you say you do not accept Doug Arnold's proposals, I wonder if you are not disturbed by, not the manipulations and outliers, that were in the graph, but the discrepancy that he described between the top level journals, as people assess them, having a lower impact factor than really badly ranked journals. Any solution is going to have problems, but aren't the problems mitigated somewhat by Doug's proposal?

*Malcolm MacCallum.* I think that there are certain problems that would be mitigated but what worries me are the ways in which this is likely to be used, and the degree to which it seems to be going along with the idea that you can make judgements by where something appears. I think we should simply be opposing use of data on journals for this kind of purpose. What was shown in the comparison you refer to doesn't surprise me because different journals appeal to different subcommunities or accept papers with a different kind of angle or approach.

*Doug Arnold.* So I just want to repeat again that there was never any suggestion that one should use the journal quality, no matter how carefully measured and determined, as a way to rate papers, or what you call products of research. I know you have been very involved with rating products of research and you may think that is what this proposal is for. The proposal is to rate roughly, to give a rough idea of what we all know as mathematicians, to put down what we all know about the quality of journals. Why do we want to do this? We want to do this, for instance, because people must make a decision on which journal their libraries are going to subscribe to. If they don't have enough local expertise in the area then the library must make a

[1] Penn State University, USA.

decision based on data. Right now they are making such decisions based on seriously flawed data, and we were hoping to replace that with reasonable data which reffects the expert opinions of the people who look carefully at the journals. You can say that people might misuse that, but in fact people are misusing a highly flawed database. We can create one that is less flawed and with clear instructions of what it can be used for and what its limitations are. The fact that somebody might refuse to honor those or do something foolish, is not a reason not to do anything, particularly because what is being done now is much worse.

*László Lovász,*[2]. So first of all thank you, John, for being out there instead of me. ao a The second remark is that I am a bit envious of Prof Arnold that he lives in a country where it's still the librarians who decide which journal to subscribe to; in many countries it is by bulk subscription by some government agency for all universities in that country, especially for the electronic versions. This is a situation which is a separate question but I just wanted to mention that this is also a very serious concern as far as I can see. My second remark is that I like very much Malcolm's remarks, essentially that the peer review system and numerical data should complement each other. In case there is a discrepancy then it should probably be more carefully looked at. We all know examples where the numerical data gives an entirely false impression, but I have also seen the peer review system run amock, with somebody who was by personality not so well liked or had one enemy in the system, and it has produced very very strange results. So I think in that case numerical data should have corrected the procedure at some point. So I think the question to look at is which numerical data and how can we use it? Now I am talking about evaluating people not about evaluating journals, these are two different issues.

*R. C. Cowsik,*[3] In India we have journals which publish only to the writers of papers in that journal - no other copies are ever sold. And we also have departments where everybody works in the same subject, a narrow part of mathematics. They quote each other so the citations would be large for them. We have a journal called Annals of Mathematics, India, and India is in small print!

*Daya-Nand Verma,*[4]. My question to the entire panel is, isn't there some sort of a parallel between the life of research papers and life of individuals? Educationalists know that all children are not equal, in the same way as you have been pointing out that all research papers are not equal. So sometimes some research paper goes unnoticed, or maybe with very, very few exceptional references by a few people, and has not been referred to for 40 years,

[2]Budapest, Hungary
[3]Mumbai, India.
[4]formerly at TIFR, Mumbai, India

100 years perhaps. Is there a way of devising a system which can pick up these exceptional, high calibre youngsters, so by that I mean the exceptional papers which go unnoticed, just as many high calibre children go not only unnoticed but get punished by the system.

*Malcolm MacCallum.* As mathematicians we like to have absolute objective truth. One area where there will not be an objective truth is in assessment of papers. It is a human activity and we're inevitably going to make mistakes. I don't think we can do anything but accept that and try to minimise its extent.

*Doug Arnold.* I would add that I certainly agree with what Malcolm just said. The most we can do is try to be careful when it come to assessing and the way you assess a paper is to read it. Counting the citations, no matter how carefully you count them, is not very helpful. You brought up the very good point that great papers in mathematics often go uncited for a long period. One of the wonderful facts about mathematics is you often see papers that are very highly cited many years after they are written. And another point is that citations come from all sorts of reasons. If a paper has a mistake and there are criticisms and retractions published, those cite the paper and boost its quality according to a foolish, citation-counting viewpoint.

*Malcolm MacCallum.* In fact I would say if you really want to be highly cited quickly the best way to do it is to write a paper that is just subtly wrong, so that lots of people pitch in to tell you why.

*Garth Dales,*[5] I would like to ask about possible political action, perhaps particularly addressed to Prof Arnold. I share your doubt about citation indices and I entirely agree that they are seriously flawed, but I see a lot of use in them, and it seems that the IMU and mathematicians don't like this and they are inclined to try to protest against this or do something. But I regret to say that political realities are that mathematicians are a small group in the overall scheme of things, and my experience is that however cogent and powerful our arguments are that impress us, they have very limited impact on our government and agencies and so on. And I wonder what your assessment is. It seems to be that the only possibility of changing the culture in this particular respect is to find allies in the much bigger subjects of engineering, biology, physics and chemistry. Unless we have allies and friends in these subject areas, we'll have no impact whatsoever on the governments and agencies, or in particular private publishers that make money out of publishing these statistics. So what is your assessment of our chances of finding allies among these subject areas?

*Doug Arnold.* Well I think that's a very good point and one that has to be raised and thought about quite a lot. I'll make a couple of comments. First

[5] Leeds, U.K.

of all my comments are limited to impact factor as a journal quality proxy. I am not taking on the bigger question of an individual or departments. If we limit ourselve to pointing out, as many have pointed out, and many will continue to point out, that impact factor is highly flawed, we will go unheard. That has already been done and is basically a proven proposition. It is not only mathematicians who are complaining about this. Many, many groups are complaining about it. I feel that - because we are a fairly small community with a great devotion to our literature and some coherence - that by providing an alternative we have a realistic chance to say: "Well you know there is an alternative that you can use instead. It is much, much better but just as easy to use. It has the imprimatur of the major math organisations in the world and there is all this evidence that it is better.' This won't be used for comparing mathematics journals to say geophysics journals, which is meaningless, but for the purposes where you need to make an evaluation and judgement on journals of mathematics. I think this has a chance to come about. I think there is a possibility that people will say "you know these mathematicians have some integrity and they really are doing this right, and maybe we should see about doing something like this.' As far as building up allies, recently I travelled to Singapore, to the World Conference on Research Integrity. They were 350 delegates including people from ministries of science and so forth. Out of the 350 delegates only I was a mathematician. I spoke a little bit about this proposal and I saw lots of allies and got lots of support. People are actually looking forward to seeing what we are going to be able to do in this area.

*Jos'e Antonio de la Pena.* Well I think it's important that mathematicians take a position with

respect to the indices, and maybe propose new ways to measure the impact of journals. But even what is done now, which is very bad, very flawed for mathematics, like measuring the impact factor of journal using this two years window which is completely nonsignificant for mathematics, could be changed. For example, why not calculate the impact factors not using the two years window but using the full history of the journal? Just simply that. That can be much more significant for all sciences: why is this not done? I had an opportunity to speak with some high-ranking person from Thomson Reuters and the answer was "of course we calculate this, we don't publish these results but we do calculate them'. So this means there is a completely different agenda, there's a hidden agenda why they calculate the indices in this way: maybe it is an economic agenda.

*Chandan Dalawat,*[6] I just want to know if this new measure or classification on the quality of journal that's been proposed, has it actually been tested and could we look at the results that it gives? Doug Arnold. No. The situation

[6]Harish-Chandra Research Institute, Allahabad, India.

is the following. First of all, I am the President of SIAM which publishes these journals, so it is not my place to personally set down the mechanics of rating the journals. The proposal, which is brand new, just passed by the IMU General Assembly, is to establish a committee to try to design the best possible system, and then consider the question of how difficult it will be to implement. I can just give you just a rough idea of at least what I have in mind, although other people may well change this. This is something akin to the program committee and panels that chose the invited speakers of this congress. That is many people, between 100 or 200, that were carefully chosen to cover many areas of mathematics. There will be a fairly small number of rating tiers, a few tiers or, perhaps, a matrix with separate tiers for journals that are tightly concentrated on one subdiscipline and broad journals, and so forth. Then these experts would review the journals and try to determine where they place them. Maybe there would be a time for public comment. There would be some rule against conffict of interest. Once they present the results, we will get the opportunity to test them. They will need to be renewed every 4 years or something like that. That's what I have in mind.

*John Ball.* To amplify that a bit, the committee would consider what would be the best way to create such a ranking system, then decide whether to implement that system, and in particular consider some of the issues surrounding such a system, maybe legal implictions, whether there would be the involvement from the community to sustain such a system, and what the knock on affect of such a system would be.

*Zhiming Ma,* [7]. Several years ago in China this problem was really very serious. For example in China if you apply for a promotion or for a prize you have to submit a document with citations. You maybe have to pay money to an agency or a library and then the agency (library) will type the citations, and then you submit it. This was several years ago; now the situation is getting better because many people complained about this. In China we mathematicians say that maybe people in other disciplines such as biologists will use this but for mathematics it's not the case. We always ask the agencies or government to distinguish between subjects, so in this way we get some improvement. Now in China (at least in CAS) when mathematicians apply for a promotion or a prize, we will not follow the general rule of metrics. In this sense we are improving.

*Martin Grötschel,*[8]. Somebody said before that we have no influence. This is absolutely not true; I think mathematicians are heard. Here is an example. The 2002 IMU General Assembly endorsed a document about best practices of journal publishing, advice to authors and so on, and open access in partic-

[7] China
[8] Berlin, Germany

ular. This document was taken up in 2003 by the Max-Planck- Gesellschaft in Germany, Germany's top research organisation. MPG and other institutions finally formulated what was then called the "Berlin Declaration' on open access. IMU's inffuence was clearly visible in this activity. Hundreds of research organisations worldwide signed this declaration, and mathematicians were the forerunners of this effort. One can come up with many ways of classifying journals. Of course, targets have to be formulated together with reasons why we want to classify, why we want to sort journals, or people, or departments by quality. Even if we have reasonable arguments for the organization of the system of our journals, we must not only provide information about scientific quality but also about the way authors are handled, the turnover times and all the things that are important for journal publishing. Making available a broad spectrum of relevant information may be an alternative to just addressing the current crude measurements. The panel addressed totally different targets, for example, whether we rank a paper, a journal, a department, or an individual, or how we compare mathematics to other sciences. We can't handle all these issues in the same way. I personally think that we mathematicians have to simply declare how we would like us and our work be judged; we then have to discuss the evaluation system with our peers in science and in administration. After that we can negotiate with them the way we are in fact judged. Most of the ideas presented here today are good, and our task is to find a reasonable combination of these measurements. My main field is optimisation and what we see in front of us is a multi-objective optimisation problem. There is something like a Pareto set that we have to target for, and which point on the Pareto curve is chosen will depend on local circumstances. We should simply be aware of this fact and spell it out. Something I was really puzzling about is one of Frank Pacard's arguments. Everyone is happy about being free to make decisions. Now the French government seems to give financial support to the universities and the freedom to distribute it. I think that everywhere in the world you would be happy to have such a situation: you just have to elect a good president and good deans. They ought to have good insight and will determine who is doing good research. Do you really want the bureaucracy to give rules? I think it is better to have good people with good judgement distributing the money.

*Frank Pacard.* I agree with you, but in France we are passing from a system in which everything was decided at the top to a system in which a lot is decided at a local level. This takes time. Assessment ffof research is not an easy thing to do at the level of a university. Also, I think that the importance of the use of metrics really depends on how the money supporting research is distributed and this differs from one country to the other. In France, for example, one of the problem we are already confronted with in mathematics is that departments now have to fight against each other inside

each university, to get research funds. And, so far, universities have no real way to decide how much support they should give to a given department. Beside the question of research support, there is also the problem of the evaluation of individuals. French universities now have to compare mathematicians with biologists, chemists or lawyers and panels performing these evaluations do not necessarily have mathematicians, biologists or lawyers on them. In this case, as you can imagine, metrics turn out to have a great impact on discussions. One can hope that the system will probably evolve towards a better equilibrium between the use of metrics and peer review, but in French universities I'm not so sure that the system has already reached this equilibrium.

*Cheryl Praeger,*[9] I thought I would say a little bit about the Aus- tralian experience. The mathematical scientists in Australia did not choose, that is, did not set out, to rank journals. It was the Australian government that decided that all journals would be ranked. The government dictated the proportion of A*, A, B and C journals. So the mathematical scientists decided that we would prefer to make the ranking rather then have the government do it for us. We ended up having to do it three times; in our first run through we decided to rank as many journals as we could, so we would have more A* and A journals, since we had a fixed proportion available for them. The government did not accept this and we were given a limit on the number of journals we were allowed to rank. Even our second attempt was not accepted and we had to makr a third attempt. We are not terribly happy with it but it is something which has had the support under pressure of the whole Mathematical Sciences community, the pure, applied, the statisticians. Everyone joined together to try and do as good a job as we could. It has not been used yet but it is going to be used in a research assessment exercise, which is happening in the next year. We fear it will be used for other purposes. Already it is being used in an unfortunate way; for example my university proposes to measure research activity of individual staff members by the number of journals papers they publish in A* and A rated journals only, which comprise the top 20% or 30% of the journals according to an imperfect ranking. All other publications will be ignored.

*John Ball.* Am I not correct in saying that there is also a ranking of conferences, because I saw a listing of this on the Australian website (see `http://www.arc.gov.au/era/era_journal_list.htm`). So I wondered whether you weren't allowed to go to a conference unless it was an A rated conference.

*Malcolm MacCallum.* That would have particular relevance in Computer Science where a lot of the best papers come out in refereed conference proceedings.

[9] University of Western Australia.

*Hamidou Toure,* [10] We are a small community of mathematicians in Africa and the administrations are trying to use these different indices. Since the evaluation of publications in journals is done normally by peer review, it will be good that the International Mathematical Union make a peer evaluation of the ranking of different journals. It will be very useful for us.

*Jean Lubuma,*[11] I would like to say something about the system which we have in South Africa. I think the colleague from Australia (Cheryl Praeger) said something which is a bit similar. The system in South Africa is such that when you publish a paper, the South African Ministry of Education allocates directly an amount of about 20,000 dollars, which is paid to the university where the research work was done for papers published in the so-called accredited journals. For the moment those are the journals which are in the ISI list. We as mathematicians in the South African Mathematical Societies fought to show the government that this ISI list is not a system which is effective and which is deffnitely not in favour of mathematicians. The government said "look, we want a simple method for us to decide' and so far the method which has been suggested came mostly from our colleagues from medicine and biology, because probably that is where all these ideas of the ISI lists were originated. So this is the situation which we have at present in South Africa, and unfortunately we tried to fight but it didn't work. So I don't agree with what was said by the Secretary earlier, that mathematicians are powerful. I think I would rather agree with our colleague from England, that we are a very small group and it is not always easy to try and convince our colleagues from biology etc. who publish almost every day.

*Jorge Soto-Andrade,*[12] I would like point out that in our country we have some Chilean analogue of NSF and mathematicians have had some word to say concerning assessment of research, but most of the funding for research comes from the government, not directly through the universities. To some extent we have been able to make the point that mathematics is specific, compared with other domains like biology or economics and so on. One of the points is that journals which count for funding for reports are those which you find in this list of ISI or Thomson Reuters. Many people in the government agencies had the idea that ISI was something like IAS or some scientific institute. They didn't realize that it was just a private enterprise with commercial criteria, like Microsoft, Thomson being analogous to Bill Gates. I would say that the International Mathematical Union is a rather small community but is quite homogeneous and has taken stance in a very significant way in the past, and if we can cite a report or some work of the IMU concerning these points this will strengthen our position. I would like to recall the report by Figa Talamanca [7] who was very keen from the

[10] Burkina Faso.
[11] University of Pretoria, South Africa.
[12] D University of Chile.

systemic viewpoint concerning ISI and perhaps some sort of update of this report would be very helpful. It pointed to the fact that the systemic role of ISI in science in the world was a very interesting subject in sociology, and there is a complex dynamics interaction of ISI with big American libraries, with publishers and so on. One interesting point also is that in our country, which is somewhat free-market oriented, the government had the idea to give rewards to papers and so if your paper is in ISI, you'll get perhaps 1000 dollars, and if it's not there you'll perhaps get just a symbolic reward. One important thing I think is that IMU may have some alternative to ISI. If one looks a little bit, one finds very impressive examples of flaws in ISI reports and listings. For instance you have a list of highly cited mathematicians, highly cited researchers in ISI, and I realized perhaps one or two years ago that no Fields Medallist is a highly cited mathematician. There is a field in which the situation is even worse than mathematics, which is mathematics education and there perhaps the best journals are not listed in ISI, and there was some reaction which was very positive from IMU and I think this should be pursued. Concerning other scientific communities, I also work with biochemists, biologists and other researchers in cognitive science, fields whose dynamics are quite different from ours, where updated reports from the IMU concerning this issue may help us a lot .

*Michel Hébert,*[13]. A few years ago the American Mathematical Society has started e publishing their own impact factor in MathSciNet. I think it was a result of their own long study. I didn't read the report in detail at that time but remember it was precisely to respond to all these wrong ways for mathematics such as the two year window. So I'm a bit surprised also that there doesn't seem to be any collaboration, or there has been no result. Don't the IMU and AMS know what each other is doing?

*Ali Ulas Ozgur Kisisel,*[14]. So in my university our struggle is usually with the university administration, which rarely consists of any mathematicians; however in the mathematics department we have quite a good idea about what should be brought up, and what should be kept down. Maybe I should give some specifics. For instance all the hiring procedures and appointments to posts are based on the number of papers in science core index journals and for instance in order to be an Associate Professor in the Maths department it should be at least 7, and that is a fairly low number, and as you could expect it has drastically different effects if you are studying Applied Mathematics or Modular Forms. So I asked some friend who was working in Ex-Soviet Union how did it happen there? And it was very easy - Kolmogorov decided everything, so no problem! But of course in today's world I guess this is out of the question. But something that we could use, and IMU or global organisa-

[13]Cairo, Egypt
[14]Middle East Technical University, Turkey

tions could do, would be to bring forward some experiences from prestigious universities, like interviews with deans, interviews with department chairs so we could use them in our struggle with our administrations.

*Gholamreza Khosroshahi,*[15] I work in an institute called the Institute for Research in Fundamental Sciences. In the beginning we were just theoretical physicists and mathematicians and the fight from the beginning started in the committees and the councils about evaluation of mathematics and physics. Physicists usually dominated the issue because of cita- tions and these kind of things and later on other schools like computer science, theoretical computer science, neuroscience, nanoscience were added to our institute. The fight was widened and there are two problems which are always there, one - inside the mathematics council you have to fight - suppose I'm a combinatorialist, at the beginning those who didn't do any research about 20 years ago said what? Combinatorics? And they were saying that it is easy to publish in combinatorics and it is very difficult to publish say in algebraic geometry etc. So this fight gradually subsided because gradually they had to publish and they couldn't publish. Then outside of mathematics, physicists used to say always "what is the citation on this' ? "This paper has 100 citations' and so forth? This fight still is going on, but I agree with Prof GrÂ¨tschel that mathematicians should be tough fighters o and they should handle these hard situations. We do that and we have succeeded. One more thing is that we have to prove to others that every discipline has its own culture: culture in mathematics is quite different from culture in computer science or physics.

*Gerhard Paseman,*[16] There are a number of communities online (such as mathoverflow.net) that are doing rankings of various things, anything from individuals to pizzas. In particular there are some communities forming, scientific communities that exchange information and they do ranking based on reputation, and it seems to me that they are models of some of the things to look at, as examples of what might be a good form of metric, and there are also some obvious mistakes in some of these models, that could probably be avoided by forming a metric. I'm curious to see how metrics for journals, for professional mathematicians, for scientists will actually reflect some of their activity online.

[15] IPM and University of Tehran, Iran.
[16] USA.

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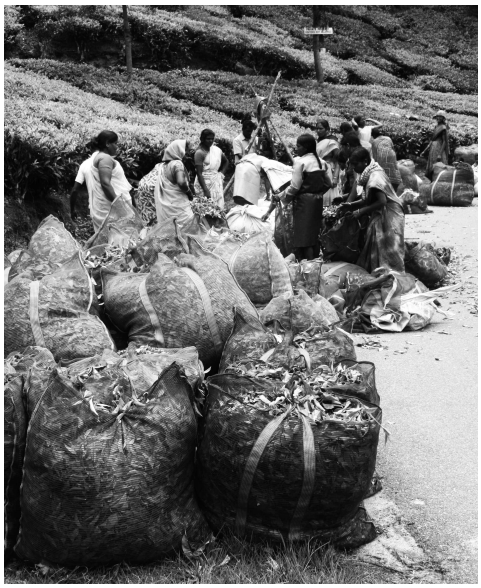

Teskörd vid Top Station, Kerala

Teplantan kan växa som träd upp till 16 meters höjd, men när den kultiveras klipps den ner till bekväm plockningshöjd. Endast de yttersta bladen på teplantan plockas. Alla te-sorter kommer från samma samma art, det är den efterföljande processen som involverar olika grader av jäsning och oxidation som bestämmer huruvida teet skall bli vitt, gult, grönt, rött, svart eller o-olong. Te innehåller anti-oxidanter såsom catechiner och theaniner samt stimulanta såsom koffein Te härstammar från Kina, men tecknet för te uttalas olika i olika regioner i Kina. Ett uttal är 'te' ett annat är 'cha' och språk runt om i världen har antingen tagit det ena uttalet eller det andra. Germanska och romanska språk har valt det förra, medan slaviska språk har som bekant valt det andra (jmfr. ryskans 'chai'), liksom hindi och andra indiska språk som telugu, medan tamil har valt den första. Turkar säger 'chai' liksom japaner och tailändare och slangtalande finnar.

[17] I detta Utskick [red.anm.]

# Interview with Guillermo Curbera

*Ulf Persson*

*Guillermo Curbera organized an exhibition on past ICM at Madrid 2006. He wrote an article on it in the EMS Newsletter, and subsequently published a book* **Mathematicians of the World, Unite!** *which was reported on in an earlier issue of our newsletter* Medlemsutskicket. *When I met him in Hyderabad, he had become the official curator, so to speak, of the archives of the ICM, and was involved in interviewing a number of past Presidents of the IMU, having it all professionally recorded in a studio at the meeting.*

**Ulf Persson:** *You have now become the archivist of ICM. What does that entail? is there a physical archive of some sort and where is that situated? And what kind of things does it contain?*

**Guillermo Curbera:** The International Mathematical Union has an archive which contains mostly paper documents corresponding to its activities. There are the minutes all its committees, correspondence between its officials, etc. This may sound boring, but quite the opposite it is very interesting since it gives an account of the international cooperation in mathematics. There are documents related to the organization of the ICM, to the awarding of the medals and prices (this documents are classified material and are not available to the public).

The archive is physically located in Helsinki, in the Archives of the University of Helsinki. This is a byproduct of the activity of Olli Lehto as Secretary of the Union. He created the archive in 1996 putting order in the documents that were stored at the ETH in Zurich. Unfortunately there is almost no documentation from the period prior to 1952.

The archivist (or curator) is the person in charge of keeping the archive in good shape and dealing with the researchers who are interested in working in the archive.

Since the IMU will be having stable offices in Berlin, at the Weierstraß Institut für Angewandte Analysis und Stochastik, the archive will move also to Berlin, probably during 2011.

**UP:** *You have been to a number of ICM. (Which ones?) How would you rate Hyderabad in comparison with the others? What was the best thing about Hyderabad? What was the worst? Anything in particular that stands out, and for which you will remember it in the future?*

**GC:** My involvement with ICMs is a late love story. I was working for my PhD in the US when I first heard about them (in particular, the Zurich 1994 ICM, where Jean Bourgain got his Fields Medal). To me the ICM sounded as strange meetings, too far away from the specialized ones that I was used to. Thus, I never attended one until the 2006 ICM in Madrid. There I was asked to organize an exhibition on the history of ICMs and then I started to speak with people who had attended and listening to stories I got more and more involved and interested. I became a fan of ICMs.

**UP:** *But this is incredible. How come they asked you to organize the exhibition in the first place?*

**GC:** It is true that it looks curious that I was asked to organize the exhibition on the ICMs. The reason is that I was known to be interested in history and had collaborated previously on some other exhibits for the World Mathematical Year 2000. Also, I guess that there are not many people who are willing to spend two years trying to create an exhibition that before existing is like a ghost. Also some courage is needed: I was given 6.000 Euros for the whole game (trips, to look for material, and all possible costs) and at the end I had to fight for 60.000 that it eventually cost. (I did not win the battle for the money for a catalog of the exhibition, but in the long run this was good, because my book originated from the non-existing cataloge).

The first ICM I could have attended was Kyoto 1990, but I was starting with my PhD and there was no funding for me for that. The real possibility was 1994 in Zurich, specially since my mentor, Joe Diestel from Kent State University, was very close to Bourgain. But my mind was far away from ICM. For Berlin 1998, I was invited to work in Australia and could not change those plans. The real possibility was Beijing 2002, and I almost attended, because we knew that Madrid was the next and we would had to organize many things, but this time personal matters prevented me from attending.

**UP:** *But to come back to the question. How would you rate Hyderabad?*

**GC:** At the average ICMs tend to improve, corresponding to the general fact that we tend to learn from past experiences. I liked a lot from the Hyderabad ICM the high attendance of mathematicians from Asian countries, as it emphasized the worldwide nature of the mathematical community. The daily news was very good. Opening ceremonies are always interesting and even moving, in this case, the cloud of media reporters taking pictures of the Fields Medalists (specially of Cedric Villani) and the paraphernalia surrounding the entrance of the President of India were very peculiar.

As to things to improve I would point out two: the lack of places to sit and relaxed while eating and chatting with friends and the chaos at the banquet.

These are side things from the scientific program, but are important since ICMs are occasions to meet and make friends. Regarding the banquet, it is a double pity because it was clear that the organizers had put a lot of effort in the idea, but failed on the practical things.

An image which I think is to remember is the next president of IMU, Ingrid Daubechies, surrounded by a crowd of young Indian women mathematicians. There is a message there, and a glimpse to the future.

**UP:** *Now that you have become something of an expert on ICMs. Would you like to sketch how an ideal ICM should be organized? What are the most important things? What would the order of priorities be? Any special details, that like spices could really make a difference?*

**GC:** It is clear that ICMs require first of all a good scientific program where there is a balanced between well established mathematicians and new and strong figures so that people attending can combine the experienced researchers with the freshness of future stars. It will never be sufficiently stressed that plenary talks should be aimed at a general mathematician, so that everybody can profit from the deepness of the view of an expert without the technicalities. This applies also to the invited lectures in the sections. This is the most important feature of all.

Apart, but of great importance, are facts such as good lecture rooms and devices so that talks can be properly appreciated. This includes the fact that information is clear and is allows to move around and attend the different choices of people.

Nowadays, more and more, the extra features are becoming more important. From round tables on hot topics, to cultural events (related to math, if possible). And making possible for people to socialize, discuss, enjoy being together with other mathematicians. Connection between mathematics and other fields should be highlighted: art, history, technology. And grab the opportunity to do popularization of math.

**UP:** *There has been much criticism that the ICMs are too big and confusing, that conferences should be small and specialized. What would you say to such people in defense of the idea of ICM?*

**GC:** Specialized meetings exist everywhere and have their role. People there are exposed to the ideas in which they work. ICM allows the possibility of looking at the large map of mathematics. This would be perfect if the right delivery of plenary talks would occur. In any case, I think it still is an experience in which the average mathematician realizes the broadness and interconnectivity of math, and the mathematical community builds unity by experience.

**UP:** *At Hyderabad you were interviewing past Presidents of IMU, and I guess a fair amount of them were around. You also had the interviews taped for archival reasons I guess. Whom did you interview and do you have anything exciting and revealing that you feel comfortable to pass on?*

**GC:** I interviewd Jakob Palis, David Mumford, John Ball, Laslo Lovasz,

Ingrid Daubechies, and also Martin Groetsche and Ragni Piene. The idea came from the Executive Committe of IMU and was to create a sort of "oral archive" of IMU. Imagine that we could now listen to Marshall Stone explaining to us how the IMU was reconstructed in the 1950 after Second World War. It would be very interesting. These interviews were taped by technical personel and will be subjected to an embargo since they cover classified issues. However, there exists the possibility of making shorter versions which could be released. This still has to be considered by the EC.

Unfortunately, as usually happens in life, exciting things tend to be the ones which turn out to be the candidates for becoming classified.

**UP:** *What kind of advice would you give to young mathematicians attending an ICM for the first time?*

**GC:** First of all, free yourself from your friends and move around, listen, look, chat with unkonw people, make new friends. Find the most exciting titles or lecturers (regardless of the area) and listen, try to profit from people you might not be exposed to again. Take advantage of everything you see, you are probably experiencing the highest density of mathematical ability and creativeness ever.

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Fotografen, självporträtt på balkong i Munnar, Kerala

# Intervju med Ragni Piene, avgående medlem av Executive Committee i IMU

**Ulf Persson:** *När du valdes in i EC i Beijing gjordes det ett stort nummer att du var den första kvinnan i den församlingen. Hur upplevde du detta?*

**Ragni Piene:** Men det var jo ikke så veldig mye oppstyr. Et oppslag i avisen til Universitetet i Oslo og en notis i Aftenposten - så et intervju i New Scientist, og et radiointervju på New Zealandsk radio... Det var på høy tid at det kom en kvinne i den komiteen.

**UP:** *Du har nu fullföljt två perioder som ledamot och har i och med Hyderabad avgått. Detta är normalt, ingen sitter längre än två perioder. Saknar du möjligheten att inte vara med längre?*

**RP:** Nei, jeg tror ikke akkurat jeg kommer til å savne det, selv om det har vært en OK erfaring.

**UP:** *Nu när du slutat vid ICM, känns det som en lättnad och att du nu har mycket frigjord tid? Eller kommer det inte att göra någon skillnad?* Ikke så stor forskjell, jeg har mer enn nok å gjøre - bl.a. som leder av Abelkomiteen.

**UP:** *Vad upplevde du som det 'jobbigaste' med ditt medlemskap?*

**RP:** Ikke så mye egentlig. Arbeidet med det "permanente sekretariatet" (jeg ledet den interne komiteen som jobbet med dette) var vel det som tok mest tid og krefter.

**UP:** *Vad var mest tillfredställande? Kan du peka (med stolthet?) på en del saker som du kan säga att detta genomförde jag?*

**RP:** At IMU har tatt mer tak i arbeidet mot utviklingsland og prøver å bli mindre "vestlig-dominert". Æren for dette tilfaller først og fremst John Ball og Herb Clemens. Ellers startet vi IMU-Net (der jeg var ECs kontakt mot Mireille). Når det gjelder det permanent sekretariatet er det bare å håpe at det går bra og at de vil gjøre en god jobb i Berlin. Ellers er jeg fornøyd med at forholdet mellom Abelprisen og IMU (og EMS) har blitt så bra som det har blitt, det har jeg følt som et spesielt ansvar.

**UP:** *Jag antar att vara med i EC innebär många möten och resor. Hur ofta möttes ni, och hur kommunicerade ni med varandra? E-post var och varannan dag?*

**RP:** Vi hadde bare ett fysisk møte i året (i tillegg til de to ICMene). Jeg var med i site-komimteene for ICM 2010 og for permanent office, så det ble noen reiser i tillegg. Ellers foregår alle EC-møter og andre komitemøter omtrent utelykkende elektronisk (en rask sjekk ga ca 8500 e-mailer i IMU-mappene mine).

**UP:** *För en utomstående är det inte helt lätt att inse vad EC gör för någonting. Det mest uppenbara är att vara med och inspektera och bedöma nya värdförslag för ICM. Skulle du säga att detta är den viktigaste uppgiften för EC?*

**RP:** Å arrangere ICM er fortsatt det viktigst IMU gjør. I tillegg til å velge sted, er det EC som setter sammen programkomiteen og priskomiteene. Når det gjelder annet arbeid, skjer mye gjennom kommisjonene (ICMI, CDC,..) og komiteene (CEIC,..)

**UP:** *Vad tycker du om venyn för ICM i Hyderabad. Många klagade över att den var så isolerad från det indiska vardagslivet och att deltagarna var mer eller mindre fångar, skyfflandes mellan hotell och konferenslokaler. I Beijing hade man som deltagare fritt tillträde till allmänna kommunikationsmedel och staden låg till ens förfogande. Att besöka Hyderabad var en mardröm. Har du några kommentarer till detta?*

**RP:** Da vi var på site visit, var vi i New Dehli (og Agra, der det var forslag om å ha G(eneral)A(ssembly)). Vi visste at de tenkte å flytte det til Hyderabad (der var jeg ikke) pga klima og kongress-senter-forholdene. Problemet i New Dehli (i tillegg til klimaet) var at det ikke var noe opplagt sted å ha det (vi så på mulige steder - et stort gammelt hotell, med åpningsseremonien på et stadion, etc.) det hadde blitt mer interessant enn Hyderabad, men trolig nokså vanskelig å organisere. Men altså, det hadde vært mye morsommmere! Og jeg var ikke klar over hvor avstengt vi ville være i Hyderabad, det var en skuffelse. Men jeg er fortsatt glad for at det var India som ble valgt!

**UP:** *Som medlem i EC blir man väl varse en hel del av vad som försiggår bakom kulisserna och mycket av detta kan väl inte avslöjas. Men är det något som förundrade dig och som du känner att du kan dela med dig av?*

**RP:** Nei, ikke noe jeg kommer på.

**UP:** *Vad tycker du om ICM som institution? Fyller den någon funktion? Många matematiker tycker att ett ICM möte är alldeles för stort och ger ingenting matematiskt, då är det bättre att besöka en mera specialiserad konferens. Har du några kommentarer till detta?*

**RP:** Nei, dette er jo noe som stadig diskuteres. Mange er ikke interessert i å dra på slike kongresser, mens andre liker det. Uansett mener jeg det fortsatt er viktig å organisere dem, det er samlende for matematikerne i verden. Det er vel ingen andre fag som har noe lignende - som favner så bredt.



Ragni Piene säljer T-shirts i IMU's monter. Ny karriär? Foto: Ulf Persson

# Some impressions of ICM at Hyderabad

*Elizabeth Gasparim*

This was my first participation at an ICM. I happened to be in India for a research collaboration, and this is why I decided to attend.

The scale of the event is very impressive. One never really realizes just how many mathematicians are there, until one participates at something of such a grand scale. It is even more impressive to notice just how large is the spread of mathematical quality among the participants, there is everything from a very modest level of mathematical knowledge up to the Fields medalists, which represent the top of quality.

It feels a bit impersonal to be part of such a crowd. At times it is like being part of a cowherd, being moved to here and there by the guards. But, on the other hand, personally I had the amusing and flattering experience of getting special treatment, on the grounds that apparently the locals think that I look like a movie star. I got asked for autographs, and this was very amusing, and even more strangely, I was filmed and photographed various times.

I did not expect to learn much new mathematics. Given the nature of the event, with speakers writing their talks far in advance, one already knows what to expect. So, in this sense, there is essentially no surprise when listening to talks. The big surprises are of course to hear the announcement of the fields medalists. One hears many gossips beforehand, but never knows for sure. The secret is very well kept. This is really impressive, given how many people are trying to find it out. The part that was a bit disappointing was the one of the laudations, the talks that explain the work of the fields medalists. Those seemed to have been poorly prepared, any some had slides that were essentially impossible to read. Overall, I enjoyed the session talks better than the talks on the huge auditorium.

I think for all the women it was especially nice to hear the president of India. There were various comments about how surprised many of the female mathematicians were to find out that the president of India is a woman.

Anyway, overall, one meets with friends, like I met with you, chats quickly and goes about finding what talk to watch next. My favorite experience of this ICM was a very quick chat with M.S.Narasimhan. I asked him for advice,

because he was head of mathematics at ICTP for so long. I told him that I am about to move to Brasil, where I think I will have the responsibility of taking important decisions and of having students who will follow my advices. I asked him if he had anything to suggest. His answer was: Have patience! I answered that this is a very difficult thing to do. He repeated once again the same advice: You need to have patience. Out of so many things that I heard at the ICM, this is one that I will never forget.

I do not plan to go to the next ICM, but I am glad that went to this one. I think it is an experience worth having at least once in a mathematicians life.

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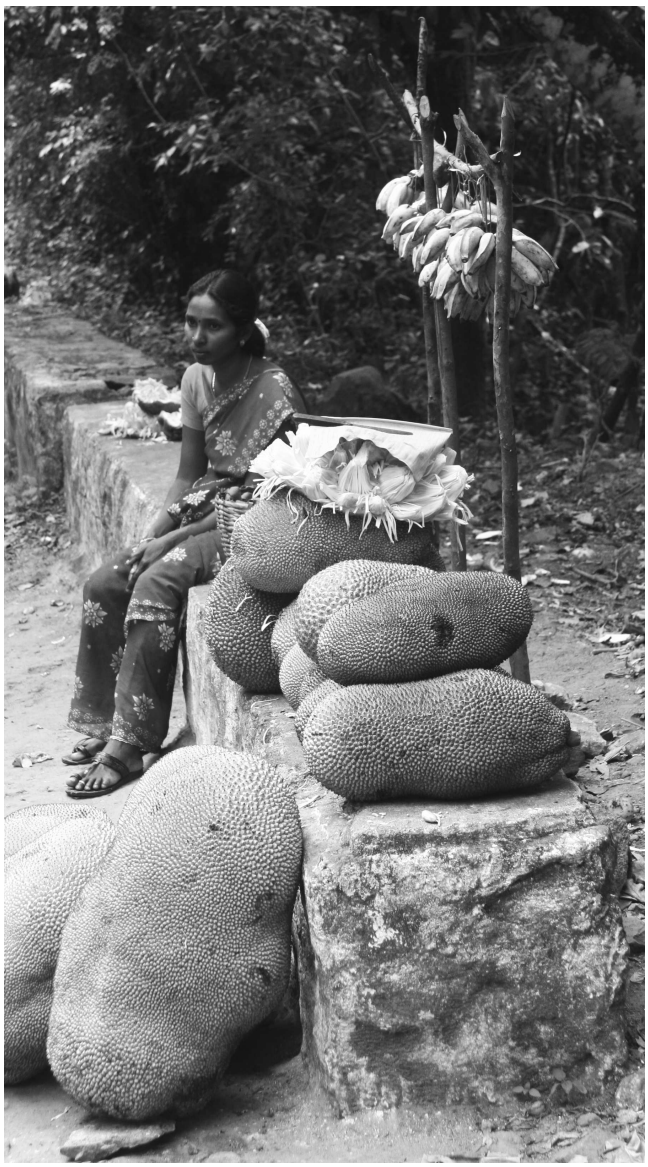

Jack frukter, Kodaikanal, Tamil Nadu

Dessa jättelika frukter - Jackfrukter (*Artocarpus heterophyllus)*, växer vilt på mullbärsträd i tropikerna. De kan bli upp till en meter stora och väga 50 kilo. I Tamil Nadu utgör den en av huvudfrukterna jämte bananer och mango. Jag har bara sett den säljas vid vägkanter i trakten av Kodaikanal uppe i bergen. Frukten är syrlig och god, men lämpar sig inte att ta hem på flyget.

# IMPRESSIONS OF ICM 2010 HYDERABAD.

*Kenneth R. Hughes*

I have been going to every ICM since 1990 - and I think I can truthfully say that the ICMs held in Asia - Kyoto, Beijing, Hyderabad - have all been outstanding and exceptional events.

For me Kyoto (1990) was probably the best - but that was because the magic of old Japan was combined with a very strong push towards the most exciting modern developments in physics - the astonishing world of string theory.Ed Witten got the Fields medal - and Graeme Segal was his prophet.

This time, Hyderabad offered no such radical revelation - though there was some push from the top to show us the importance and excellence of ergodic theory and dynamical systems, particularly as applied in number-theory. But on the whole the programme attained a fine balance, between between pure and applied mathematics: and between traditional areas like algebra,geometry and analysis. Most strikingly, some of the new leaders, like Cedric Villani (who was a Fields medallist), nicely straddle several disciplines. And several of the most luminous expositions were about providing rigorous foundations for the generally sketchy or heuristic conclusions reached by physicists working on thermodynamics, or engineers applying the finite-element method.

The Fields medals which always provide for rivalry and excitement on the first day have now been joined by a number of other awards (including the newly instituted Chern prize), and on the second day we were all moved by a documentary movie which looked back over the life and achievements of the great geometer SS Chern, who from his wheelchair, had presided so memorably over the Beijing ICM.

One goes to these big meetings partly in the hope of getting an overview - a sense of direction: which way are the bright young people taking mathematics currently. Of course, much new work builds on fields which are already well-cultivated: for example, the Hyderabad meeting confirmed and continued the interest in random structures already well-established at the last two ICMs.

But there were also new departures. Here, one unexpected trend which struck me, is the growth of interest in p-adic Hodge theory on both sides of the Atlantic. This is a fiendishly difficult subject yet it seems to be drawing talent away from more traditional areas.(My friend,the publisher, Roger Astley of Cambridge University Press, has noticed this too, and remarked to me, that if he could find someone to write a good introductory exposition in English, he'd jump at the chance of publishing it.)

A second more general trend which I spotted is that theory building is back: the Madrid ICM was dominated by people like Terry Tao who are outstanding technicians and problem-solvers: but some of the best talks in

Hyderabad were given by people like Jacob Lurie, Kevin Costello, and Mike Hutchings, who are attempting to further their disciplines by first building big machines. This harks back to the days when it was fashionable to proceed by first creating new structures such as cobordism, etale cohomology or k-theory. Another example was provided by Andre Kapustin, who gave an exposition of string theory ,which persuasively linked it to the somewhat formidable machinery of higher categories.

On the other hand, Alain Connes's programme for developing Non-commutative Geometry, which was big in Europe just a year or two back, now seems to be in decline.(Poor Matilde Marcolli, who reported on her joint work with Connes at Hyderabad, was waylaid at question time, by Indian physicists, who were complaining that Connes had not met their criticisms despite 20 years of complaints.)

A great feature of the conference was the large number of outstanding presentations made by mathematicians of Indian origin, including notably, young people like Khare and Kedlaya. This was not just a sop to our Indian hosts, but reflected a remarkable development - India now really has great depths of talent especially in areas like number-theory, and physics - but it is also a tribute to the growth of a talented world-wide Indian diaspora.

A special Indian flavour was also imparted by the lighting of the lamp at the opening ceremony, and a number of the foreign participants (such as the American historian of mathematics Kim Ploffker) were inspired to put on Indian costume. There was also a regular cultural programme - with lectures and demonstrations of Indian classical music, and a dance presentation , based on the tragic story of Lilavati, the daughter of the famous medieval Indian mathematician, Aryabhata. In the story Lilavati misses the felicitous time astrology has fixed for her marriage, because a pearl falls into the water-clock and blocks the outflow. She has to be compensated with having her name given to her father's great book on algebra.

But here,in the 21st century , Hyderabad-known as the CITY of pearls - has had an altogether luckier outcome,and given many mathematical gifts to us all.

Markatta, Kodaikanal, Tamil Nadu

*Markattor* utgör näst människan den mest utbredda primaten. Det huvudsakliga utbredningsområdet är sydostasien, men de förekommer så långt norrut som Afghanistan. En spillra lever i nordvästra Afrik och på Gibraltarklippan. De är vanliga i Indien, inte bara i skogen utan även i städer och tempel. De är mycket oskygga, för att inte säga påträngande, och farliga för människan eftersom de bär på olika för dem ofarliga virus som Herpes B. Markattorna, speciellt Rhesusapan, är populära såsom försöksdjur, men av ovan nämnda skäl knappast lämpliga som sällskapsdjur. De formar intrikata sociala strukturer. De hanterar sina näpna händer precis som människor.

# Mina intryck av ICM[1]

*Bengt Johansson*

Foto: Ulf Persson

Den första dagen på ICM 2010 i Hyderabad var en stor upplevelse. `http://ncm.gu.se/node/4747` Det var mäktigt att få bevittna Indiens president överlämna prisen till de olika pristagarna och tillsammans med några tusen delegater (totalt deltar 3500) medverka till de ovationsartade applåderna när vinnarna annonserades. Har inte fattat mycket av vad de gjort - en kort beskrivning för icke-specialister hade varit välkommen. Det verkar klart att en av pristagarna, Stanislav Smirnov har Lennart Carleson mycket att tacka för sina framgångar - när Smirnov arbetade på KTH. Värdet av detta stöd från "Stockholm" uppmärksammas också i beskrivningen av Smirnovs karriär.

Efter prisutdelningen talade jag med Mikael Passare och Torbjörn Lund som också är på plats. De berättade om sitt intresse för svensk medverkan i Klein-projektet: http://www.kleinproject.org/ och planer på att koppla det till Mittag-Leffler Institutet. Bill Barton, president of ICMI, håller i många av trådarna och Bill har rekommenderat Mikael och Torbjörn att ta med NCM i planeringen. Första dagen mötte jag också Christer Kiselman - liksom alla våra indiska vänner förutom Jonaki Gosh som inte deltar - men inkl ambassadör emeritus Shetty.

Den andra dagen har också varit givande. Efter en liten shoppingtur på morgonen - bästa och billigaste shopping jag upplevt - och tillbaka till konferensen mötte jag först Ulf Persson som bl a berättade att han på uppdrag av IMU skall intervjua alla Fieldsmedaljörerna. Vilket hedersuppdrag! Vi talade om att vi snabbt måste få till ett möte Ian Stewart och Steven Strogatz. Eventuellt åker vi och hälsar på dem i höst[2].

I programmet finns mycket få programpunkter om Mathematics Education. Den enda programpunkten andra dagen var "Relation between the discipline and school mathematics". Ordförande var Fieldsmedaljören (1998)

[1] Detta utgör en lätt redigerad version av ett massbrev av dagbokskaraktär som författaren sände sina kolleger i NCM under sitt uppehåll. `[red,anm.]`

[2] IMU skall vara EMS, Stewart besökte jag ensam i oktober, resultatet står att läsa på annan plats i Utskicket. Strogatz däremot var mer svårflörtad. `[red.anm.]`

Timoty Growers, University of Cambridge, UK, som mästerligt höll ordning på panelen som bl a bestod av vår vän från indienbesöket Ramanujam (Ram) från Institute of Mathematical Sciences, Chennai. http://www.imsc.res.in/ Vidare Heinz Steinbring från University of Duisburg-Essen som jag träffat bl a när han arbetade med Erich Wittman i Dortmund, och Ivan Yashchenko, Moscow Centre for Continuous Mathematical Education, en tidigare kollega och nära vän till Viktor Firsov som jag också träffat tidigare i Moskva.

Innehållet i paneldiskussionen som var OK. Heinz nämnde att Erich Wittmann är fullt aktiv och att man just firat hans 70-årsdag - och att hans läroboksserie för lågstadiet går mycket bra. Nämnde lite om vår nya Geometribok med Känguru-problem och Heinz tyckte att vi (dvs Karin Wallby) borde skriva till Erich och berätta hur hans arbete påverkat bokens struktur.

Ivan tyckte liksom jag att vi måste "återupprätta" det goda samarbetet Ryssland-Sverige som legat nere sedan Viktor gick bort. Vi enades om att höras av när vi är åter hemma från konferensen. Ivan är bl a expert på Rysslands "cirklar" och aktiviteter för spetsutbildning av ungdomar.

Under paneldiskussionen satt jag intill Bill Barton som fö hälsade till alla NCM-are. I panelen fanns också William (kallas också Bill) McCullum från University of Arizona, som lett arbetet med Common Core State Standards. http://ncm.gu.se/node/4591 Bill, William och jag gick efter paneldiskussionen direkt till en bar! och tog några öl tillsammans. Vi samtalade bl a om kursplaneutveckling, testutveckling, historiskt, internationellt - och att William måste komma till NCM och berätta om hela processen med nya Standards - jag nämnde naturligtvis bla Tom Rombergs besök 1989 och vårt seminarium om NCTM Standards. Bill rekommenderade William att snabbt acceptera inbjudan. William och jag ska träffas idag och titta närmare i våra kalendrar.

Efter "postseminariet" i baren fick vi uppleva en fantastisk indisk "Dance Performance" innan det var dags för Conference Dinner tillsammans med våra indiska vänner. Under middagen ändrades mitt Indien-program snabbt så att jag inte åker till Ram och Chennai som planerat den 23:e på morgonen utan istället till Mumbai och Ravi Surbramaniam (en av de sex som besökte oss i juni) på kvällen den 22:e för att medverka i ett internationellt tvådagarsseminarium om Teacher education och Equity. Till konferensen - förutom ett 40-tal indiska matematikdidaktiker - kommer också Ole Skovsmose och Jill Adler (som jag fö redan träffat och bytt några ord med här - hon arbetar fn också på Kings i London).

Autorickshaws, stationen i Madurai, Tamil Nadu

Seminariet leds av Ravi och äger rum på Homi Bhabha Centre for Science Education, vid Tata Institute of Fundamenthal Research i Mumbai.

http://www.hbcse.tifr.res.in/

http://www.hbcse.tifr.res.in/events/upcoming-event/discussion-seminar-on-mathematics-education

På kvällen den 24 åker jag från Mumbai till Ram för två dagar i Chennai.

I dag blir det bl a en genomgång av de många förlagens utbud av litteratur - i en särskild utställningshall här på konferensen. Har redan hittat några intressanta böcker att ta med hem.

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Hyderabad 2010-08-21

I dag började jag med att hälsa på Indiens "Grandfather of Math" professor Raghunathan, Tata Institute of Fundamental Research, Mumbai, och ordförande i konferensens programkommitté. Han var ambassdör Shettys[3] handledare då Shetty studerade matematik. Enligt Raghunathan var Shetty en av de allra mest begåvad doktoranderna - men valde att lämna matematikstudierna för diplomatkarriären vid 22 års ålder. Jag tackade Raghunathan för att han stöttat det svensk-indiska samarbetet och givit det sin välsignelse. Jag bytte också några ord med presidenten för IMU, Laszlo Lovasz, bl a om den ungerske legenden Tamas Varga som jag hade lyckan att träffa i Berlin i mitten av 80-talet.

Jag träffade som planerat Bill McCullum igen och vi bestämde att planera för hans besök på NCM att äga rum någon gång under våren - ev i samband med ett nationellt seminarium om kursplanearbete - hur det kan och bör gå till och hur det absolut inte borde få gå till. Stötte också på Frode Rönning som alltid är glad och positiv - och Ole Skovsmose som jag ju också kommer att träffa i Mumbai om några dagar.

Genomgången av alla förlagsutställningarna ledde till inköp av fyra böcker.

Så mötte jag Bill Barton igen och han frågade om jag ville medverka i panelen i den sista programpunkten för dagen - om The Pipeline Projektet, ett samarbetsprojekt mellan IMU och ICMI. Se
`http://icmi.math.auckland.ac.nz/` Jag fick en timma på mig att förbereda mig och tackade naturligtvis inte nej. Min uppgift var att kommentera Bill's rapportering från projektet och svara på ev frågor från publiken som inte var alltför stor - som sagt var det sista programpunkten. Tror det gick hyggligt, Bill verkade nöjd - och jag fick en gåva från organisationskommittén, ett handgjort schackspel i trä och en sidensjal.

I morgon bär det av till Mumbai.

[3] Den indis ambassadören till Stockholm, som pensionerades i år (60 år), och som deltog i Per Martin-Löfs konferens förra året [`red.anm.`]

# The French Elitist Educational System[1]

*Yves Meyer*

All the French Fields medallists (excepting Alexander Grothendieck) have been alumni of *École Normale Supérieure de la rue d'Ulm* (which I will abreviate in ENS-Ulm). This is a striking fact. There are a few other Écoles Normales. The one where I am teaching (ENS-Cachan) is less prestigious than ENS-Ulm and more oriented to applied mathematics. In France applied mathematics is less prestigious than pure mathematics and technology is less prestigious than science. This theme will be present all along this essay. If you enter ENS-Ulm, you know that you shall give up money and power definitely. It is a choice of life. Your life will be devoted to acquire and transmit knowledge. I entered ENS-Ulm in 1957 and only 40 students in Sciences and 37 in Humanities were admitted. The entrance exam to ENS-Ulm was quite selective. Many among my schoolmates were expecting to become high school teachers. I will later explain why in those times being a high school teacher was so rewarding. The brightest undertook some research work.

Let me try to explain the historical *raison d'être* of the French elitist educational system. It was designed to fight against the extravagant privileges of the French nobility and was consistent with the goals of the French Revolution. Before describing our elitist system, let us stress that it only applies to a tiny part of higher education. High school is not selective in France. High school ends with an exam named *baccalauréat*. This exam is quite easy since eighty per cent of the candidates will succeed. Moreover every teenager which obtains a *baccalauréat* is accepted in the university of his choice. Tuition does not exist. But our open admission system is hypocritical since half of the undergraduate students drop out during the first year of college. This is typical of France, a country in which noble ideals come along with a poor management and no attention paid to the details. In contrast with this loose system, medicine and engineering are highly selective in France. There are more than two hundred engineer schools and most of them are not affiliated to any university. Medicine is a cursus which is given inside the university but follows completely distinct rules. There is a strict numerus clausus. The number of students admitted in Medicine after the first year's exam ranges from 4,000 to 8,000 depending on the job market. The list of the French elite schools needs to be completed with *École Nationale d'Administration* and business and management schools, like *Hautes Études Commerciales (HEC)*. The number of students admitted to one of these elite schools is about ten per cent of these who are entering a University. You cannot enter one of the

[1] This essay is part of the intreview I am conducting with Yves Meyer, and which will appear in its entirey in the EMS Newsletter 2011

elite school unless you accept to endure two or three years of intense training after the baccalaureat. This training is given in what we call *Classes de Préparation aux Grandes Écoles*. At the end of this training you shall take one of the exams and if you succeed you are allowed to enter the corresponding elite school. If you fail at all the exams you took, then two or three years of your life are lost, but in sciences ninety per cent of the students from *Classes Préparatoires* will enter one of the engineering schools. The French elitist system is a democratic system, based upon strictly anonymous written exams. Every candidate is labelled by a number. The professors who are rating the written exams do not know the names of the candidates. The choice of the most talented candidates is completely fair and no biases are introduced. However this system is much criticized nowadays. It is accused to reproduce an elite. The criticism is grounded on the following fact. The family of the candidate is often playing an important psychological role in helping the candidate to accept the intense training which is needed to enter an elite school. But people who are making this criticism against the French elitism are confusing economical status with intellectual level. When they are defining an elite they claim that a primary school teacher with a rather low income belongs to the elite, which is simply ridiculous. If some parents are very demanding to their children, such a family is viewed as being favored.

I am returning now to the situation in French high schools. Let me begin with figures. In 1957 only 9,500 boys and girls got a *baccalauréat* in sciences. As I have already pointed out *baccalauréat* is the exam you take when you leave high school. *Baccalauréat* is also the ticket you need for entering a university. These figures did not meet the needs of a developed country and in 1959 Général de Gaulle ordered to reorganize French high schools. De Gaulle's reform worked since nowadays the figures have been raised to 146,300 which is very good, even if the level of *baccalauréat* in sciences is much lower than it used to be. Before 1959 the children at the age of eleven had to take an exam for entering high school. At this early age the family played a key role in the success. Nowadays high school begins later on, at the age of fifteen, and is almost open admission which explains the rise from 9,500 to 146,300 in the sciences I have referred to above. It is of course a success, but a price has had to be paid. Here come the bad news. Before entering high school all the French kids between eleven and fifteen shall receive exactly the same education in a structure named *Collège d'Enseignement Secondaire*. Unlike Germany and the United States, France has always been willing to build a completely egalitarian educational system. These *Collèges d'Enseignement Secondaire* were created by Jean Berthoin in 1959 (De Gaulle happened to be a President at the end of 1958) and modified in 1963 and 1975. The goal is to offer all the children some basic education so that they can decide what they want to be at the end of it. Then the teenagers may either enter a traditional high school (general education), a technical

highschool, or begin a professional training. But *Collège d'Enseignement Secondaire* is the place where our educational system is facing the most serious problems. The children who are receiving exactly the same teaching up to the age of fifteen have already developed extremely different interests. Many children are just bored by what is being taught and are becoming violent. Technology is not taught seriously in our *Collèges d'Enseignement Secondaire*. Technology is not given in French education the importance it deserves. We will come back to this point later on. A cheap trick which is used now in France is to tune the educational level to what can be acquired without much pain during these critical years at *Collège d'Enseignement Secondaire*. The teachers are not very demanding. A byproduct is the deterioration of education in French high schools. Our*Collèges d'Enseignement Secondaire* are failing to achieve their ambitious goal and every four years a new Minister of Education comes with a brillant idea to fix these problems. In our fully centralized organization it is not permitted to adapt what is taught to the needs of the children. The lowering of education in French high schools implies that the intellectual level which is required for entering an elite school depends on what is learnt inside the family. These remarks imply that the criticism against a *reproduction of an elite* is absolutely fair. But the people who are making these criticisms are exactly the same who are in favor of our *Collège d'Enseignement Secondaire*. It is a vicious circle. The problems I am mentioning do not affect France only. A UNESCO program is aimed at understanding the role of *shadow education* on the achievements of children at school, especially as far as mathematics is concerned. Shadow education means the intellectual training a child is receiving from his family. A specialist of these issues is Georges Haddad (`g.haddad@unesco.org`). These difficulties which are serious cannot be solved by the suppression of ENS-Ulm for the sake of egalitarism. It would be the same disaster as the abolition of Harvard or Princeton in the US. Let us observe that gender or ethnic quota cannot be introduced in the French elite system which also presents a problem. For a long time there were two separated *Ecoles Normales Supérieures*, one for boys and one for girls. Now they are fused together and the number of girls entering has been divided by four, as compared to the numbers fifty years ago. It is a disaster.

Education in France relies on some intellectual and moral traditions, as it is the case in every country. France cannot be fully understood if you do not accept the skepticism of Montaigne, if you do not know the philosophy of Descartes or the fights of Voltaire against the exorbitant power of religion. These moral and intellectual values which have been so strong and important for centuries are becoming meaningless to many teenagers of the 21th century. Moreover these values are questioned by some of our new immigrants who are not willing to accept what they view as a cultural imperialism. A new humanism should be built and combine the traditional values of France

together with the Jewish and the Muslim inheritances. As a school-boy I never heard of Rachi of Troyes (1040-1105). At Tunis where I was attending high school I never even heard of Ibn Khaldoun, which is a shame since he was born at Tunis in 1332. Ibn Khaldoun was one of the major intellectual figure in medieval Islam. Is France really ready for recognizing our debt to Rachi de Troyes and to Ibn Khaldoun ? Is Europe ready to acknowledge that we inherited from a brillant Islamic culture ? I hope so.

There are some serious drawbacks in the French elitist educational system. I will focus on one of them. From 1976 to 1986 I was teaching at *École Polytechnique* which is the prototype of a French elite school. Most of the students of *École Polytechnique* want to become bosses of some important companies. In 1981, during one of my classes, I evoked the scientific and technological challenges that France was going to meet. I was delivering this passionate message to the full class consisting of 460 students. They laughed loudly. I interrupted my speech and remained silent and embarrassed. One student sitting in the first row stood up and told me the following:

> If we ever had a technological problem to be solved during our professional life, we would order an engineer from *École Centrale* (a less prestigious engineer school) to do it. We are born to command.

In a sense we were back to the absurd privileges of the French nobility. The hierarchy between the French engineer school is extremely rigid and explains the arrogant attitude of the students of *École Polytechnique*. But the same hierarchy exists between the top American Universities. It exists nowadays between universities all over the world, since the Shangaï ranking was introduced. But in the States the elitist attitude is compensated by the fact that you will soon be evaluated on your own achievements and not on your university where you got your degree. In France your career is governed all along your life by what you did when you were twenty years old. In France you are rarely been given a second chance in your life. Some people try to change this rigid attitude. Nowadays the traditional ranking of the scientific elite schools is challenged by new schools oriented to management and finance. It implies that *École Polytechnique* might eventually lose its privileges and be forced to adapt to a new environment.

I have actually experience of teaching at a lower level. To understand my decision to begin my life as a teacher, I need to evoke what was the situation of my country in the late fifties. A terrible war was raging in Algeria. The French army responded to the legitimate demands of Algerian nationalists by torture and napalm. All young French men were drafted unless they were graduate students. In other words beginning a Ph.D. was a cheap trick for avoiding the draft. If not you were forced to fight a cruel and unjust war.

Could I claim that my research, which did not even exist at that time, was so important to my country that I should be exempted ? No, certainly not ! Beginning a Ph.D. for avoiding the draft would be like marrying a woman for her money. I wanted to fall in love with research, not to use it as a clever way to obtain a privilege. I confessed I was not preparing a thesis. Taking this decision, I felt I was showing some solidarity with my class age. This looks childish today. I was drafted. Then I asked to be a teacher in a military school, a decision which was encouraged by the Army. It was a way of doing your military service. I was sent to the *Prytanée Militaire de La Flèche*. La Flèche is a tiny city located at two hundred miles southwest of Paris. This school was formerly a college run by the Jésuites. It is also the place where the French philosopher Descartes studied. Today this high school belongs to the Army. It was dedicated to the male children of the officers serving in Algeria or in Germany. Germany was at that time divided into four occupation zones. One zone was occupied by France. I taught there three years which included two years of military service. Of course I was not paid, which was the reason the Army liked this arrangement. I was twenty one years old and my students were seventeen or eighteen. The students were separated from their family and were receptive to my sympathy. Many of these students became professionnal mathematicians and are now my friends. I was eventually sent to Algeria during a short period, from June 1962 to September 1962. I arrived at a place where fortunately the fightings were over. This happened during the summer and my students did not suffer too much from the absence of their teacher. My way of teaching was evaluated two times by truly experimented specialists (*Inspecteurs Généraux*). The evaluators told me that I was not a good teacher. Indeed a good teacher at the high school level needs to be much more methodic and organized than I was. These *Inspecteurs Généraux* advised me to apply to the University. I had also other problems with my teaching. I eventually felt guilty to be the one who is always right while kids are wrong most of the time. In some sense I needed to also feel the pain of learning that my students endured. To do research means to be ignorant most of the time and to often make the many mistakes which I criticized in correcting my students home works. Socrates makes it very clear that he needs a discussion with his friends to discover the truth. Truth is never given to him as a gift from God ; truth needs to be elaborated through a collective work. It was not the way I was teaching. It was to be the way I was going to work with my research students. In 1963 I applied for a position at Strasbourg as a teaching assistant. I was 24 years old. I wrote my Ph.D. there.

My experience of teaching in a high school shaped my entire life. I understood that I was more happy to share than to possess. If I read a beautiful novel, I want to share my pleasure with someone. Supervising a thesis has always been a most rewarding experience. It means giving to my Ph.D.

student the best of myself. I always hoped that she/he eventually would become a better mathematician than I am. This happened to quite a few of my fifty graduate students. My first research student was Aline Bonami. I am keeping very strong ties with my former students, like in a family.

My experience of beginning my career as a high school teacher should not be proposed as a model. Life was much more open in the early sixties. When I decided to switch to the University, I immediately found a position as an instructor.

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Gatuförsäljare, Tiruchchirappalli, Tamil Nadu

# Job offers at WIAS

For the IMU we are seeking a

**Scientific Officer for the Commission for Developing Countries (CDC) and the International Commission on Mathematical Instruction (ICMI) of IMU (Reference No. 10/25).**

**Responsibilities:**
Report to CDC President and Secretaries on the awarding of grants, keep record of CDC grant awarding, process applications for travel grants and conference support from the developing world, assist in ICM travel grant awarding process, participate in the implementation of the decisions and duties of the ICMI Executive Committee and the ICMI General Assembly in cooperation with the ICMI President and Secretary-General, communicate with the ICMI member countries, draft written materials, prepare minutes and the ICMI Newsletter, supervise the CDC and ICMI Web sites, control the business operations and ICMI finance, monitor deadlines, assist in the application of third-party funds.

**Qualifications:**
Relevant university degree and additional qualification in science management, applicable experience gained in the administration of an international organization and the activity in scientific associations, experience in work with developing countries. Effective English and German skills, command of French or Spanish is a plus. Organizational skills, independent and flexible working, decisiveness and ability to solve complex situations. Interest in mathematics education preferred. Availability for occasional travels abroad.

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**Clerk for finances / controlling (Reference No. 10/24).**

**Key responsibility** is the subject area **Finances of the Secretariat of the International Mathematical Union (IMU)** which is hosted at the Weierstraß-Institut. This includes the budget management of the IMU Secretariat, especially ongoing financial surveillance and management, application for and supervision of third-party funds, preparation and supervision of invoices, assistance in the preparation of the annual program budget and preparation of the cost benefit accounts. Administering and accounting of travels, travel expenses, grants, and support funds is another duty.

**Qualifications:**
A business administration degree (university of applied sciences) or a related other degree and knowledge of public budget law, especially government grant rules, are required. Experience concerning national and international funding guidelines and their application is expected, knowledge of tax law and appropriated use of donations preferred. Experience of application of travel expenses regulations and the cost benefit calculation with budgeting are a plus. Solid computer skills (MS Office, SAP R/3), communication skills and service-oriented abilities, and very good command of English are required. We offer a lively work atmosphere in a modernly

equipped institute and expect a candidate who is flexible, able to work in a team and cope with heavy workload situations.

♠

**IT Administrator (Reference No. 10/21).**

**Qualification:**
University of applied sciences degree in computer science or equivalent degree. Essential functions: Administrate the IT hardware and software for the IMU Secretariat members (MS Windows, MS Office); administrate the server of the IMU Secretariat (Linux, Typo3, Apache, PHP, Mailman, MySQL); contribute to administrate the WIAS Web server (Linux, Tomcat, Java, Apache); contribute to further develop WIAS's own administration tools (Java, LDAP).

We offer a job in an enjoyable environment where performance counts, independent, flexible, and creative work, opportunity to attend training courses for further qualification. Questions concerning technical issues will be answered by Dr. Gerhard Telschow (`Gerhard.Telschow@wias-berlin.de`).

♠

**Archivist / Librarian (Reference No. 10/23).**

**Responsibilities:**
The qualified candidate is an archivist (FH degree) or a librarian (FH degree) managing the archive and reference library of IMU. Because the IMU archive has evolved historically, there is historical and contemporary archival material. The duties comprise: Establish and maintain an online data base, catalog new media, this includes cooperation with the archive and library of the Berlin-Brandenburgische Akademie der Wissenschaften (BBAW) and the WIAS library. Assist the administrative activities of the IMU Secretariat.

**Qualifications:**
University of applied sciences (FH) degree. Sound computer skills (Content Management systems), proficiency in usual Office programs and very good command of English. We offer a position in a pleasant environment and expect a candidate who is excited about his/her work and able to cope with heavy workload.

Submit your application materials (usually CV, references, list of publications), and be sure to give the reference **No. 10/*, by December 3, 2010** to:

**Prof. Dr. J. Sprekels Direktor des WeierstraßInstituts fÃ¼r Angewandte Analysis und Stochastik im Forschungsverbund Berlin e.V. Mohrenstr. 39, 10117 Berlin**

# Efterlyses - förslag till årets Wallenbergpristagare

*Per Salberger*

Wallenbergpriset har delats ut sedan 1983 (under detta namn sedan 1987) av Svenska Matematikersamfundet. Det har delats ut till speciellt löftesrika yngre svenska disputerade matematiker, som ännu inte erhållit en fast forskartjänst. Wallenbergpriset har varit den mest prestigeladdade utmärkelse som en yngre svensk matematiker kunnat få inom landet. Den uttalade avsikten med priset har varit att uppmuntra matematisk forskning. De flesta av pristagarna har också fortsatt sin karriär som matematiker vid svenska universitet och större delen av pristagarna är idag professorer. Priset är i år på 300 000 kr.

En priskommitté bestående av undertecknad, Kurt Johansson och Nils Dencker har utsetts av samfundet.

Kommittén ber genom detta brev om förslag för år 2011. Förslagen ska innehålla motivering och gärna tänkbara sakkunniga som kommittén skulle kunna närmare tillfråga. Den person som föreslås bör vara högst 40 år.

Förslag skall vara kommittén tillhanda senast 8 februari 2011. Förslag kan sändas per epost till

`salberg@chalmers.se`

eller i pappersversion (i så fall i tre exemplar) till

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*Matematiska institutionen, CTH,*
*412 96 Göteborg*

Tidigare pristagare är:

| | |
|---|---|
| 1983: Torsten Ekedahl | 1997: Erik Andersén och Bernt Wennberg |
| 1984: Svante Janson och Anders Melin | 1998: Lars Ernström och Timo Weidl |
| 1985: - | 1999: Olle Häggström |
| 1986: - | 2000: Tobias Ekholm och Erik Palmgren |
| 1987: Johan Håstad | 2001: Warwick Tucker |
| 1988: Mikael Passare och Ulf Persson | 2002: Pär Kurlberg och Genkai Zhang |
| 1989: Arne Meurman | 2003: Dmitrij Kozlov och Oleg Safronov |
| 1990: Håkan Eliasson | 2004: Julius Borcea och Sergui Shimorin |
| 1991: Per Salberger | 2005: Hans Rullgård och Andreas Strömbergsson |
| 1992: Håkan Hedenmalm | 2006: Mattias Jonsson |
| 1993: Johan Råde | 2007: Hans Ringström |
| 1994: Mats Andersson | 2008: Petter Brändén och Anders Karlsson |
| 1995: Kurt Johansson och Anders Szepessy | 2009: Mats Boij och Kaj Nyström |
| 1996: Peter Ebenfelt | 2010: Robert Berman. |

## The Linda Peetre Memorial Fund

The Linda Peetre Memorial Fund invites applications from mathematicians in Estonia, Latvia, Lithuania, and Sweden for research visits and participation in conferences.

Applications should be sent to Mikael Passare <vice-president@swe-math-soc.se> no later than December 15, 2010, and contain a short description of the proposed activity; a budget; a short CV; and a list of relevant publications. Priority will be given to applicants from the mentioned countries in the order listed.

The Linda Peetre Memorial Fund was established in 2007 thanks to a donation from Jaak Peetre and is named after his mother Linda Peetre (1903–1961).

The Board of the Fund consists of Jaak Peetre, Christer Kiselman (chair), and Tobias Ekholm, Mikael Passare, and Milagros Izquierda (ex officio members as President, Vice President, and Treasurer, respectively, of the Swedish Mathematical Society), and Magnus Fontes and Per-Anders Ivert as deputy members.

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Pondicherry, eller numera sedan 2006 officiellt Puducherry är en forna fransk koloni, och blev inte upptagen i Indien förrän 1954 när den franska överheten avslutades. Det är ingen stat, utan ett så kallat 'Union Territory' som styrs direkt av de federala myndigheterna. (Det finns i själva verket sju sådana 'Unionsterritorier i Indien, inkluderande huvudstaden - Delhi, själv). Pondicherry är i själva verket en förvanskning av det ursprungliga tamilska namnet Puducherry, som betyder 'ny by'. Kolonin har varit i fransmännens händer sedan början av 1700-talet, med vissa avbrott under engelskt styre. Det franska inflytandet är fortfarande märkbart. Poliserna bär hattar med galliskt stuk, och man kan dricka vin och äta blodiga biffar. Staden delas naturligt i två, med de franska kvarteren i ett prydligt rutmönster, närmast havet. Där bär de stenlagda gatorna franska namn och husen har en sydfransk prägel.

# Interview with Ian Stewart

*Ulf Persson*

*Ian Stewart is a recently retired professor of Mathematics at Warwick University. He is generally known as a popularizer of mathematics, and has written a large number of books addressing the general public, 'Does God play Dice' being the first. He has received a number of prizes celebrating his achievments as a popularizer, among those the Faraday medal in 1995. In addition he has contributed regular math columns for the Scientific American and frequently appeared on radio and in the daily press. Many students of mathematics have come across his textbook on Galois Theory. This interview is in the tradition of chats with Marcus du Sautoy and Keith Devlin which have appeared in the newsletter last year. Let us jump into the interview right away visting him in his office at the department.*

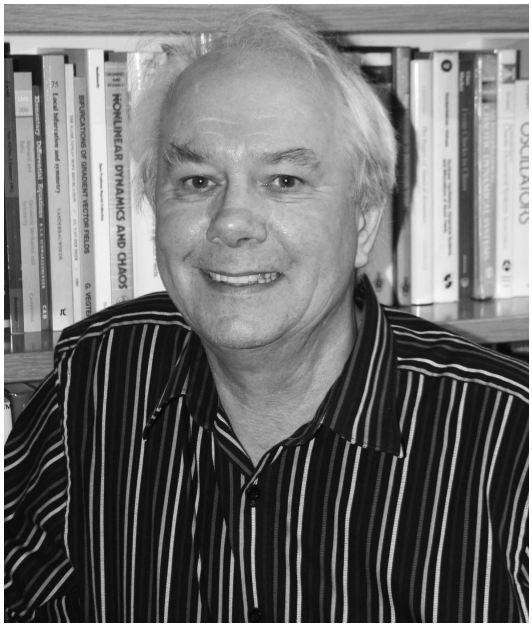

Foto: Ulf Persson

UP: You really have a lot of books here.

IS: Yes, I am retired but I want to keep my office here as long as possible. Once I am kicked out I will have to bring them home and my wife, who thinks I have already far too many books already, will be very upset. The walls of one room are completely stacked with science-fiction. I have over 4000 books and over one thousand magazines. I have been interested in science fiction since a child and never lost interest.

UP: You read only science fiction?

IS: Come on. What do you think? I have always been interested in straight science and I read a lot of it, popular or not. In recent years my wife has become interested in Egyptology and we have traveled to Egypt many times, so I decided that I would learn some Egyptology too, so that I knew what we were visiting. But it is true I read a lot. I would say two or three books a week. I always have a stack of books next to me. I usually read with our cat on my lap. My wife and I spend most evenings sitting and reading next to each other and not talking at all. I guess that many people would consider this as a sign of a failed marriage. Failed or not, we are perfectly happy with this state of affairs. We've been married for 40 years.

UP: Nevertheless science-fiction must be a passion of yours. Have you written any science fiction yourself?

IS: Yes I have in fact published two books with my coworker Jack, and even before that in the late 70's when I was in Connecticut I wrote some short stories and had them published.

UP: I guess it is not so hard to get science fiction published.

IS: It is not as easy as it used to be, many of the magazine that served as outlets are no longer operating. But there is actually a new venue, on the back page of 'Nature' of all places. They nowadays publish a one page story, with a picture, every week. I have so far had five stories published. I think this is pretty much a record. Now they have more printable material than they can print.

UP: I guess your own books, considering their various editions and translations, will fill a shelf just by themselves.

IS: In fact they fill several. I used to have them in order but I recently moved in here and the books are more or less haphazardly stacked.

UP: It will be very sad when books are replaced by those 'reading plates' or whatever they are called. Books as physical objects are so nice to handle, and one should never make light of them as pieces of furniture either, they make a home a home. Whenever I visit people with no books at home, I feel that it does not feel like a home, more like a hotel or airport lounge.

IS: At the moment books are still doing very well, but for how much longer I cannot tell. I suspect that once the transition starts in earnest it will all go very fast indeed. It is after all irrational to let information to take up so much space when it can be reduced to almost nothing. But I am sure the publishing industry will be able to handle the situation. Books will continue if with other means and contracts will have to be renegotiated, but that are just worldly technicalities. So my status as a writer will hardly be affected I guess.

UP: What will happen to your library then?

IS: My younger son is really interested in books too, and an avid reader needless to add. He is sure to take it all over when me and my wife pass away. He claims that he always wanted to run a used-book store.

UP: Those people never sell any books. They will definitely not sell books they have not read, and once they have read a book they get attached to it and will never get rid of it.

IS: This is fine with me. At the moment he is actually selling things. Used cars in fact. About 50,000 a year. He works for Peugeot and handles all their trade-in cars and commercial fleet cars. And transport of new cars. So much is going on in the world that you have no idea of.

UP: Far more bulky than books.

IS: Far more bulky than books that is true, and with modern technology, books will almost take no space at all, as I just said. By the way have a seat. So you are not going to record our session. How are you going to remember it all?

UP: Do not worry, I am blessed with an exceptional memory. When it is all over I will just sit down and record everything more or less verbatim. If you would happen, heaven forbid, to say something stupid, I will discretely blot it out, or if you would formulate yourself a bit awkwardly I will fix it up. Just trust me.

IS: I guess I have no choice, but it sounds incredible to me. So please go head and fire your first question. I am game.

UP: According to Keith Devlin there are three mathematicians to whom the media turns when a piece of mathematical news has to be commented on. Namely him, Marcus du Sautoy and you. All Brits incidentally. Would you agree?

IS: Yes I would. On the whole. We get asked a lot more often than most others. The media needs to turn to someone they know can deliver, and we have delivered in the past. It is so much simpler for them not to have to try out new people all the time. Though other mathematicians turn up reasonably often, which is good.

UP: So it is a kind of brand recognition. So once you have gotten a foot in, and prove yourself to be basically capable, you are set. So the natural question is how did you get a foot inside. I am very curious to know.

IS: I gather you would not mind doing that kind of footwork yourself. In my case it all happened early on in my career, and I guess almost by accident. Back in Cambridge I was an editor of the undergraduate journal Eureka, which dealt in puzzles and that kind of thing. It is about to publish its 60th issue. My Director of Studies at Churchill College held the editorship before me and I suppose he kind of wanted it to stay in the family so to speak.

UP: But you did not do it out of duty, you actually enjoyed it, it was congenial to you. You were lucky to be given the opportunity, but it would of course have been wasted had you not had the aptitude. And then how did it go from there?

IS: It was a long process actually. At Warwick, where I continued as a doctoral student in the late sixties, I kept on as an editor but now devoting myself to the local student maths magazine 'Manifold'. It also helped that Christopher Zeeman, who founded the mathematics institute here at Warwick, took his duties very seriously. Not only was he running a department, recruiting people and all the usual things he was expected to do, he also reached out to the community, giving popular talks. In 1968 he gave a radio broadcast about topology for the BBCÑwe printed it in Manifold, of course. He believed that this kind of activity was OK for an academic; in fact, important. Of course as the department grew, there were only handful of us in the beginning, he had to delegate his many assignments, and it fell on my lot to give popular lectures and such things. In every department there tend to be a few people you can count on doing that odd extra-curricular thing and I was one of them.

UP: Still 'Manifold' was a rather obscure publication, with all due re-

spects, reaching very few people.

IS: Well, we sold it worldwide to over 500 subscribers and it lasted 12 yearsÑbut basically, yes. In the late sixties there might have been a total of some 600 students at the university. Not in math but in all subjects. It certainly was a very narrow base, but one thing led to another, and then I found myself running a math column in the French edition of Scientific American. I wrote the pieces in English and they were translated into French. I write fast so that was easy. You know of Martin Gardner of course.

UP: Sure. Did you ever meet him?

IS: In fact I never did, although I did have occasional correspondence with him. In fact I ended up 'replacing' him at Scientific American — not that he was ever *replaceable* — but of course not right away. You know the story, he finished in ...

UP: ... 1981. And was replaced by Douglas Hofstader, but that fizzled out pretty soon I recall.

IS: True, and he was replaced by a computer scientist, Kee Dewdney, who turned the column into a purely computer based one.

UP: And that did not work either.

IS: It was fun and well-written, but it wasn't mathematics. None of those people had the charm of Gardner, and more to the point, computer algorithms do not have the same fascination to the public as mathematics has.

UP: I remember that in the early eighties there was a lot of concern among mathematics departments that computer science would suck up all the talent and mathematics would become obsolete, playing the role of say Latin in the academic world. But it never happened.

IS: How could it have happened? In fact computer science has been successful enough to make its people superfluous. Nowadays computer systems tend to run themselves with minimal input. So people with degrees in computers find themselves out of work, unlike mathematicians.

UP: There simply is not the same broad culture as in mathematics. Being mathematically trained in a liberal arts way at least endows you with a broad background. But to return to your career.

IS: Yes, the column in the original Scientific American disappeared for a time, but as I told you it was revived in the French. And pretty soon other European editions such as the German, Italian, and Japanese published my columns as well, and it might have been a foregone conclusion that the Americans decided to revive the tradition.

UP: We are now speaking about..

IS: The early 90's. So now I was running a column with some 600'000 potential readers. That is awesome. Just imagine how many people your own math articles may reach out to? You need to take a whole department and consider its lifetime output to get anything with comparable readership, if even that.

UP: If even that. There are not 600 000 mathematicians, nothing close to that. So even if you would include the total readership for all mathematics, you would not even get near. But mathematicians read your papers in a very different way.

IS: Yes one would hope so, otherwise there would be little point in engaging in mathematical research, or at least to publish its fruits.

UP: But by then you must have caught the eye of the media?

IS: Sure. As the tale illustrates, one thing leading to another. I was asked to write a popular math book, and so 'Does God play Dice' appeared. It was a tremendous success, and for me personally also a financial one. Having had such success I was naturally asked to write more, and even if the subsequent books did not do as well, they did tolerably so justifying their appearances. The amazing thing is that it was only at this stage that I got myself an agent.

UP: Yes that is amazing. I and an old professor of English wanted to publish a popular book on Astronomy in the 90's. He had had some success already on a book questioning the historical fact of Jesus, but that proved to be of little worth. We sent inquiries to twenty or thirty publishers of popular science, and almost every publisher got back to us expressing surprise that we did not have an agent. Apparently this was the rule and most publishers did not want to deal with authors directly.

IS: Of course once I got an agent, things really picked up. For one thing he was very aggressive managing to get fairly big advances for me and of course if publishers are induced to pay you a lot, they are going to take you seriously and do everything they can to promote your work. And needless to add that worked well for me too. The agent also had a feeling for what was going on in the publishing world, he could suggest a new topic for a book that some publisher wanted to market. Something I would otherwise have had no inkling of. Then I was also lucky. In the 90's the demand for popular science books picked up again after a lull of some twenty-five years. Or rather, I believe, the demand was finally discovered by the publishing industry. No doubt it was Stephen Hawking who revived the old tradition. His book 'A brief history of time' was really hyped up. He was presented as the new Einstein. And it worked!

UP: And his invalid status certainly helped too.

IS: It certainly did not hurt. I guess few people actually read the book, but it was felt that you had to buy it and refer to it to show that you were on top of things. Then there was a slump again around 2000, that is when Marcus was due to step in. For that reason he had a much harder time getting in on the market. Anyway surfing on the wave I ended up writing a book every six months. Even my agent thought that I was overdoing it, but I just could not help myself.

UP: So how do you do it? Keeping up such a pace I mean.

IS: It is a hobby. I do it strictly as a hobby. Writing comes very easily

to me. I do not touch-type but I am pretty fast with my two fingers. I used to be able to do about eighty words a minute. In recent years my peripheral vision has decreased somewhat, which makes me more liable to make typos, and hence it slows down the process, but the main thing is that I never agonize. I just sit down and the books pretty much write themselves. As far as they do not it is due to insufficient preparation. Then I simply have to do some more reading.

UP: What does the university think of all this? Writing books for the popular market is that not frowned upon? This is not what you are primarily expected to do. You should prove theorems.

IS: As I said it is a hobby of mine. And if I had not, so to speak, been allowed to write my books in the academic environment, I would have left and gone freelance. It is true that my kind of activity is, or rather was, looked down upon to some extent. But that has changed a lot in recent years. And besides I write plenty of technical papers too, so they should not have any reason to complain. Now as I was awarded a prize, a prestigious one indeed, the University perked up.

UP: . tell me about the prize.

IS: It is called the Faraday Prize, and it is given by the Royal Society for successful efforts to reach out to the public. Dawkins got it of course, very well deserved, and recently Marcus has been awarded too, as he should have. As a consequence the university decided that it would be a waste having me teach undergraduates, that could be done by someone else, and this freed a lot of time. The Vice-Chancellor ('president' or 'CEO') simply gave the math department an extra sum of money so they could find a replacement. So I kept this ad-hoc position for twelve years, until I retired. It was renewed two times, so they must have thought I was doing something right. There was no official title given to me, as the case is with the one at Oxford, where the title of the position, gives the holder a lot of authority dealing with the media world. I was very happy for Marcus getting it, until then he was constantly thinking of where he would end up next, would he be able to keep on doing mathematics?

UP: But your out-reaching activities are not confined to writing books.

IS: By no means, I give public lectures, I appear on the radio, I even do some TV, but that I do not really like, there is too much effort involved. Just to make a brief appearance on the tele the thing may have to be re-shot a dozen times, there is always something going wrong, a hand getting in the way or some other stupid thing. For that reason I do not do much TV, I very much prefer the radio. Marcus on the other hand does a lot of TV...

UP: ... he has become the David Attenborough of mathematics ...

IS: ... and he does it very well indeed, do not be so sarcastic. But it is exhausting. I cannot understand how he can put up with it. All that travel ...

UP: ... but traveling is exciting, just think of all those exciting destina-

tions he is taken to ...

IS: ... how fun is that? Being flown to India say and spending all your time before a TV-camera. Where is the magic? As I said I very much prefer the radio. Just recently Marcus and I and Caroline Series, who is another person at our department who is willing to do that odd thing, appeared live on a series chaired by Melvyn Bragg. He runs a very good show and takes up many interesting topics in science. We were supposed to speak on imaginary numbers and it was all done alive. I like that. Even if you get lost and hum and hem and all that, the audience understands that, it makes it much more authentic than an edited thing, and will thus be more liable to hold the attention of listeners.

UP: To return to your writing. How much time is actually spent reading up on the material, because even if you would have a wide mathematical culture acquired in your formative years, you cannot know everything.

IS: Of course this is true. But I have a wide mathematical taste, so most things I can easily get interested in. In fact you need to have a wide taste if you are interacting with the media, because if something has the slightest connection to mathematics they will call you up and you have to be able to say something intelligible on the spot. As to your first question I would say that of the time I take writing a book about half is taken up by preliminary reading.

UP: I am sure that many readers of this interview would be dying to know the secret of your craft.

IS: If there was a secret I would not divulge it would I? That is after all the nature of a secret. Still I can of course give some general advice. If you would like to write, write a book or so, just sit down and do it. It is a simple as that. The end result might not be very good, most likely it will be awful, but it will teach you a lot. Then you are often told by publishers to have a special audience in mind. I do not know my audience, neither do the publishers in fact. They seem to have not much of a clue. Could it be students, other scientists, lawyers, teachers, ministers....

UP: I am very much in favor of the notion of the 'intelligent layman'...

IS: ... who is not put off by a formula or two...

UP: ...exactly.

IS: An old advice, which still is very much true is never to underestimate the intelligence of your readers only never overestimate their ignorance. So in fact if I am writing to anyone at all it is myself as a fifteen year old..

UP: .. that is exactly the kind of advice I have given to people. To have a bottom-up approach and write to the child within you.

IS: Yes it is excellent advice, and something most successful writers do instinctively. As a teenager I read a lot, mostly science fiction, as I have already told you, and popular science. My parents had subscribed to something that gave a steady supply of such material. I read Patrick Moore, as I was very interested in astronomy, and Isaac Asimov who did double duty.

So when I write I subconsciously ask myself what was I interested in then, what did I know, what did I want to know? Of course I am liable as an old hand to become a bit too technical at times..

UP: .. an occupational hazard...

IS: Yes, true, but on a second reading I often can spot those professional indulgences and take a more critical attitude, how much of this is really necessary.

UP: It is always very hard to cut out something that you have written.

IS: But necessary. It is the sign of a professional. One book I wrote I actually ended up cutting out a third of its bulk in the end.

UP: But it is still on your hard disc.

IS: Yes it is still on my hard disc, some of it was (I feel) very good writing—but on a topic that didn't really fit the rest of the book. I may some day be able to recycle it. And anyway if you do not cut it out your editor will. Editors are usually good, and could be very good if they are really good. It is not just that they give local advice, they can give you very good structural advice to the effect say of suggesting a different order of the chapters, to cut some chapter out because it really does not fit, or even to suggest additional chapters. Editors have a lot of experience and you should really think very hard before discarding their advice. They are usually right, even if it is a bit hard to accept this when you think you are done with a manuscript and are being returned to the drawing board again. Of course at time you can get saddled with an editor with whom you do not get along. This is a very hard situation to find yourself in. In the end you have to trust your own judgment.

UP: It seems that writing comes naturally to you. Maybe you dreamed about becoming a writer when you were a child.

IS: I am not a natural writer. And I did not dream particularly about becoming a writer. It is true, however, that I wrote a lot when I was young. My father had gotten me a used typewriter and me and my friends used to play with it. We wrote stories, silly poems, and all kinds of things. I found at the time that although I had no problem writing short pieces, I just could not write anything long.

UP: You had not yet learned the art of padding out.

IS: That is true. It's no longer a problem! Quite the reverse. But I found myself writing more and more. Basically my skills are the result of lots of practice. There is no substitute for just doing the thing. Simple if brutal advice. And as to writing a book it is very important to have the overall structure of the book clear in your head. If you do not have that, you will not know where you are heading and will end up going in circles. It does not have to be something elaborate, nor anything fixed in your mind, because as you go along the structural plan may change. Having that structure in your mind, and as I indicated, it does not have to be anything you need to formulate and write down, means that there is a book in you, not just

the general idea of a book you would like to have written. Now having that structure of the book in your mind means that you do not have to write it in sequence, you can write a little bit on chapter seven, then skip to chapter eleven, then start at chapter two...

UP: As films are being shot. Very confusing to the outsider.

IS: Exactly. It has the advantage that you can work on what you are most geared up for at the moment. Otherwise you might get stuck on some boring part and lose momentum. That is a waste of time. True I try to discipline myself getting the hard parts out of the way first, trusting that the easy parts will write themselves. Though sometimes they turn out not to be so easy after all... Another thing which is very important, is not to polish the writing as you get along. Everything is provisional contingent upon the book as a whole. When you come to chapter seven you may realize that chapter one has to be rewritten. All the effort you may have put into correcting typos and combing out awkward sentences would be wasted. The first thing is to get the book done, after that you may start the polishing process. Then I find myself it is much easier to print out the entire manuscript and read it pen in hand. If you try to do that on the screen you lose the flow...

UP: .. and worry that you will cut out anything essential in the editing process...

IS: Exactly. Then when it comes to the final editing, correcting typos and such trivial things, you can do that on the screen easily. This is how it works for me at least, other writers find their own routines. The point is that there is no secret to writing except just to do it, and the kind of advice you may give is all of a very general kind applicable to all, anything specific advice you give may or may not have any relevance at all to you.

UP: Tell me about your science-fiction novel. Did it sell a lot?

IS: It was written with a sidekick, and you certainly would not read a review of it in the New York Review of Books—though it got some good reviews in the SF magazines. It began when I and my co-author Jack Cohen were invited down to Plymouth to participate in a quiz show on radio. Plymouth, as you may know is a coastal city along the channel..

UP: ...I know I visited it back in 1966...

IS: Good for you. Nevertheless it involves a boring five hour ride, and just to amuse ourselves we decided on trying to work out a plot for a science fiction novel. It was to be set in the Jovian atmosphere, huge whale like creatures, floating around. They were playing anti-gravity games with the Jovian satellites setting up gravity so to speak in order to dispatch of comets. They decided to send them to Earth after all that was a dead planet, because an atmosphere containing so much of that poisonous gas oxygen, ruled out anything lifelike. So the book starts with us earthlings discovering that a comet is heading straight for us, deciding that it cannot be a coincidence.

UP: This seems clever.

IS: Do I once again detect a slight sarcasm in your remark? Science

fiction is clever, or at least ought to be. When we arrived we contacted an SF agent with a synopsis of the plot. He was interested and asked us to send him what we had. We did so, and he got back to us complaining that we did not have a fully worked out plot. But we had not been asked to supply one, only to show them what we had so far. He ended up selling the idea, so of course we had to to write it, and have it published.

UP: I have never been a fan of science fiction, in fact I have never really read anything. In principle science-fiction seems great and a real challenge to your imagination, after all you are so to speak setting up new parameters and exploring the consequences. But science fiction has a very bad press, at least outside the science-fiction community, it is not really considered serious rather somewhat kinky, and I suspect that much of it is of pulp-quality, rather stereotyped, almost always involving space travels. Still as a child I spend a lot of my time, to the worry of my mother, inventing imaginary worlds, and in a way that is what mathematics sometimes is all about. Setting up axioms and exploring the consequences.

IS: It is true that much science fiction is sterile and unimaginative. Stereotyped as you say, although I am a bit puzzled as how you have come to your conclusions, admitting to never having read any...

UP: ... the less you know about a subject, the easier it is to entertain strong opinions..

IS:.. yes much can be said for ignorance, apart from its supposed bliss. I obviously do not share your haughty attitude to the craft. There's a lot of good SF writing too. Let me tell you about Sturgeon's Law. Theodore Sturgeon was an SF writer in the 50s and 60s, and someone once said to him 'Ninety per cent of science fiction is crap'. Sturgeon responded 'Ninety per cent of *everything* is crap!'. That's Sturgeon's Law. Critics of SF seem to focus on the worst bits—yet they would never do that with mainstream writing.

As a writer you are sent by publisher to literary events, some are big and in the nature of festivals, other are smaller more intimate events. There are one about every week somewhere in England. Then you meet those truly literary types. I do not give much for their novels. They seem mostly to write for a small coterie, mostly made up of themselves. Old-fashioned virtues like good narratives are gone...

UP: .. they hey-day of the novel was the 19th century. Dickens clearly wrote what nowadays would be classified as soaps, reaching a huge greedy audience through is serializations...

IS: .. yes Dickens was a great writer of soaps. Yet your analogy with mathematical exploration is not so bad. There is one writer in particular I have in mind. In order to appreciate what she is really doing you need to delve very deeply into the structure of her imaginary world, which she assumes all her readers have already done. Without this a priori familiarity her books do not make sense at all.

UP: So you need to make an initial investment, would it really be worth it?

IS: This is a very reasonable question. It is in fact not too different from mathematics. You read a paper in a field not familiar to you, on the first page you will inevitable encounter a mathematical object of which you do not have a clue. The writer assumes of course that all his readers are familiar with it, so there is no need to offer a definition, let alone an illuminating one. You are helplessly stuck, and do you really want to invest time and effort learning the necessary prerequisites?

UP: Yes mathematics is hard work and in spite of all what is said about the beauty of mathematics much of it strikes you as very mundane and ugly and you rather do something else, but this is seldom emphasized in popular books on mathematics.

IS: Let us not become cynical, although it is always a tempting cop-out when the going gets tough. Let us dwell a little bit on the good things of science-fiction. Let us talk about Discworld...

UP: ... Discworld? I have never heard of it.

IS: You have not? You have not heard about Terry Pratchett. Next to Rowling he is the best-selling author in Britain, and he has also a big following in Australia, France, Germany, Poland, and Czechoslovakia. It is all set on a flat universe resting on the backs of four elephants, all of them standing on a turtle... that kind of thing. It is once again nothing you would be likely to encounter in the New York Review of Books (or any other literary review for that matter.) But Pratchett has won literary prizes for it.

UP: That figures, and explains a lot. It is fantasy?

IS: It is fantasy if you like. Humorous fantasy. But Pratchett puts it too good use. He uses it as a vehicle to discuss, often in a satirical mood, many aspects of modern society.

UP: In the tradition of Jonathan Swift?

IS: Yes, nothing is really new under the sun. Jack and I knew Terry — Jack had known him for ages — and we thought that we could jump on that particular band-wagon and use it also for a vehicle for science. So we contacted him. He was willing in principle, but said it would not work if we followed the approach in The physics of Star Trek—'explaining' the science behind Discworld events. You know — dragons breathe fire because they eat some combustible material. But on Discworld, dragons breath fire because that's what dragons *do*. Discworld is not about science, it is about magic. Nothing happens for clear scientific reasons it happens because of inscrutable magic reasons. And also narrative imperative, the power of story. Things happen on Discworld because the story makes them happen. Our world isn't like that.

But we were able to come up with a solution. Inside Discworld the wizards of Unseen University could create a little world referred to as 'Roundworld'. No bigger than a football sitting on a shelf, from the outside...

INside, thouhg... well, without narrative imperative, it doesn't know what size it ought to be, so it can be any size it likes. Our whole Universe fits into it— in fact, from the wizards' point of view that's what our Universe *is*. So inside Discworld, insulated from the magic, is our world, a world in which scientific principles apply. The wizards of Discworld look at it as a curiosity, but being the custodians of which, they are obliged to take good care of their charge. Like owning a pet gerbil. So the structure of our books, of which we so far have published three, and are thinking about a fourth, consists of chopping it up in chapters, every other one of which is really in the nature of a footnote...

UP: .. footnotes are frowned upon nowadays, whenever I have sent any review to the Math Intelligencer, their first demand is to get rid of the footnotes. I like footnotes, and in fact in the old literature footnotes played a very important role, sometimes even dwarfing the text itself. It is a pity you cannot have footnotes to a footnote. Footnotes to me give a stereographic picture and they also indicate that there is much more to a subject than can ever fit between the covers of a book..

IS: .. that was quite a footnote. Pratchett singlehandedly revived the footnote in popular wiritng: he uses it for comic effect. He adds amusing asides from the main story, often parodying academic writing. But let us not digress unnecessarily, the temptations to be so are ubiquitous anyway. So in addition to our 'very big footnotes' there has to be a gripping narrative that fits well into it all. There Pratchett is invaluable. Unfortunately—tragically, you might well say—recently he has been affected by a initial stage of early-onset Alzheimer's, 'post-cortical atrophy'. It doesn't affect his intellectual abilities, but one morning he woke up realizing he could no longer touch-type, and he had been a journalist for forty years. He is sorting it all out and finding ways of getting around it, but the basic circuit on which most of us operate namely brain, fingers with keyboard attached, and screen is broken for him. It has slowed things down.

UP: Speaking about digressions, let us try to return to the topic of mathematical writing. Devlin was assigned to write a book on the Millennium problems. Some things were easy for him to do, such as the P not NP problem (on which he had actually worked himself if not that seriously), but the Hodge conjecture stymied him, still he had to produce something, and as a result it was not as satisfactory as the other problems he dealt with.

IS: I am going to do the same. Write on the Millennium problems that is. As part of a broader book. And there is no way that I can skip the Hodge conjecture! I need to write something on it. But... it is extremely hard to convey anything of it to the public. The Birch/Swinnerton-Dyer Conjecture is much easier, for one thing you can spend a lot of time explaining the problem of counting points on elliptic curves. The Hodge problem is very different.

UP: You need to write on cohomology, there is no way around it.

IS: True. And to be honest I never really warmed up to cohomology. I know of course how to deal with it formally, but I have no real understanding of what it really is. I lack an intuitive approach to it. It is just machinery to me.

UP: Actually one of the skills a mathematician needs to have is not only to understand things but also to suspend understanding if needs be. Most mathematicians learn the definition and the way to perform computations as a formal game, but have little intuitive understanding of it. I suspect few mathematicians have any personal intuition about cohomology, it is just a tool, and depending on what you are working on it is an indispensable tool. Vector fields are very intuitive, but 1-forms? I once proposed the topic of explaining differential forms as a test lecture for a position. None of the candidates produced anything but standard definitions. I was disappointed, although I certainly would never have been able to do differently at that stage of my career.

IS: Oddly, I quite like differential forms— I started in Lie theory and exterior algebras are fun. In fact for many elementary concepts, you only realize you have not understood them much later in your career, or at least there are certain important aspects of them, but you only become aware of those as you mature. Jordan normal form, say.

UP: And that understanding you would never have been able to get initially. Once you have learned a subject, you are often able to articulate your understanding in a clear way, and naively you may regret that you were never exposed to that clear formulation from the start. But the truth is that then you would never have been able to appreciate it.

IS: True. Often when teaching a course I am asked for a motivation what the course will lead up to. They want a kind of mini-course, a road map so to speak, before they start out. Of course when it comes to something like the Lebesgue integral it is easy to make such a motivation by pointing out the defects of the Riemann integral; but in many cases no remarks make much sense until after you have been exposed to the material. Your views are going to be enlarged, and in what way will not be clear until your views have really been enlarged.

UP: Just as our conversation just now. If you have never struggled with learning mathematics what we are saying now simply does not make any sense. But if you have we would hope that our comments would ring a bell. I think that one problem with learning mathematics is that in order to understand A you really need to understand B first, but to understand B you also need to understand A. From a strictly logical point of view you have entered an impasse, but from a more pragmatic point of view you spiral up, going through the process several times, and after each rotation you have a better understanding of A and B which will help you to get an even better understanding of them next time around.

IS: It is very true. How often do I not get students who get stuck and who

refuse to continue from then on. Humans are not logical machines, if you just read on, I plead with them, you might find something that throws some light on the issue. Only very elementary things can you hope to understand in such a white and black way, as you grapple with more advanced material there is bound to be many graduations of gray.

UP: We were talking about the Hodge Conjecture.

IS: Yes, I had hoped we would leave that behind. It is of course not enough to understand cohomology, you also need to understand it over the integers versus the reals and complexes, and something about harmonic forms. I do not see how you get to convey anything of that at all. I am myself very confused about the issues. And besides I have been told that there really is very little evidence for the conjecture, only that in the few cases it has been possible to work it out explicitly it has been verified. So most likely that conjecture will be disproved by some clever and complicated counterexample, just as one pre-Perelman thought of the possible fate of the Poincaré conjecture.

UP: Now a common strategy when it comes to presenting mathematics to an ignorant public (which could include your colleagues) is to take a top-down approach and simply water things down by extricating all the technicalities. In the end what you have will be unintelligible to the layman and the expert alike.

IS: This is clearly horrible, and I know many examples, but will not disclose any names. But sometimes you have no choice. All you can do is to try and convey that something is important that it exists and wave your hands. One way around it is to focus your account on personalities. The human interest element always works.

UP: I guess this is what Singh does, especially in his book on Fermat. You cannot hope to learn anything specific from it, even if he ostensibly includes a lot of mathematics. But one thing he does well is to convey the excitement.

IS: And that is very important. There are of course books with educational ambitions, and those seemed to have been more common in the past then now. I am in particular thinking of Sawyer, who really wrote books with a clear educational goal without being regular text-books...

UP:..yes I recall one of his books on calculus, pointing out that a bouncing ball performs an infinite number of bounces in finite time...

IS: .. a nice way of illustrating the sum of a geometric series I would say. But nowadays much is gained by simply making people aware of the existence of things they otherwise would have had no idea of. Such as mathematical research and the passion it can engender among those who engage in it. We really have to fight against this popular conception that mathematics is a dead ossified subject.

UP: I would say that mathematics as a subject of popularization has both advantages and disadvantages over other sciences. In mathematics you

can give people a taste of the real thing, even if it is just going to be a rather elementary puzzle, while in the other sciences you have to take the word for it, you have no way of independently verify experiments. On the other hand in other sciences the public has a very good idea of the interesting objects of study, be they galaxies, cells or atoms, you do not need to introduce them, while in mathematics. except for numbers and certain elementary geometrical concepts, even basic ones need to be introduced, and once you have done that, you have usually exhausted their attention spans without having delivered anything at all. This even goes for lectures for non-experts, say at an ICM. Precision and systematics are mathematical virtues but not necessarily so in a lecture. The popular lecture, and now I include those at professional gatherings as well, cannot hope to instruct but should be content with informing and entertaining.

IS: Yes I would agree with that.

UP: I also think that the general public is not that interested in applications of mathematics, they share the taste of mathematicians...

IS: ..you mean of pure mathematicians...

UP: ...It is one thing to emphasize the importance of mathematics to improving telephone connections and secure transfers of money when you are addressing a funding agency, with the public it seldom generates much more than a polite yawn. What can you expect, they reason, people are paid for doing mathematics after all, so no surprise that it is useful. Big deal.

IS: Yes it is the big concepts that intrigue people, and mathematics is filled with them.

UP: People are really intrigued by cosmology, which has no practical applications whatsoever, and the cosmologists are confident enough not to feel compelled to regret that, as we mathematicians tend often to do when addressing the general public, they feel that they stand on their own legs, they are in no need of external justification. Mathematicians should take the same attitude.

IS: Yes mathematics should really exploit those riches much more than they do. Infinity, higher cardinalities, those are not really inaccessible topics, on the contrary they speak to people.

UP: I have been given elementary lectures on hyperbolic geometry to interested high-school students and beginning university students, and it has been very successful, on the other hand it is hard to see how you can fail with such a topic. In fact I think that hyperbolic geometry would make an excellent setting for science-fiction. In a sense this was the way it was originally conceived. I am surprised that it has never really been done. Not even in the way of Gamow's Mr. Tompkins stories.

IS: I think it has been done, but seldom very successfully. I sort of attempted something in one chapter of Flatterland. But science fiction is not only about setting new parameters. As you indicated before, you really need to come up with a good narrative idea that fits naturally in the context.

UP: Could be. Yet my point of view has always been to imagine you are inside a hyperbolic universe and then wonder how it would be like. In this way you not only stimulate the imagination of the audience but also your own. I have been able to prove things about hyperbolic geometry by virtue of this identification, which I probably would never have been able to do otherwise. In order to work with mathematical concepts you need to have an emotional relation to them, otherwise they will not generate any associations.

IS: Or rather it is the cloud of associations that surround them that constitute what you call the emotional attachment. This remind me of the various isomorphic ways in which different pieces of mathematics can be articulated. From a formal point of view there is no difference, any proof in one domain can easily be translated into the other. To fix ideas, just think of Cartesian coordinate geometry versus synthetic. But that misses the point. Sometimes the one presentation sometimes the other makes you come up with a useful idea. What may seem very natural in one setting becomes very contrived in another, and you would never have thought of it had it not been for the first perspective.

UP: I think this points to an important thing about Platonism and mathematics, a topic which is marred by much confusion. I guess all mathematicians are Platonists at heart, otherwise they would not find the activity meaningful.

IS: I guess by that you mean that mathematics exists outside us, that our research is not amenable to wishful thinking, that it is in short not magical, what you find when you turn around the corner is not up to your own discretion, it is forced on you. With this I definitely agree, but then to posit a heaven of ideal forms, is something quite different. How do we ever get in touch with those ideas?

UP: This is taking Plato too literally, remember that he is an ironic writer, who speaks through metaphors, and such should never been taken literally, then they become merely silly. I have personally no problems with the idea of an ideal world, as long as it is not taken literally, but just seen as yet an example of a Platonic shadow. Platonism as expounded by Plato may be thought of just one concrete earthly manifestation of a Platonic Platonism so to speak. I suspect that Plato may have had something like that in mind, but was prevented from formulated it, as that would just make a mockery of it all.

IS: This sounds very clever, and is so no doubt, but I myself am very partial to the views of Reuben Hersh. I think he has been greatly misrepresented as just another social-constructivist, but he is far more subtle. Mathematics is a social activity, just like any other, how could it be otherwise; but that does not mean that it is purely subjective and arbitrary..

UP: ..Objective from the point of view of the individual, but not making sense beyond society. Just like money, a shared convention...

IS: Exactly. Money is a very good illustration, and one which Hersh uses himself. Where is money? Not in actual bills and coins, not even in written contracts or in computer files kept by the banks. It is highly abstract and cannot be pinned down to any material object. It exists ultimately as a shared convention between human beings. You as an individual are unable to flaunt it. You cannot go to the bank (my father worked in a bank, incidentally—today he'd be called a security guard) and claim that you have a million pounds in your account, although it only says a thousand on the slip, because your pounds are actually worth one thousand of ours. No banker would accept that (certainly not my father). But of course if there is a real serious financial crisis, so serious that this highly abstract convention ultimately built on human trust is seriously cast in doubt, it will all be tumbling down as the house of cards it really is. Money is not to be found in any one individual, it is found in mutual trust between individuals, and something similar is the case with mathematics.

UP: This is a very attractive image, and I agree with you that Hersh is one of the most insightful commentators on the nature of mathematics and human culture, and I found his book 'The Mathematical Experience' he wrote with Philip Davis wonderful. Yet ultimately I feel that there is actually something beyond a shared human understanding, elegant and persuasive as it may appear. But perhaps I am just wanting to be contrary. However, the anti-Platonic attitude I find by Brian Davies, I have a harder time to respect. First he makes a caricature of Platonism and then he attacks it by implicitly accepting Platonic ideas. Of course this kind of circularity is inevitable once you engage in philosophical thought with a strong metaphysical flavor. What I particularly object to is his idea that the study of the neurology of the brain will shed light on the nature of number.

IS: I agree with you that this sounds a bit far-fetched. As to your characterization of his attack on Platonism I have so far nothing but your word and would not pass any judgement until I have studied him myself. But I think that our concept of mathematics is really very much dependent on our particular surroundings. To us the natural numbers are very natural indeed as we are surrounded by well-defined objects which are stable in time. But just imagine beings in the Jovian atmosphere to which everything is in a flux. They would have a wonderful understanding of fluid dynamics, but the natural numbers would not enter as a basic concept, maybe eventually, but not anything they would teach in school.

UP: This is an amusing example, still rather anthropological, as you would admit. And I can also see, after your previous confession, what it is coming from. Yet all such examples are based on a kind shared idea of intelligence as a Platonic entity existing beyond the individual intelligences of each set of beings. I would like to recall C.S. Pierce's suggestion that the natural numbers are more fundamental than logic itself. And I very much like that suggestion. Just note how awkward the attempts were of Frege

followed by those of Russell and Whitehead to base arithmetics on logic. The proof that one and one makes two is a travesty, intended or not, on mathematical reasoning. And those formal definitions of numbers, although good for precision at least within a certain formal context, do so little in catching the essence of numbers. Gödel did it the other way around, he studied logic as a consequence of the integers, and the results were striking. Principia Mathematica, is a cob-webbed cathedral forgotten by everyone, while the Gödel theorem has especially in recent years been very much hyped up and become an item in the tool-kit of every self-respecting intellectual. And yet, I must admit that its relevance to mathematics is very slight to non-existent.

IS: That is true, as a mathematician we do not normally worry about anything being undecidable.

UP: A friend of mine gave a summer course on the history of mathematics. After that he gave a take-home exam suggesting about fifty different questions. One of them was 'what surprises you most in the history of mathematics'. It is a good question, probably better than he realized. How would you answer it?

IS: Of course a lot of things surprise me in mathematics as well as in its history, but I would be hard pressed to single out any over-riding ones.

UP: My spontaneous reaction was, why is there a history after all. In other words why are mathematical problems solved at all? There are many dead-end problems such as odd perfect numbers, the four color problem, maybe even the Goldbach hypothesis and the twin-number conjecture, which cannot be solved, and if solved only in some mechanical non-illuminative way. How come not all problems are like that? Dead-ends, at least to the human imagination? It is a mystery why something so seemingly arbitrary as Fermat's theorem actually gets solved. I think Gauss thought of it as a random uninspiring diophantine equation. Here we have Wiles, who dreams about fame and glory as a child through proving Fermat's theorem, probably the first unsolved mathematical problem he encountered in his life, and then chances in his adult life on a sub-field which miraculously turn out to have an unexpected connection to that impossible identity. Talk about disc-world magic.

IS: You pick up things quickly, I see. In a sense just as with the mystery of existence itself, would it not be there, we would not have occasion to wonder. But I agree with you, and in fact Hilbert had the idea that there really were no undecidable problems in mathematics. If we wanted to know, we would know. Although naive I think that basically Hilbert has been proved right.

UP: Hilbert had excellent intuition. He is falsely, or rather misleadingly thought as of the father of formalism. Hilbert was no formalist by temperament. His idea of formalism was simply to make mathematical reasoning itself subjected to mathematical reasoning in order to liberate mathematics from some potential problems. In order to do so you needed formalism to

translate human thoughts to material objects, which is the point of formalization. Incidentally this is what computers are all about - turning the spirit into flesh. Leibniz understood that. This whole business of Gödel is really applied mathematics. Applying mathematical reasons to mathematical reasoning. The result turned out not to be what was expected, and that is often the case of honest scientific research, and hence not satisfactory, at least depending on your point of view. Of course much has been made of the liberating effects of the negative result which is Gödel's, but most of that is plain silly, including the uses Penrose made of them, although I do of course sympathize very much with the aim of the latter. To me formalizing mathematics is like presenting a picture pixel by pixel. Invaluable for many purposes, but of course such a presentation gives to the human mind no idea at all what it is all about. Understanding is seeing, as the metaphor goes, and that is a very good metaphor I would say. To me human understanding of mathematics is non-Platonic, and here I would very much agree with Hersh and his adherents. But what Hersh does, is very much like what Berkeley does, namely claiming that there is no distinction between what is perceived and the object giving rise to the perception. Berkeley as an idealist is extremely logical and consistent, and his solution to a classical philosophical dilemma is a beautiful example of a Gordian knot being cut by Occams razor. Like everything coming from pure thinking the end result is somewhat bizarre, and Berkeley is forced at the end of the day to posit a God to give it all commonsense coherence. So ironically, pace Dawkins, religion could as well be the result of an excess of rationality as of a lack of it.

IS: Too much philosophy on an empty stomach is not good for you. I suggest we take a break and I will treat you to lunch at a nice pub close by. Most of the food they offer here on campus is not very inspiring.

UP: And why is not Gödel relevant to mathematics?

IS: *fumbling with the key to his office.* Please tell me!

UP: In fact hard-core established mathematics deals with a level of abstraction of say four or five or some such number, while logic consider systems with any kind of abstraction, which probably will never have any human interest at all.

IS: You may be right. But hurry on I am starving. I have my car in the garage, let us take off.

*They descend stairs leave the Zeeman building and climb up a few levels of a nearby parking garage. IS unlocks the doors of a sleek sports-car seeming fit for interplanetary travel and our two combatants squeeze inside into a more or less supine position. IS apologizes that this is not really a sports-car, as it has two rudimentary seats for two extra passengers (preferably dwarfs) in the back, but that his wife drives the real sleek sports car in the family.*

IS: Parking can be a problem here at Warwick University. Coventry City

Council is not terribly sympathetic . It won't allow any more car parks on campus. That's not very clever, and a bit short-sighted. By all means encourage us to use other forms of transport, by making them better. But don't put artificial obstacles in the way. Making cars more efficient, less polluting—good idea. Increase parking much more slowly than the University grows— fine. But limit it altogether, no matter how big we get— won't work. Visitors always complain that they can't park.

UP: In America it is said that a College President has to deal with three major problems. Sex for the undergraduates, Football for the Alumni and Parking for the faculty.

IS: True, true. There are plenty of empty spaces on campus. A bit more parking would simplify life. It would be more efficient and less polluting, done properly. One good idea that has come in: a park-and-ride. I don't disagree with the principles—just with what happens in practice.

UP: How far away do you live?

IS: A mile.

UP: Only a mile, how come you not walk?

IS: It would be very inconvenient as I also go to a gym every day and to tag along my bag would be too much work. It would also take about an hour and a half of time that could be spent on more useful things. Anyway, I do less than 5000 miles a year in my car — about half the average.

UP: In the States they have discovered that sometimes the most efficient way to deal with traffic congestion is not the standard one of building new roads or upgrading existing ones, but to tear down existing roads. In this way rather than encourage added car use they are discouraging it. And it works beautifully.

IS: You are suggesting that they close down all the parking?

*They drive along Gibbet road discussing the pros and cons of public executions, and then arrive at the Pub. A typical English pub, mostly frequented by elderly people and offering, unlike twenty years ago, a big selection of wines, which they both turn down in favor of real ale. They order food and continue unabated their conversation.*

UP: I went to the Muybridge exhibition at Tate Britain in London the day before yesterday. He was quite a celebrity. He suspected his young wife of unfaithfulness and promptly sought out the suspect and shot and killed him just like that. Because of his celebrity it naturally caused a stir. In the end he was acquitted on the grounds of only having done the honorable thing as an injured husband. Times really have changed.

IS: Of course without his studies on locomotion he would be forgotten.

UP: Yes, I know about galloping horse all four hooves of the ground.

IS: The trotting horse to be exact. I actually did a lot of work on animal locomotion. Fascinating.

UP: Did you get into it because you were genuinely interested in the problem, or was it simply that you happened to have a piece of mathematics

that turned out fortuitously to be useful?

IS: The latter case. It turned out that I had done some work on networks and oscillations, and the result fitted very well into what had been found out about animal locomotion. In fact a biologist contacted me after I had presented my work and there was a fascinating cooperation. Are you interested?

UP: Sure. The striking thing is that there are only a limited number of gaits. Humans walk and run on their two legs, there is nothing in between.

IS: Not entirely true, small children hop on their legs when energetic, but you seldom see that kind of sustained locomotion among adults. The case of quadrupeds being the most studied, is more complicated and hence more interesting. Among horses you definitely see three kinds of gaits, walking, trotting and galloping, and for many horses there is also a forth, cantering. The same is true for dogs, though they bound instead of cantering, and possibly for cats, but in horses it is most beautifully illustrated. It was for a long time assumed that elephants could only walk. The reason being that they are so bulky, but lately careful studies have disclosed a possible new form of locomotion among elephants, running with their hind legs and walking with their front legs so to speak. It is awkward of course, any locomotion involving an elephant is bound to be awkward. Now when it comes to arthropods, such as the insects with their six legs, and spiders with their eight, it really becomes interesting. Centipedes and millipedes are of course the ultimate, and it might be here that the thing started. Such many-legged animals consist of many segments which need to be synchronized. It also indicates that gaits are controlled by a very primitive feature of the brain, one so simple that we are probably being able to explain it mathematically. Another important thing is that for each speed, there is a corresponding gait which is the most energy efficient.

UP: So if we try to run too slowly, we naturally start walking, because that is what feels least stressful, in the same way if we start to walk very fast, we would naturally start to run, as that would feel less painful.

IS: You get the idea. It is a sweet piece of mathematics, and we are still working on it.

UP: You have in your books promoted the case of mathematical applications to biology, and you have done a lot of work with a biologist.

IS: I wrote a book on mathematics and biology fifteen years ago, and this is sufficiently long ago I think to justify returning to the topic, although I have the ambition never to repeat myself, but so much has happened in the interim. And Jack, my biologist colleague, I have known for years.

UP: Biologists are usually very suspicious of mathematicians, and they resented in particular the intrusion of catastrophe theory in the 70's. The mathematicians are seen as ignorant and arrogant, both traits being a consequence as well as a pre-requisite for the other, and not really appreciating the complexity of biology. Mathematicians look for simple and elegant so-

lutions which have aesthetic explanatory value, while this is not the way it works in the real world. The solution to the genetical code being a case in point. There was at one time the suggestion of a very simple combinatorial explanation. The real explanation turned out to be far more mundane and as a result of accidental evolution fossilized.

IS: They simply cannot afford to be so anymore. And I think that catastrophe theory got an undeservedly bad press, excessive claims apart, it had and has much to offer biology. And not only that, there is as I have just indicated a huge amount of mathematics that has significance to biology. And soon it is believed that biology will provide mathematicians with real interesting challenges.

UP: But it is never going to be the kind of two-way traffic that is the case with physics, when a physical intuition can actually be helpful in solving a purely mathematical problem. String theory has so far no physical applications to the real world, but definite applications to mathematics. Physics is undeniably very mathematical in its temperamental approach. Simple all-explaining principles are sought, amendable to calculation and endless manipulation. Biology does not work at all like that.

IS: Once again you have very definite opinions, could they possibly be due to ignorance?

UP: Quite likely, but you do agree do you not?

IS: I do not think it is a real issue really. The point is that biologists have got stuck when it comes to major biological problems, such as say embryology and cancer. New ideas are desperately needed. And it is here that mathematicians come into the picture. That is something funding agencies have recognized and they are forcing biologists to change their attitudes. The problem is that biologists are so mathematically ignorant, and even worse in Britain that goes for the chemists as well. Some time ago the chemistry departments in England having tremendous problems with enrollment decided to cut down on the mathematical requirements. The results have been catastrophic. For a time, British degrees in Chemistry were not accepted abroad as professional qualifications.

UP: My son happened to go into Chemistry, perhaps more by accident than as a result of mature deliberation. He has mathematical understanding and works in physical chemistry. I have been told that there is a real shortage of people like him. A big drawback for the subject as a whole, may translate as a small advantage for the individual. My brother, having never taken a single course in Chemistry all his life, has now found himself a professor of Chemistry at Liverpool. He finds the British students to be so mathematically unprepared that he only employs oversees doctoral students.

IS: And of course you cannot avoid Chemistry. After the Watson-Crick discovery it became clear that biology was chemistry. Therein was the real revolution in their discovery.

UP: And many physicists caught in the post-bomb blues turned to biol-

ogy as the new frontier.

IS: Yes they did. I do not really understand your skepticism regarding mathematics and biology, I expect there to be a wonderful interaction in store for us.

UP: It is true that the most interesting article I read as a teenager in the anthology of 'The World of Mathematics' was the chapter on Magnitude by d'Arcy Thompson. I was truly fascinated with the way simple mathematical and mechanical ideas could explain so many things. But it was not until thirty years later or so I got hold of the whole book 'Growth and Forms'. I believe that many of his ideas, although of Victorian vintage, may be ripe for revival.

IS: Yes, he had many beautiful ideas, such as on morphology. I believe that their potential has not yet been fully explored. But there are many other mathematical ideas entering the fields, ideas which apparently you have never even dreamt of. You should read my upcoming book.

UP: Still to take a typical biological problem attacked by mathematical or maybe rather computational methods is to figure out the spatial structure of complicated biological molecules, such as enzymes. The spatial structure gives a clue to the way they actually operate. But such predictions based on well-understood quantum-chemical principles, are very complicated to make and being calculations they do not provide any human conceptual understanding, which is what normally drives mathematicians.

IS: Maybe pure mathematicians. But there is a world out there, and it is wonderful that mathematics can actually be applied to it. In order to to so effectively and relevantly you need a basic conceptual understanding I admit that. But on the other hand you cannot avoid the dirty work. It is an inescapable fact resulting from the increased power of our computers that numerical simulations are going to be made. Who can stop them? You really have to come to terms with the fact that a large part of mathematical activity in the future will be devoted to intelligently performed numerical simulations. You might find this to be too much of engineering, but what is wrong with that?

UP: Nothing really, or at least nothing as to which I would like to get involved in explaining at the moment.

IS: Fine. Let us get up. I will pick up the tab as promised.

*the two friends are now leaving the pub going back along narrow country roads filled with cars*

UP: Last time I was by Kenilworth was almost twenty years ago, and then I came by bicycle.

IS: You could not do it now.

UP: What do you mean? Do I look too old?

IS: Calm down. It is simply that traffic has increased. Now there are so many cars about that even the narrow country roads which used to be ideal

for cycling are now filled with speeding cars. It would be very dangerous. I myself have stopped bicycling to work a long time ago.

UP: Let us return to biology. I grant that there is one very nice and simple idea in biology, and that is Darwin's idea of Natural Selection. When I first encountered it I was surprised that such simple and powerful ideas were also to be found outside mathematics, although it does have, at least to the purist, a slightly tautological feel.

IS: Evolution is a fact of nature.

UP: And that was known long before Darwin.

IS: True. Lamarck has been unjustifiably maligned. He was a clever guy, and in fact he proved that Darwin's idea was not trivial, as you seem to insinuate, by presenting an alternate, if that is the correct word as he did his work before Darwin was even born, an alternate explanation that turned out to be wrong.

UP: I do not think that Darwin's idea, when properly understood was trivial, far from it, it gave to biology a structure and a purpose which it had lacked before, although of course the older idea of evolution itself may have been the crucial ingredient in that Darwinian revolution. But there is no way we can really predict the way evolution will go, there are too many factors affecting it. Even retroactively we are in trouble, as there is so easy to come up with all kinds of scenarios. I am in particular thinking of the so called field of evolutionary psychology in which they are doing earnestly what Kipling did tongue in cheek.

IS: This is true, there really are too many of those 'just-so' stories floating around.

UP: There is this idea that everything is being evolved for a purpose. Take the case of traffic lights. They are excellent markers when you want to give directions, but that is not why they were invented. Every invention has unintended consequences, and those can be taken advantage of. This is how evolution to a large extent works. There is a beautiful article on this by Gould and Lewontine from the 70's. They refer to spandrels.

IS: Yes, I am very much aware of this. And take the fact that we are so good at driving cars. Well, most of us. Was there any evolutionary pressure to make us good drivers? Of course not, there were no cars hundreds of thousands of years ago. We are simply co-opting other skills we have developed. The problem is that such simple-minded and exaggerated claims give ammunition to the proponents of intelligent design. Although of course they do not know how to use it properly, they are too stuck in a cul de sac, it is just that they manage to get more attention from the media, whose interest there is to present a real controversy between intelligent designers and Darwinian evolutionists, when there is none.

UP: In fact every criticism of Darwinism is construed as an attack on its foundations, when more often than not, it is just a way of clarifying what it is really about. As to genes, one thing that the public has learned, and learned

so well, is the mistaken idea of genetic determinism. Genes only play a partial role in our development. In such sophisticated creatures as crocodiles and turtles, even sex is not genetically determined but the intermediate hormone production is externally triggered, in fact by temperature during incubation.

IS: That is very true. Of course the people involved in the genome project had a interest in presenting the project as a major step in being able to eradicate disease. Given the complete genome of a tiger, can we produce a tiger?

UP: Of course not. There are other traditions involved beyond the transmission of the genetic information. Such as the the transmission of bacterial flora.

IS: True. You can only produce a tiger from the DNA if you have a tiger mother. She directs, at least in the beginning in a crucial way the embryological development.

UP: There is apparently a lot of debate in the biological community why there is so much junk in the DNA code. I have a very simple explanation for this. When I have been programming in PostScript I have often used previous programs and inactivated large parts of it and added to the new program. Do this inductively and soon you have big programs of which just a tiny part is active and necessary. The same should be going on with the DNA information, There is no evolutionary pressures to edit it.

IS: The very simplicity of your explanation would make you very suspicious of it, if you want to be consistent with your previous views. I agree, there is the phenomenon of avatars, of ancient features accidentally being re-activated during the embryological process. Much of the information is outdated but still potentially there to be mined. But I am not so sure how much of the junk is really junk, and whether when being informational junk may nevertheless serve other useful functions, like padding. You know that the genomes of amphibians are much longer than that of mammals. We seem to be able to package it better. My explanation is that mammalian embryology is conducted under very controlled conditions in the womb, in particular the temperature is very stable. Tadpoles in the pond meet a wide variety of contingencies, and in particular may encounter a wide variety of temperatures. The genome needs to give detailed instructions for any such contingency.

*our two conversations partners have now reached the parking garage. As to be expected all the sites are taken, and after having wasted precious petrol, they need to exit. Clearly they would never have been let in, unless there was a space to accommodate them—but where was it? As a result they have to park further away, but as it is not raining, neither makes any complaints.*

UP: Now when there comes to medical research I think that there is much nonsense being produced. And medical research is what usually is noticed by the media. There seems to be a feeling among the public that science is

something that produces facts, weeding out the bad one from the good ones, by applying exacting scientific criteria. But this is a chimera. Science is no facts, it is about theories giving coherent narratives, their structure being restricted by facts, but not being facts themselves.

IS: I agree with you that shoddy research is not just being done in the social sciences but also in the natural. The problem is that doctors are under a lot of pressure to produce research in order to get promoted. Often they have no training whatsoever for it..

UP: .. in many cases maybe not even the temperament for it either. To become a doctor means to be very receptive and learn a lot of facts. This must attract a certain kind of receptive personality, or at least further develop that innate tendency.

IS: Let us not get into such speculations. It is enough to note that they lack the proper training and understanding. They take some data, they run it through some standard statistical tests of which they know nothing, especially as to their appropriateness, only that they are so to speak 'scientific'. Then there will always be patterns to be discovered given any data. But the crucial thing is never to have old data confirm a hypothesis which is formed on the basis of it. That is circular. One you have a hypothesis you need to test it on new data.

UP: C.S. Pierce, whom I have already referred to, noted that given any data you can always come up with a lot of a posteriori patterns. Those prove nothing until tested, as you say on new data, the patterns need to be a priori given. Pierce was in some ways a forerunner to Karl Popper.

IS: You see how mathematics, basic mathematics, along with mathematicians can really play a role. There are many other examples of such idiocies being given a lot of media attention. I am in particular thinking of those alarmist report on declining sperm counts, a pity given the state of overpopulation that they are not true. This is just bogus. Sperm counts vary tremendously over time for a single individual. It does not adhere to a normal distribution, rather a scaling one, and halfway through the study they changed the cut off limits as to what counts should be counted or not. So stupid. Or a recent way of identifying autistic children, when in fact the risk of misappropriating a healthy child is very high, because autism is so rare. It takes such a small amount of mathematical good sense to debunk all of that.

UP: Mathematicians are smarter than other people? It is hard to entertain this idea when you think of your colleagues.

IS: Mathematicians are smart, at least in certain ways, and also in ways that matter. We tend to underestimate our colleagues because we take their strengths for granted. Just as we also tend to underestimate ourselves because we tend to compare ourselves with the real towering geniuses of the field.

*The two men disappear into the building, no doubt continuing their en-*

*grossing conversation. let us pick it up again when they are back at the office.*

UP: This matter of genetic determinism. Mumford, incidentally my old advisor, has gone into vision. I once brought up our uncanny ability to recognize faces, and he told me that this ability is almost gone when it comes to looking at faces upside down or on a negative, adding that there has been no evolutionary pressures to hone our ability in such artificial settings. An off hand remark surely, but what are the consequences? So our ability to do such feats can be explain by a long chain of chemical synthesis, eventually started out by the axioms given by the DNA...

IS: ..I get your drift. You are thinking of long proofs?

UP: Yes I am. I am not rejecting the idea in principle, only that when worked out in terms of chemical pathways it becomes so long and complicated that no human mind is able to fathom it.

IS: So you see an analogy between logical proofs, compulsive at each step, and biochemical pathways. That the organism is constantly providing 'proofs' or maybe we should say performing computations, of awesome complexity.

UP: It was thought at one time that consciousness itself is just the result of a huge computation which we are unable to check and follow.

IS: The idea has not become definitely discredited, pace Penrose. I would say that consciousness is the last line of defense when it comes to what many think of as the onslaught of Darwinian materialism. But let us not get lost in this.

UP: Many proofs we encounter early on in our career are short and snappy and striking. You could just think of Euclid's proof of the irrationality of the square root of two or the infinitude of primes. Few proofs are of that nature. Usually when you are a referee, checking a proof is often rather boring, more like checking the steps of an extended calculation than having a series of intellectual epiphanies. You may have some kind of local understanding, but usually the global is missing. Like following a calculation, you can check it step by step, but the end result may nevertheless appear as a total surprise.

IS: I would not be quite so pessimistic. Often with good proofs there is in addition to the local steps a clear structure, an effective strategy if you prefer. Reading through it you get a good idea why something should be true, it is not just a mindless verification of something being true. Long proofs need not be oracular.

UP: If a proof proceeds with a case by case analysis, two or three cases may be accepted, but if it breaks down in a hundred different, usually with little relation to each other, one feels a bit cheated. On the other hand a long proof based on natural reasoning may often be more illuminative than a short one based on a trick seemingly picked out of a hat.

IS: There are many such proofs, and of course once a proof is embedded in a more general setting it becomes more transparent. I think that the proof

of the irrationality of the square root of two would be much more natural once students learn about unique factorization of rationals, the difference being that unlike the integral case you now allow negative exponents. Then a square if characterized by having even exponents. So what could be simpler than that?

UP: Yes elementary proofs are often less satisfactory than more advanced one. Once you learn about holomorphic functions, and here in your basic education is the very first time that true magic enters into mathematics, the proof that every polynomial has a root becomes so simple, that once you have seen it you can never forget it. On the other hand out of such a proof you can with a great effort extract an elementary one. Such a proof may not require much knowledge, but it will nevertheless seem rather contrived.

IS: This illustrates another aspect of what I discussed before, on the matter of the synthetic versus the Cartesian approach to geometry.

UP: As when it comes to prime-numbers, I thought as a child, that the rarer they became, the easier it would become further on to become a prime. This shows a rather basic understanding about the distribution of prime numbers, but it is far too vague to provide a proof of any kind. Then Euclid's proof is very simple. On the other hand it gives an understanding in a way that Euclid's proof does not, being far too slick.

IS: Yes there are other ways of exploring the same ideas, such as figuring out how many numbers there are below $N$. Of course we know, it is trivial, but it might be fun to work it out given just a finite set of primes and compare. Of course if you do and are clever you will hit on Euclid's proof. Among other things.

UP: This shows that in mathematics ideas are far more interesting than results. If you would only study mathematics memorizing theorems and proofs, you would learn nothing and in particular never be able to come up with original proofs yourselves, only straightforward variations of old ones. And I sometimes fear that this is what many of our colleagues are doing. It is this playfulness of mathematics that does not usually show in the finished product. It is this playful curiosity that the good mathematician feels instinctively and without which the whole activity of doing mathematics just becomes a chore. Not that being a chore necessarily does stop people doing it anyway.

IS: Now you are getting cynical again. I need to leave having an appointment. But I pick you up later, this time it will be your turn to treat me to dinner.

*So let us return a few hours later. The two friends are now sitting in a Malaysian Restaurant. IS seems to be quite a celebrity. Lots of people come up to him asking for autographs and wondering when he will give a public lecture again, live or on the radio.*

UP: So you are actually giving a lecture on alien forms of life in Birmingham tomorrow afternoon. Do you believe in aliens?

IS: You make it sound as if it was a question on par with do you believe in God?

UP: I guess it is in a sense. And you can always take an agnostic stand if you want to hide.

IS: If pressed we will all be agnostics on that issue. But if I would be allowed to go out on a limb, the very fact, incontestable if I may say so, that we are here, shows that it is bound to happen again or somewhere else. Otherwise we would think of us as being unique in the universe, and this notion of uniqueness, with its inevitable implications of privilege, is something modern science has taught us to be very suspicious of.

UP: If you take a probabilistic attitude to the origin of life, and ultimately the appearance of intelligence, and consciousness, because we would not really think of the former without the latter, it certainly makes a difference whether we think of the universe as infinite in extension or not. In the first case we would both be convinced that anything that is possible will have appeared and will appear an infinite number of times.

IS: That is true, but the universe is not infinite, and then you can make some pretty accurate estimates of habitable planets.

UP: And we will come up with a huge number of candidates, a real astronomical number. Hundred of billions of stars in our Milky Way, hundred of billions of galaxies, but here the number of levels stops. But such numbers, although huge in terms of everyday life, are really tiny when it comes to the combinatorial numbers that occur in mathematics in rather simple situations, like writing down the number of all possible books, that Borges did in one of his most well-known stories.

IS: So you know Borges. He is almost a science-fiction writer. And a very good one!

UP: The kind I would approve of. Pared down to the essentials. But my point is that the big bottle-neck in evolution of life may have been the appearance of something like self-replicating molecules such as DNA. To me it is a mystery otherwise that life on earth has a very simple down to earth definition so to speak. Does it involve DNA. Why could there not be other types of lives?

IS: I guess once DNA-based life has gotten a foothold it exempts the possibility of other things to develop, except possibly some parasitic kinds such a viruses. Anyway your remark proves nothing about the radius of the bottle-neck.

UP: That is true, but my hunch is that it is a huge gap between having the conditions habitable to life and the probability of life, let alone intelligence to develop. Just think of the total lack of intelligent plants, or any kind of higher intelligence developed in the oceans. The only thing I can think of when it comes to convergent evolution on that score, are the octapuses, which among other things have developed eyes, almost identical to those of the vertebrates.

IS: Yes this is remarkable, and does it not in a way undercut the argument you are going to make?

UP: Anyway any statistical estimation on the possibility of life is more or less completely arbitrary. It could be off with an order of hundred magnitudes.

IS: This is in principle true, but you are letting yourself being carried away by your pessimism or cynicism whatever. I would on the other hand want to argue that what constitute what is actually being habitable is discussed in far too restrictive a fashion. It is argued that a multiple-star is ruled out. Why?

UP: Because of the unpredictability of the 3-body problem. The planet could have a truly erratic motion, completely unperiodic.

IS: Could in principle, but not necessarily so. Furthermore it is assumed that the planet needs to be within a certain distance from the sun. The Earth is really too far away from the sun; without the greenhouse effect of our atmosphere, we would be down to -20C or so on the average. Even more far-fetched is the idea that the planetary system needs a Jupiter to deflect the comets. On the other hand a Jupiter throws asteroids at you. What is worse?

UP: Then the planet needs a big moon to stabilize precession, otherwise the axis of rotation could at times be pointed along the plane of the orbit, as the case with Uranus nowadays.

IS: I have heard this argument being promoted. It is very stupid.

UP: But if the axis points to the sun, the oceans would boil close to the poles.

IS: Come on. Do the calculations. The weather would be a bit extreme, to be sure. But the oceans wouldn't boil, unless the Earth's orbital period was much longer, and then it would be further away and not get so hot. There could well be a semi-permanent hurricane. For one thing the changes would be so gradual that it would have very little effect on the flexibility and concomitant resiliency of the evolutionary process. It takes millions of years for a chaotic axis to change position significantly. Also there are strong evening-out processes, especially where oceans are concerned. Nothing in the deep oceans would notice any change. Ice Ages happen faster, and life in general has no major problems surviving those. During the polar night does the temperature at the poles drop down to close to absolute zero, as you seem to indicate? It gets cold, but not too cold for polar bears or penguins. I am not saying that if this suddenly happened now, it would not have catastrophic consequences for life as we know it, but that's a silly way to think. Life as we know it is adapted to the climate we have, not a totally different one. So I am saying that it would not have any serious effect on life in general. Evolution would find new adaptations. Basically life could in principle occur at a very wide latitude of given parameters. Extremophiles (silly word, we're just as extreme to them) show that.

UP: Freeman Dyson even has an idea about life on neutron stars with processes going on at an incredible pace.

IS: Bob Forward wrote several novels about it. It strikes me as very reasonable. I would say that I am surprised that life of some form at least is not much more prevalent than it is. It does not have to be based on carbon, we tend to assume so, being too caught up in our anthropological point of view. A failure of imagination. A lack of courage in thinking. The thing about aliens is, they're alien. *Different*. That's what 'alien' means.

UP: You would say that science-fiction would help.

IS: Yes, if you would like to put it that way. Fiction is a means of going beyond, and science gives a structure and necessary constraints, to what otherwise would be mere flights of irresponsible fancy.

UP: You are claiming that imagination only works under some sort of constraints.

IS: Yes, this is why mathematics is so successful. An imagination that encounters no resistance dies out. Resistance is necessary to stimulate and feed it.

*Maybe this is the note on which to end this. The two men are keeping up their engrossing conversation. But do we need really to learn more? After all conversations like that can go on for ever. And I am afraid this one is, will they ever leave that table? Will one of them actually be able to do the verbatim transcription he so rashly offered to do?*

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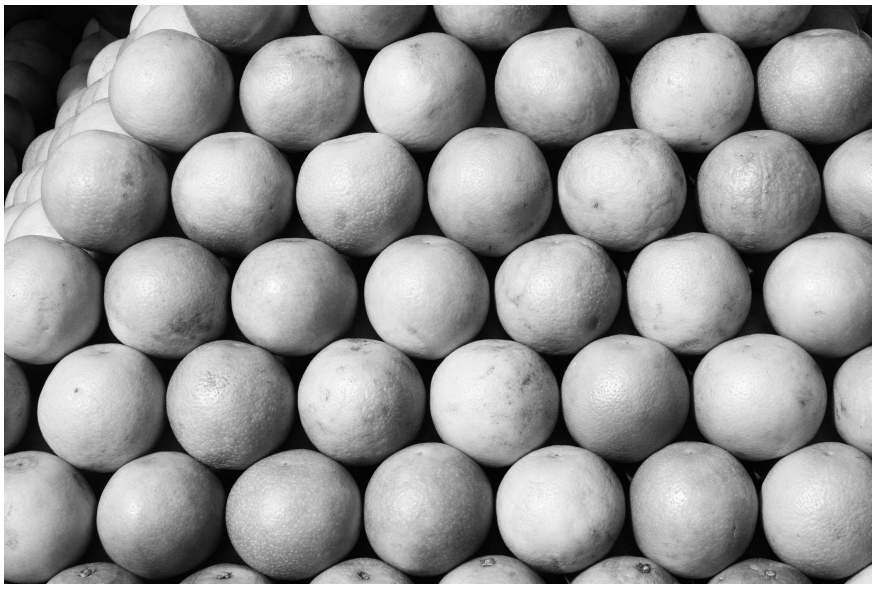

Kepler-staplade apelsiner, Golconda Fort, Hyderabad

# Min tid i Lund

*Håkan Hedenmalm*

Gert Almkvists kommentarer avseende tjänstetillsättningen efter Hörmander i Medlemsutskicket (maj 2010) gav åtminstone mig en känsla av obehag. Det är nog välkänt att det var jag som fick tjänsten. För den som studerat handlingarna vid tillsättningen framstår det klart att de sakkunninga agerat sakligt och sökt få fram den kandidat de uppfattat som mest lämpad. Att då ändå i skrift framföra synpunkter som syftar till att smutskasta de sakkunniga gränsar till ärekränkning.

I Sverige har vi ett system där de anställda vid en matematisk institution inte har något väsentligt inflytande över tillsättningar. Detta ansvar faller istället på en tjänsteförslagsnämnd där institutionens röst kan vara mycket svag. Om majoriteten av de anställda är negativt inställda till den nyanställde professorn blir hans/hennes situation svag. Detta var min situation när jag kom till Lund 1996. Det var förmodligen ett misstag för mig personligen att ta tjänsten i Lund, som jag senare bestämde mig för att lämna 2002 [Arbetsklimatet blev olidligt 2000/2001]. Jag hade t ex 1995 ett erbjudande om professorat från Trondheim. Men det var ändå ett gott försök att utveckla matematisk verksamhet i Lund och vissa positiva resultat kvarstår fortfarande.

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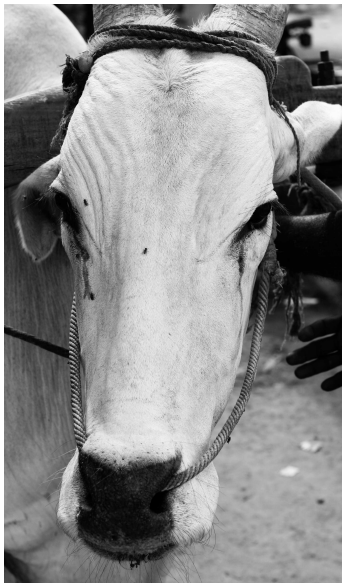
Oxar används fortfarande som dragdjur i stora delar av Indien, oftast i par, förenade med ett gemensamt ok. Oxar kan dra tyngre last än hästar, och är dessutom uthålligare. Nackdelen är dock att det går mycket sakta. Kon är som bekant helig för hinduerna och spelar en mycket stor roll i den hinduiska mytologin. Kon jämföres med modern, troligen på grund av mjölken. En rättrogen hindu kan inte tänka sig äta biff likt vi skyggar för människokött. Fram till 60-talet var det strängare straff på att skada en ko i en trafikolycka än att köra ihjäl en fotgängare.



# Attityd och plattityd

*Om Platons idealism och trivialitetens olidliga lätthet*

*Gustaf Söderlind*

**För ungefär 25 år sedan** deltog jag i den konferens i Amsterdam där ECMI (European Consortium for Mathematics in Industry) bildades, och jag satt sedan under en del av 90-talet i organisationens styrelse. Under de första åren ordnade vi några sammankomster, som var ägnade att knyta kontakter mellan matematiker och industriforskare. Vid ett av dessa tillfällen hade vi en grupp på närmare tio personer med olika bakgrund. En välkänd industriforskare hade erbjudit sig att föredra ett problem som man arbetat med på företaget F sedan 50-talet, inom ramen för företagets kärnverksamhet. Med på mötet fanns även en berömd matematiker, M, samt en handfull andra personer med varierande bakgrund och erfarenhet.

Industriforskaren föredrog sitt problem och redogjorde för de lösningsmetoder man använde. Så efter 20 minuter, när han var klar och gick och satte sig, reste sig M och gick till tavlan.

”Jo, förstår ni”, sade han och ritade en grupp nivåkurvor på tavlan. ”Här har vi en sadelpunkt.” Han pekade på tavlan och vände sig till deltagarna. ”Lösningen är att hitta avståndet till närmaste sadelpunkt. Resten kan en ingenjör ta hand om.”

M menade att det inte fanns mer att göra för en matematiker. Att företaget F hade förstått ”lösningen” redan på 50-talet, och att det handlade om mångmiljonbelopp - dagligen! - att kunna hitta bättre approximationer till just denna lösning var inget som intresserade M. Det var helt enkelt inte längre matematik när det kom till att approximera, beräkna och analysera med datorn som hjälpmedel. Sådant betraktade M som ”trivialt”.

**Kan man göra anspråk** på att vara ”vetenskapernas drottning” utan att intressera sig för matematikens tillämpningar, eller framstår det bara som ett utslag av hybris? Peter Lax, legendarisk matematiker och numeriker, tillika hedersdoktor i Lund, har sagt att datorn är för matematiken vad teleskopet blev för astronomin och mikroskopet blev för biologin – en träffande analogi som visar att matematiken inte längre särskiljer sig från andra vetenskaper genom att vara av uteslutande icke-empirisk natur. Men denna syn verkar långt från allmänt accepterad. Den rena matematiken för påfallande ofta fram en självbild med rötter i Platons idealism, som starkt avviker från mer moderna, låt oss försiktigtvis säga aristoteliska, föreställningar om vetenskapens natur.

Kanske vill den rena matematikern ännu definiera sin vetenskap så, att empiri är den förbjudna frukten, som leder till syndafallet och att matematikern lämnar den rena, sköna konsten, där de platonska idealens metrik

är norm. Sådana tankar är centrala, exempelvis i G. H. Hardys lilla bok *A Mathematician's Apology*. Som bekant menade Hardy att matematiken kunde liknas vid konst eller poesi, och att det var betydelselöst om den någonsin kom till användning. Matematiken har ett högre, estetiskt värde, ja till och med högre än poesins, och Hardy skriver:

*"Archimedes will be remembered when Aeschylus is forgotten, because languages die and mathematical ideas do not. 'Immortality' may be a silly word, but probably a mathematician has the best chance of whatever it may mean."*

Det är svårt att ta boken på allvar, särskilt som Hardys jämförande kommentarer om poesi knappast kan betecknas som djupa eller betydelsefulla. Boken kan snarare ses som ett försök att hävda att det allra mest esoteriska har ett egenvärde, vilket ur kulturhistorisk synpunkt torde röra sig om en trivialitet – om det inte är falskt.

**Nyligen publicerade Matematikersamfundet** en liten informell undersökning om vad en matematiker idag bör kunna för att betraktas som välutbildad (Medlemsutskicket 15 februari 2010). Undersökningen, som genomfördes av Philip Davis och David Mumford, gjorde inga anspråk på vetenskaplighet, utan frågan skickades runt internationellt inom en liten grupp matematiker, verksamma inom ett flertal specialiteter. Svaren, som jag ska återkomma till, är intressant läsning, inte bara för att de är ganska olika, utan kanske särskilt därför att matematikens förhållningssätt till andra vetenskaper många gånger framstår som isolationistiskt, och ibland till och med tycks utgå från nidbildens perspektiv. Jag närmar mig givetvis den här frågan från den tillämpade matematikens sida, och är särskilt nyfiken på vad som sägs i undersökningen om numerisk analys och beräkningsteknik. Detta är ju numera den specialitet inom de matematiska vetenskaperna som har den största publikationstakten, om man nu kan betrakta denna omfattande verksamhet som en enda specialitet.

Att lämna den konstruktiva banan blev ett banbrytande steg för den moderna matematiken. Men samtidigt som matematiken gradvis försåg sig med prefixet "ren", lämnades fältet fritt för konstruktiv metodik. Dit hörde den numeriska analysen, som för hundra år sedan ännu var outvecklad och inte ansedd som självständig disciplin. Visserligen hade stora matematiker som Newton, Euler, Lagrange och Gauss intresserat sig även för beräkningar, men sådant hörde inte hemma i Platons ringhörna.

**Den moderna numeriska analysen** framträder omkring 1950, tillsammans med de då nya datorerna, båda inspirerade av John von Neumann. Numeriken kom att få en mycket snabb utveckling. Alla har hört talas om Moores lag, som empiriskt visar att datorkapaciteten (hastighet och minne) ungefär fördubblas var artonde månad. Men det är betydligt mindre känt att den algoritmiska utvecklingen har varit lika snabb, i några fall till och med

ännu snabbare. Det beror nu inte på att numerikern blir dubbelt så smart var artonde månad, utan på att ju "större" problem man vill lösa, desto mer effektiva algoritmer brukar finnas att ta till. (Här finns intressanta kopplingar till komplexitetsteori inom datavetenskap.) Den tillämpade matematiken och beräkningstekniken har därför fått ett enormt genomslag under det senaste halvseklet. Saken blir naturligtvis inte sämre av att den icke-konstruktiva matematikens ekvationer kan lösas, låt vara approximativt, och komma till den användning som Hardy förringade.

Numerik är helt enkelt matematikens fortsättning med andra medel.

Målet är att kunna genomföra stabila, noggranna, och omfattande beräkningar effektivt. Vi slutar inte vara intresserade av Schrödingerekvationen vid den enkla väteatomen, där klassiska analytiska tekniker ger insikt, utan vi räknar med att kunna dra intressanta slutsatser även för den ur analytisk synpunkt hopplöst komplicerade vattenmolekylen. Den moderna beräkningstekniken är redskapet, som låter oss analysera en verklighet där Euklides' passare och ograderade linjal är museiföremål. Hans instrument må vara ovärderliga i Platons idévärld, men de saknar den förbluffande räckvidd som beräkningstekniken visar sig besitta.

Vad har då matematikerna att säga om tillämpad matematik och numeriska beräkningar i undersökningen? Det visar sig att omkring hälften av svaren anger någon eller några former av tillämpad matematik och beräkningar eller numerisk analys som viktiga inslag i en matematikers utbildning. Det gäller bland andra undersökningens författare Philip Davis och David Mumford, men även Barry Mazur. Arieh Iserles är själv verksam inom området, och Peter Lax, som fått låna sitt namn till den numeriska analysens "fundamentalsats", efter sina banbrytande insatser på 50-talet rörande diskretiseringsmetoders konvergens, kan också räknas dit. Man noterar dock en betydande skillnad mellan den anglo-amerikanska traditionen och den kontinental-europeiska. Den senare förefaller endast betona den rena matematiken.

**Professor Ulf Persson**, Göteborg, som lämnat ett långt och utförligt svar, ligger förvånansvärt nära Hardys idealistiska syn. Persson menar att matematiken är så rik som vetenskap att han svårligen skulle kunna ge en översikt över ämnet; dock skulle han "lätt" kunna ge en översikt över astronomi. Man kan fråga sig varför detta skulle vara lättare – själv skulle jag, det medges, ha svårt att ge en översikt över numerisk analys, men föreställer mig ändå att jag har ett bättre grepp om mitt eget ämne än om andras.

Kanske har detta att göra med matematikens abstrakta karaktär, som ansetts väsensskild från annan vetenskap. Persson menar att matematiken är mer besläktad med humaniora, och framställer således matematikern som "intellektuell", vilket man inte behöver vara i samma utsträckning i andra vetenskaper, eftersom där görs ett stort och monotont arbete med empiriska

undersökningar. Men hans exempel, att den experimentelle biologen varken skulle behöva förstå eller förhålla sig till Darwins teori, övertygar knappast – tvärtom kan detta utan vidare avfärdas med motexemplet Lysenko.

Samtidigt liknas matematikern, och hans banbrytande framfart i begreppsvärlden, metaforiskt vid australiska aboriginer, som antas ha en oöverträffad stigfinnande förmåga i oländig terräng. Liksom hos Hardy får matematiken till sist en närmast överjordiskt spirituell karaktär, åtminstone i förhållande till sin inkarnation numerisk analys, *"where the spirit [becomes] flesh"*, som Persson uttrycker saken i en fotnot. Denna kommentar måste till yttermera visso anses både välfunnen och träffande. Om man härav ska dra slutsatsen att anden är stark, medan köttet är svagt, må dock vara osagt.

Trots att Persson menar att datorer sannolikt kommer att spela en allt större roll i matematiken, anser han inte att de hör hemma i en matematisk utbildning, med motiveringen: *"It is too trivial and the necessary skills are easily picked up"*. Perssons lista över lätta, triviala och ointellektuella ämnen blir således längre och längre. Kanske vill han bara framhäva att matematik är svårt. Det är det nog ingen som betvivlar, men försöket att leda påståendet i bevis, genom svepande trivialiseringar av ämnen som inte omfattas av den egna estetiken, är naturligtvis dömt att misslyckas, och man undrar vem Persson försöker övertyga, om inte sig själv.

**Man kan sålunda inte undvika** att slås av den vetenskapliga exceptionalism som genomsyrar Perssons inlägg. Om den inte sammanfaller med Hardys ståndpunkt ligger den i alla fall ohyggligt nära. Här frammanas en bild av att matematiken varken är, bör, kan eller vill vara som andra vetenskaper.

Detta synsätt dyker upp från tid till annan och kan åtminstone i viss utsträckning betraktas som en etablerad självbild. Under senare hälften av 90-talet var jag ledamot i Teknikvetenskapliga Forskningsrådet, TFR. Som bekant slogs våra forskningsråd för tio år sedan ihop till Vetenskapsrådet, VR. Inom VR kom så TFR och NFR att slås ihop till NT-rådet, med N för naturvetenskap och T för teknikvetenskap. I samband med omorganisationen diskuterades namnet på NT-rådet. Jag var, som avgående rådsledamot, engagerad i diskussionen, och kommer väl ihåg att man från matematiskt håll i Sverige lanserade förslaget att rådet borde heta "Naturvetenskap, teknik och matematik". Jag uppfattade förslaget som ett dubbelt kategorimisstag. Det var som att säga "öl, vin och alkohol", och därmed försöka antyda dels att öl och vin inte innehåller alkohol, dels att alkohol är en dryck, precis som öl och vin.

Förvisso är den rena matematiken en a priorisk vetenskap, till skillnad från empiriska vetenskaper. Men även empiriska vetenskaper sysslar med begreppsbildning, logisk inferens och teori. Fysiken gör ofta uttalanden som är intill förväxling lika matematikens – till exempel påstås tyngdkraften vara den negativa gradienten av gravitationspotentialen. Här saknas varken idé,

begrepp, abstraktion eller teori.

Skillnaden är därför en annan: medan matematiken *endast* arbetar med koherenssanning måste empiriska vetenskaper *dessutom* eftersträva korrespondenssanning. Det senare ställer besvärliga krav när teorierna konfronteras med verklighetens vulgära data. Att matematikern M hoppar av projektet i denna ödestimme blir då begripligt, inte för att saken inte skulle ha med matematik att göra, utan för att det ofta är bättre att fly än illa fäkta. Det triviala är inte alltid lätt, men det är alltid olidligt.

Tanken att (den rena) matematiken har en unik, insulär ställning i förhållande till andra vetenskaper förankras i stället filosofiskt hos Platon. Denne utvecklar i *Staten* (ca 380 fKr) tanken om ett motsatsförhållande mellan den perfekta idévärlden å ena sidan, och den defekta sinnevärlden å den andra. Man tänker sig således att den rena matematikens perfektion står i kontrast till de empiriska natur- och teknikvetenskaperna, som antas sysselsätta sig med det metaforiska skuggspelet på grottväggen, och vars kunskapers bäst-före-datum antagligen är ännu kortare än Aischylos' tragediers.

*Ars longa, umbra brevis.*

**Dock tror jag inte** att denna attityd är hållbar. Det finns ingen anledning att ställa sig vid sidan av och hävda en särart utan koppling till – eller betydelse för – andra vetenskaper. Av allt att döma är matematikens framtida finansieringsmöjligheter knutna till att vi åtminstone kan troliggöra dess långsiktiga och strategiska nytta. Sannolikheten att lyckas finansiera Hardys matematik i döda poeters sällskap ter sig försvinnande liten.

Det är därför min mening att matematiken har allt att vinna på att ompröva sin självbild, och att överge den i sammanhanget förlegade platonska idealismen, vars kompass får en allt större missvisning. När den vetenskapliga världskartan har ritats om otaliga gånger under den moderna vetenskapens fyrahundraåriga historia, har matematikens fokus förskjutits och Arkimedes' cirklar rubbats. Matematiken har kommit att bli en nödvändig förutsättning för modern vetenskap och teknik, och har aldrig varit så användbar som idag, inte minst tack vare konstruktiva beräkningsmetoder.

Tillämpad matematik och beräkningsteknik är därför idag centrala och omistliga delar av den moderne matematikerns utbildning. Denna tanke är inte vågad. Den är blott aristotelisk.

*Gustaf Söderlind*
Professor i Numerisk Matematik
Lunds Universitet


New Delhi
Kolkata
Mumbai
Hyderabad
Chennai
Bangalore
Puducherry
Tiruchchirappalli
Madurai

# KALENDARIUM

( Till denna sida uppmanas alla, speciellt lokalombuden, att inlämna information)

**Finsk-svensk talteorikonferens**
*KTH 26-28 maj*

**Tate-Symposiet**
*Beijersalen 31 maj*

**Jean Bourgoine**
*KTH 4-8 juni*

**Årsmötet**
*Umeå 4-5 juni*

**Svensk-Catalanskt möte**
*Barcelona 16-18 september*

# Författare i detta nummer

**Douglas Arnold** President för SIAM.

**John Ball** F.d. President för IMU (02-06)

**Bill Casselman** Associate Editor för Notices,samt dess omslagsredaktör.

**Guillermo Curbera** ICM groupie från Spanien. Kurator för IMUs arkiv.

**Elizabeth Gasparim** Brasilianska verksam i Edinburgh.

**Håkan Hedenmalm** En gång professor i Lund, numera verksam på KTH.

**Kenneth Hughes** Talteoretiker från Kapstaden.

**Bengt Johansson** Föreståndare för NCM.

**Torbjörn Lundh** Matematiker vid Chalmers. Intresserad av matematisk biologi och artificiellt liv.

**Yves Meyer** Gauss-pristagare i Hyderabad. Harmonisk analytiker.

**Ragni Piene** Avgående ledamot av Executive Committee. Verksam i Oslo.

**Ian Stewart** Produktiv populärvetenskaplig författare.Science-fiction entusiast.

**Gustav Söderlind** Professor i numerisk analys i Lund.

# Innehållsförteckning



## Notiser