Notes on witness sessions during the second half of the Nanojury process, West Yorkshire, 2005.

A full video archive of the Nanojury is available, including witnesses on the subjects suggested by jurors, which formed the focus of the first half of the jury process.

The following are rough notes and not should be taken as more than an impressionistic guide to what was said during the sessions. It almost certainly contains inaccuracies for which neither the witnesses nor PEALS can take responsibility.

Witness: Bea Leigh, BB Consultants Ltd (formerly GlaxoSmithKline).
26th May 2005 :

-When I talk about drugs, I'm talking about ethical pharmaceuticals not the alternative [i.e. illegal] kinds of drugs. My Background is I'm a scientist, a Biochemist – I worked in the States, a children hospital in Harvard - Also worked for Cambridge University, worked for a medical research Council at the Bench as a laboratory investigator - Then I moved to major pharmaceutical companies, sometimes Beechams, sometimes Beckman and now GlaxoSmithKline – Bulk of office career was linking our internal scientists with our academic scientists worldwide – important to keep talking to people to what out what people are thinking and what is going on especially in terms of Nano-tech – The particles are so small and its is very easy to be frightened of things they can't see – A nanometre(nm) is about 10-9 of a meter and so you can't hold anything to show people.

- In this session I would like to talk about a few general examples – talk about the economic situation if we don't do anything because Nano-technology can make jobs in a big way – give some examples of Nano-medicine, which is currently availably – Very hard subject.

- So what does Nano mean? It means 10-9 - A million is 10-6 and a Nano is 10-9 e.g. every time you take a breath you will take in 25,000 Nano-particles - so just because you can't see it you shouldn't be frightened of it e.g. In Marks and Spencers if you buy trousers with the label "Nano-protect" it means they are covered with a very fine layer of nano-particles – A lot of Sunscreens also contain nano-particles

- Just give you a few facts and figures – to go back to nano-medicine – A huge area – started in 1905 when Albert Einstein found and calculated that the size of a molecule to be 1nm – so that's where it started back in 1905 – You can put a million nano-particles on the head of a pin – Bacteria are a bit bigger about 1000nm – that is the kind of range we are talking about

- Became a bit of a political item – Q Clinton set up something called the "Nano-tech initiative" – UK followed suit but had a smaller amount of money –

Another thing you have to bear in mind is that because the particles are so small the normal laws of physics tend not to apply e.g. gravity – which is why there is some concern and some people feel we need to move slowly into the field of Nano-technology – because it is unchartered water – Government responsible for looking at the problems seeing if we need new regulations/legislations etc - that is all in place – needed when you are using what we call disruptive technology – you're doing things in a completely different way – What I find interesting is that nanotechnology is the application of physics, engineering, biology and medicine – Not always easy to relate to doctors – Interesting about Nanotechnology is that engineers look at the parts of cells e.g. proteins – because if you think about it in effect you living cells are like little nanotech machines – they are perfect examples I nature of little nanotech machines.

Q. How can man actually manipulate matter of that size – do actually do things with it? Can we physically manipulate matter that size or do we wait for them to do it themselves?

A. Yes we can – things can very easily be measured at a molecular level e.g. when cells bind chemicals change – little needles with really sensitive points can even move molecules – so by using both chemicals and instrumentation we can manipulate matter.

Q. What was it called before it was called Nano?

A. Parts of Nanotechnology would also be called chemistry – Wasn't actually seen as a subject until people could actually see things – Einstein came up with the size of a molecule but he couldn't actually see it – was a brilliant piece of theory

- The UK is particularly good at Bio-Nano which is where we are at in terms of Nano-medicine – what will be sad is that if we don't back our scientists or the industry we will end up buying back from Japan and Korea

- Just to talk a little bit about the pharmaceutical industry which I was a part of for the past 24 years – It takes an average of twelve years to get a drug on the market – most of this is for safety testing to make sure it is safe – costs about $800million – the research and development costs continue to increase – yet the number of drugs coming out is flattening – so you are spending more for less return

- Give you a few examples – Risk is a very important dimension when working in the pharmaceutical industry – people forget that by definition, all drugs you take are toxic – if they weren't toxic they wouldn't work – the problem/challenge is to look at drug delivery – which means only to affect the parts that need it and not other parts.

- The drug doesn't always get to the right place – goes through GI tract – can manipulate the size of the molecule of the drug down to nanoscale then you can

be much more precise about the targeting of the drug to the right part of the body – Cancer treatment

- Whole series of experiments you can do to ensure you get the drug to the right place in the most effective way without getting lost

- Blood/brain barrier – very important biological membrane – keeps all the rubbish out of the brain – work out which drugs you want to enter the CNS - put the drug inside a bead – cross the blood/brain barrier fools it – Cures for Alzheimer's and Parkinson's – In a way you are applying new physics to biology

Q. Is Nano-technology also concerned with stem cell research?

A. Yes- Work with stem cells and gene therapy is all in nanoscale – it is a worldwide race – Science works worldwide – a lot of work comes out of universities and the pharmaceutical industry works closely with them – then they go on to licence it – Gene therapy is one to watch for the future – Nano-technology is more about delivery of pharmaceutical to receptor

Q. How did you come up with the idea of Nano-technology? How was it introduced?

A. Nano-technology just refers to things that are very small – Nano-medicine is the application of their physical properties

Q. What about the common cold? Why not use Nano-technology for that?

A. Viruses are very hard – they mutate every year and are very small – Nano-technology cannot fix it unless it stays the same – the cold and flu medicines only make you feel better until the body heals itself

Q. How do you know what to target? Do all diseases carry different cells? Is that how you target them?

A. Actually working with a couple companies on the drug-delivery side of it – trying to get the right particles to the right place – nothing is actually on the market

Q. How do you know what cells to target?

A. Still being investigated – disease are very complicated – look for distinctive markers on different cells – then you can target them – Medicine is not a science it is a growing art form and we are still evolving and learning – Heart disease for example is very complicated with lots of different receptors involved – still needs to be researched

Q. How do you know if you are delivering the right particle to the right place and if not could it go wrong? What could the effects be?

A. It is much harder to target internal organs - for lungs you can inhale – need to find receptors on cells to ensure drug actually gets there – if you swallow a pill usually enough ends up in the right place

Q. We as a human race are abusing the world – more should be done at looking at using natural and alternative medicine – enough isn't being done to research natural resources and to stop testing on animals – What do you think about that?

A. In terms of testing on animals the industry is using less and less animal every year – the reason animals are being used is because the government tells the pharmaceutical industry the experiments have to be done in that way or it won't get the licence for the product

Q. Could there be a potential danger with Nano-technology if the nano units were able to reproduce and get out of hand?

A. I think there is – Nano-particles are natural and artificial – there is one point that that if artificial nano-particles are released into the atmosphere they will have an effect on atmospheric chemistry

Q. Who decides the direction of research? The scientists, government or funders?

A. Tony Blair has a good grasp of science and its applications – takes advice from scientists like Q – Blair will the talk to Clinton/Bush and say that we hear that nano-technology is a good are to be in – what should we do next? – Talks to his chief scientist – talks to his senior professors – say it has its advantages for the UK economy and population – Then government says its ok – Here's £300 million- go work on nano-technology and see how you go

- Going back to how Nano-technology started – I think it has been due to the availability of stronger more powerful microscopes enabling you to see them – I mean nano-particles always been there, we just haven't been able to see them – actually being able to look at the makes a difference

Q. How do you make sure that whatever is swimming around will do something to help A and not B?

A. If you have an object that you want recognised – need to find a receptor that get recognised by the drug

Q. You said earlier there was a race for dugs? What are you trying to achieve?

A. More effective therapies needed for the major diseases – e.g. cancer therapy is coming a long very well – breast cancer, prostrate cancer – but there are other cancers where the therapy is not as precise as it should be – then there are the major really hard ones such as Parkinson's and Alzheimer's – everybody is working towards those goals

Q. Which countries are advancing more in nano-technology?

A. Probably US – which is more due to budget and not brains – UK is particularly good at what we call "Bio-Nano" and there will be a centre opening in Oxford – UK is a world leader – Always comes down to money – a lot of new instrumentation is required in the field of Nano-technology – China is also leading in this area

Q. Where does funding for nano-technology come from? Does initial funding come from government?

A. Yes – also comes from public purse – sponsor people to research areas – professors and university – provides licences – Pharmaceutical industry is unique in that it fails 98% of the time – No other industry starts with that level of failure

Q. How would you de-mystify Nano-technology? How will public know about it?

A. De-mystify it by actually explaining how these things work using everyday examples and simple terms – Try to talk to people and engage them by using easy examples

Q. What are the boundaries? How far should/could this technology go? What are the moral/ethical boundaries? How far can you take the experiments?

A. Another thing about the pharmaceutical industry is that it is the most regulated in the world – you can't manoeuvre without asking permission

Q. What about the affordability/ availability of the drugs? Will they be available for everybody?

A. As with every new development – they are expensive to start with but as you go on the costs come down – as we get better at making them they get cheaper to make

Q. Levels of sustainability in relation to immediate future – Our attitude is that we all think that nothings going to happen to us in the next 100 years – We're OK – Got enough gas, electricity and enough coal - Also in relation to cannabis - Do you think cannabis does deal with pain?

A. Yes it does work – It is illegal at the moment but I think that will change – no reason it shouldn't – If the form of delivery was changed such as instead of smoking it, it was a pill then it would really help – there is a down side in that you do go psychotic – so watch out it does destroy your brain but it tackles pain

The next 50 years are really important to humanity – we are coming to the point that the population of the earth is stabilising – probably stabilising to about 10 Q ion in about 2050 – Really good global aim that we have is that there are 10 Q ion people living on earth in a way that is stable – we no longer increase CO2

levels etc etc – We need technology that is better than what we have already in order to sustain all this – Nano-technology can make a big impact in the are of solar science – having a really large are of solar cells can really contribute to this area of sustaining

Q. Is there a limit to what Nano-technology can do?

A. It's a science – science changes everyday – its about finding out things – Who knows the limit.

1 June 2005,

Jim Thomas.(ETC group: a watchdog that looks at the impact of new technologies especially in developing countries)

NT, Shares many of the concerns as GM except with broader implictaions.

What is the impact on the poor? Lets look at previous experiences of new technologies. Waves of new tech changes soc significantly eg ind rev, genetic enginerring. These are all disruptive technologies. There are common Q terns with these waves, rich and powerful dvelop techs, so the poor don't benefit for a very long time. The technology gap. Those who don't have time and resources to consider the implications are caught by surprise.
NT will be the next ind revolution.

It will allow us to effect change.
Who owns the technology? It must involve e.g. people form dev work, disabled etc. We must look long term. Scientists look at the present, if NT has such a widespread effect we must consider what the implications are for 30 yrs time and the implications of development now.

Think of it as a change in the way we do manufacturing. It is not a few new technologies but a massive economic shift.

1. Who owns the tech? It is clear. $9bn pa, half from corp (many large multi nationals e.g BP, Shell) and ½ for gov (US, UK Japan). ½ of gov m oney is military. Therefore it will not naturally help poor people. Cos are getting ownership of molecules, atome the very basis of matter. Therefore corporations will have legal ownership. This has big implications for the power of these bodies. Conglomeration of power. Some Q ents are also being claimed for the process eg. Process for making gold.
2. Environmental considerations. RSA naotach initiative, spokesperson dangerous to use nanotech particles in sunscreen as it damages DNA. Dr

Howard (Liverpool) looked at this eg nano particles come from cars and incenirators. Nano particlkes are 1/80,000 of the width of a human hair. They are the most dangerous parts of pollution. They are very toxic. We are now using these to make products. Further research: smaller thgey are the more poisinous they are, they can cross the skin they can get across blodd brian barrier. Big toxicology question here. The gov is now saying yes there is a prob. We need to regulate all partcles must be asessed but, we don't know how to do it. There are no agreed tests.

3. What does this mean for poor. Carbon nano tubes, stronger and lighter than steel and better conductor than copper. This means for copper producers eg Zambia, one of the few resources they do have is copper. Also nanao partciles can replace cotton. 1bn people are cotton farmers.
4. Security: artifical legs for soldiers etc.
5. Food. What about nanoengineering of food.
6. 'Going below the level of life'. Someone is trying to build an artifical living being which raises lots of ethical implications. What are the implications for disabled people? some disabled activists say 'actually we don't want fixing we want to be given rights'.

What about the positives?
I am very sceptical. Its 1 thing to say we can cure MS but that needs to be driven by people with MS themselves not pharma. There are some good uses. Eg cleaning water.

Questions:

Corporations and control
Q – why have companies been allowed to put harmful particles in cosmetics – how have they been allowed to get away with it?
Titanium dioxide you get in sun block – it reflects right. Cricketers have it on their nose, blocks light and reflects it back. If you make t/d nano-particle it reflects light, but not normal light. Chemically it is still t/d just smaller, so it can be kept in that. Under the law it is an old product, but because it is nano now it behaves entirely differently.
So it could be in anything?
It could be. If you look at sunscreens the chances are they are nano t/d. also using them for colours. Loreal – skin creams esp. anti wrinkle creams take nano particles deep into the skin and then break open. They would say that when they started using them they had assumed it wasn't going to be harmful, but they are. That's why there is no regulation, no labelling, cos they are invisible. Last year the royal society reported that these materials are different and have different toxic properties, and the government agreed that they need regulation, but the dept of environment said maybe regulated in 4 years.
Royal society are the most eminent scientists. Science minister, lord sainsbury commissioned them. Royal society tend to be very conservative, they tend not to criticise new science, surprising that they have criticised nano-technology.

Q ; You mentioned japan and other countries invested a lot of money?
Are people in england benefiting from that.

Uk is putting round 90million in to nano tech. the jobs in nanotech at the mo are chemists, nona tech scientisits, so very high tech jobs mostly based in universities and high tech labs.
In the future?
I kind of imagine that is who it is going to be, who is developing it. Study done by the health and safety exec who estimated there were about 400 people working in nanotech at the mo.

Vested interest of companies – carbon rods able to substitute for copper etc. that bein the case it is reasonable to say they might find sub for oil, is the reason they aren't looking into it cos of the vested interest?
There kind of is. There is a lot of work going into alternative energy sources. Companies like bp are doing a lot of work on things that can be added to oil so it burns more efficiently. Never been regulated, or tested, but is going into the environment
So it is more efficient use rather than substitute for?
Yes, mostly.

Is the technology the prob or the hands in which the tech resides
Yes, except guns are designed to kill people. Yes, of course the question is who controls the tech, whose using it and whose interest they are using it. Tech suggest more ways in which you can kill people. The way in which tech is developed, it is developed for a particular purpose. That line becomes blurred I think. Built into the tech itself are assumptions as to how it is going to be used and who is going to use it.
But example is dynamite, which was used to access areas – most things have a flip side, just depends on the mindset of the people who come up with them
That's fiar enough.
I think it is good what people like you are doing, needs to be people asking questions. Hope you don't hold back tech progress, can't think of one tech where the costs outweight the benefits. People like you are beneficial in holding corporations to account.
Usually cost benefit analysis is conducted alongside a set of presumptions – and usually governments etc. the [people who lose their jobs probably wont see it that way. Progress for who and why whom? I don't think progress goes in one way, it is decided by who has the most money and who is the most powerful. And that is not necessarily the best way. Nuclear power has raised massive costs, kids round kiev, the environment, unstable arms race. Now have attempts to close down nuclear industry. Chemicals and pesticides – probably could have increased the amount of food in other ways if we had chosen do, but they didn't choose to. It benefited a small group of people and so everyone else has got to swollow it. That's the thing that is missing, we sometimes don't talk about all the other technologies we could have developed. So with gm food, could have gone into developing organic foods. We make decisions all the time. If we are going to back nanotech which is very expensive then we are going to not put money in other places.

Could you explain how the costs outweigh the beneifts?
I am open to having a really broad debate where people say actually this is going to work for us, and deciding based on hearing lots of voices and then

coming to a decision. There are going to be a set of disruptions, but at the moment all the decisions are being made by a bunch of industrialists and some scientists, but the people that are effected do not have a say in it.

More positive things or more negative things? – your opinion? Last week we had a lot of positive, and were told there were very little negative things. This week its been completely the opposite.
Are you talking about different aspects of nanotech than what was spoken about last week?
Its tricky. The thing that ius so significant about nanotech is it is being used across the board, manufacturing, food, clothing etc. last week the people you had work in the industyr and have to believe in it, which is fair enough. I find it odd doing the good and bad. For any nanotech application there is going to be a reason it is developed and people are going to buy it so there will always be something positive, cos people are paying for it. But then things you should consider are the unexpected side effects, the wider problems that may arise. Chemical warfare developed that may be able to target particular ethnic types etc. why are they being developed? Cos there are a number of pharmacutical companies whose Q ents are running out and they can develop nanotech casing so can get a new Q ent. Aids drugs are not availabe to so many cos of the Q ents. Then a lot of drugs that have gone through the safety test, but if we wrap them up and cos they are going direct to one part of the body then it doesn't matter that they are harmful (so nanocasing is developed) so it is a way they can make money out of a drug they thought they had lost money on.

How is research funded, does it bias your position, when you talk of ppor people who?
Our group is funded by some governemnts, development agencies – as in the part of the governement that works with the developing world – the canadian and swedish. Also foundations that give money (i. rockafella) that give money to help poor people.
Dopesn't bias position, what biases our position is were not interested in developing nanotech, were interested in what will help the poor. We have a history of looking critically at other tech, that biases our position. Until recently we looked at helping farmers in 3rd world improve their position. A lot of orgs that represent small farmers. We work very closely with them. We work with indigenous peasent movements, in a two way process, partly telling them about nano tech and them telling us this is what it feels for us. We do workshops with them.
In terms of research, have you done any on how it impacts on west yorkshire?
Not a lot, cos the most of what we look at is what happens in the developing world. We work abit with unions, the tuc, so health and safety effects.
Pilkington glass produce a type of window which has a layer of nanotech. But some of the questions relevant to 3rd world are relevant here. So window cleaners

Your baths will have a coating that mean they don't need detergents.
Q – I saw a product like that called Aquanet.

The point to capture here is that window cleaners would lose their jobs, but maybe there would be an environmental benefit

Q – you said you worked from the bottom up. How do get your research when you start from the bottom. You only cover certain countries.

Q – That's the big challenge. Government at the moment only listen to industrialists and a few scientists.
So finding an alternative bottom-up approach is difficult. This jury is a start. Maybe we need an international convention or procedure

Q – Diasbled people.

Q – Disability is a really interesting issue because they can't look at technonology on a level playing field.

Q – How help someone paralysed from the neck down.

Q – what does it mean working at the level at the atom.

Q – can connect neurons to artificial limbs in new ways (? check)

Q – the implant is like having another ear in your brain (a cochlear implant). If you had compulsory implants she would become disabled. Still haven't perfected the side effects.

Q – I have a son who's 42 years old but can't walk and has other disabilities. My other kids educated him.
People tell us that they know more about our kid than you do.

Q – It's the society we live in, not the disabled person that needs educating.

Q – Either fix me, or make society more tolerant. Saves money for the authories compared to giving disabled people rights. Along with fixing, there's enhancement.

Q – No way of deciding what is ethical, and what isn't.

Q – How does the artificial soldier know when to stop killing?

Q – all sorts of different technology. Centre for soldier nanotechnology. At what point do humans become a machine.

Q – is this what nature intended

Q – cloning – on the tv – what they use would be flesh

Q – dna is made by atom by atom – they making bacteira cel by cell and this could be applied to other animail or humans and vegetables

Q -= what happens to the bacteria when it has been coloned.

Q – bactiera artifcial atom by atom and he will use this for other organism and use it to soak uup climate change – there is aloads of questions

M – human robot why would a super human wantss to control

Q – we enhance our bodies alll the time but how far do u go

Alias- designers babeis?

Q – working a t small scalle and read dnea very quickly so u can get healthy eggs and sperm very quickly in the cattle

What regulation and is there a helath and saftey set up?

Jiim – no. for specidif application there is – for drugs and comsmetics there is. Assume if it has something in it before then it safe vut it does not take into account that these products have used nano tech. in europe and the uk, there are looking at separte body, we would say there has to be a separate body to look at nano. They say shift reg to accoung for the nano – 4 yeara before the regulation will commence, but there is nano products already out.

Q – I have been writing report – how to put nano reg into place - there are none but they realise they have to – there needs to be labelled – there are not labelled but they have to consult int the public.

Mohammed – what legislation is in placed to ensure the publlic is inovled?

Mohammed – what would happen if there is no regulation

Are we playing eith a fire thath we dokn;t know how to conteol

Q – bioweapens, put into water supply and cauase probs and thi s could be a problem if it goes into the hands of terroist – fire over protesters crowd and makes the crowd to sleep. It goes off if it goes when in congacg with sweat.

Can poor countries be helped by the nano – dialouge of nano and the poor – cleaning up water, solar pannel for power, cheapre drugs,…….in content – not as straright forward – the poor knkow what is suitable for them and there culture. Neting with nano pesticidies, good for malira, lots of people have to sleep people who sleep outside, if it kills mosquitoes what is going to do to me. In all africa there is only two or three microscopes that could detect nano.

Mental health – I don’tknow – imagine around drugs, what is normal,

Q – why han’t more been done for the poor countries – not been done quicker?

Q – people have the answres to those quesstions, in india there have huge copper pots and makes the water clean. In the wesst we isgnore this kind solutions

Animal testing – we don't know what effect on animals. Be – this would lead to less exp't.

Something about the delivery of the drugs,

Is this a big brother thing – yes, regulate the ones that can have or be used to survaliance, little sensors on the fields and tell the farmers about how much nitrogen and is on the farm.

Charles Medawar, Social Audit – 2 June 2005

For last 35 years worked with group that grew out of the consumer movement. Am a layman, but am emphatically a layman. Before I was invited to talk about nanotech I probably didn't know more than a viewer of "doctor who". 2 reasons I wanted to come is cos I wanted to learn about nano tech cos it is going to be important in the area of medicine – my specialism, and secondly am fascinated by citizens juries's, very important to bring a real voice to the debate.

Outside of social audit I have done other work such as universities on life sciences, advisor to parlimentary committees, and the australian government.

My immediate reaction to when I began to see what nanotech was, like all new tech it was going to be a mixture of good, bad and indifferent. Like all tech it is about who controls it and how. I analyse through a model of consipiracy of goodwill. People clubbing together trying to do the right thing but doing the wrong thing.

Doesn't matter what the org is, mainly find basically honest decent individuals. But put them together, put them in compartments, only make them responsible for little pots of the work and you can end up with a huge mess.

Many people working in the pharmaceutical industry believe they are doing the right thing, but all sorts of reasons they end up doing the wrong thing.

Pharmaceutical industry usually refer to big companies that make all the medicines, medicines that are prescribed and that you'll buy from the chemist. They are hugely profitable, they would say cos they need the money to invest in research, I would say cos they like it that way.

One of the reasons we regulate it and the way we regulate it deeply confuses important things in trade and important things in health. If trade is properly conducted perfectly legitimate, as is health. But the idea that you can balance the two things in keep them in perfect harmony so you can do both well at the

same time has been shown time and again not to work. There are numerous drugs in america that do more harm than they do good.

The parliamentary committee – way in which medicine safety and effectiveness is controlled in this country – agency called MHRA – one of the best agencies. Whole process is very secretive. The more I have looked at the detail of the evidence the more I am appalled. It just isn't what people would want, doesn't deserve public trust – is what this committee found – 'serious weakness in mhra, oblivious to criticism of outsiders, unable to accept they had any shortcomings, needed to do far more to deserve and earn public trust' – very imp. Cos having an industry like this regulate nano tech is very dangerous.

Food and drug admin – 'fda believes existing battery of tests is probably sufficient for nanotech' – talking about current range of animal tests. Go on to say that they test very few, and then the product not the process.

Predictive value (what they will do in humans) of animal tests is very low,

Who appoints onto MHRA – like gvmt dept, hived off, about 600 people, in effect civil servants, report back to minister, though minister is incharge, s/he will know very little about the technol.ogy they control. Basically they do what their civil servants advise them.

Regulation is shifting hugely toward europe. EC was founded as an economic union. The health side is incredibly weak. All pharmaceutical business is regulated by part of commission that regulates trade, so seriously into deregulation and letting the industry do what it wants to do.

To what extent are pharmaceutical companies likely to get involved with nanotech. 1 ¼ million references to nanotech + Pharmaceuticals on google.

At the moment pill goes all over your body, doesn't target where you want it to hurt. Nanotech is good for them because it targets where you want to go.

I do ask you to question to what extent health depends on intro of new tech. I think we could make far better use of the tech we already have, more intelligently and more fairly so you have proper distribution. Bedrock of health is

Remember how dazzlingly drugs are we are running before we can crawl. Fildamine – awful drug, advised widely,s stop morning sickness and cause deformation and considerable handicaps - how do drugs effect children and how they affect adults. The subtle difference in different people we all rect differently to different drugs – one size fits all – we can react very different. The social complexities and the impact of adverse effects are very different for people – e.g. if you have depression and have kids etc.

Q - Test on animals because to dangerous to try on humans

Charles -But it gives you very little info, human vols used with small dose to see how they work in the body

Q – nano predisposes that nano will be use in the right conditions and so on.

Q – can u make seeds

Charles – yes, probably make what you want even tables – at least that is the metaphor.

Q – is there a body for stem cell and gm and so

Charles –there is no collaborative international body for pharmaceuticals

Charles – govt, become less powerful, health policy is influenced by things like prestigious etc. the point of the jury is to get the independent people voice. It is no point get the views of the experts. The expert are deeply out of touch the language they use is far from our understanding

Q – we have people in the gov't that should not be there. They keep reshuffling, taking on different responsibilities

Charles – MRSA, infections and big election issue. The questions of public trust

Q – baker trying to fly a plane –

Charles – deeply out of touch. As a baker you know when to stop, what is appalling is the arrogance and how

Charles – fancy streptococcus bacteria – we go to hospital to get better but we come out worse. If they can't clean a hospital it can't be confident to deal with nanotechnology. It is difficult to deal with.

Q – Q Thomas, mapped the human genome, building atom by atom bacteria. Build custom bacteria, what is the risk going out of the control.

Charles – bacteria good and also negative – in principal good but have to be careful.
Q – new tech help with the detection of disease

Charles – it will. Matron, could have prevented it without the detection. No questions that new tech could help with the detection.

What is social audit ? companies have accounts and then an audit comes along and assess the accounts – social audits measure what companies give to the community and then branched off to medicine

Q – where are the results of the social audits

Charles – give you lectures and papers and website gets .5million visitors

Who is funding your work and who do your represent

Quakers and no government and no companies – try and keep independence.

How did I get into – in the 60's on which magazine – consumer protection and journalism then work with ralph nadar.

Do u think that doctors simply go through the maual?
How do u differnetiate between layman and experts and how do u make experts approcahable

Which there was a arrogrant editor – her attitude if u can't read it is because its crap not becauase im stupid

I wish dr did go through the manual. How do u keep up ewith all the drugs, there seems to be a hugh amount of poor prescribing.

Q – why is ther is so much secrecy

C – informaton is power. The ability asks quesstion if u are excluded from the process, the scresy is friegtful

Why has the govt not learned from past misstskes

C – how often do u hear a politician own up to making mistakes – why the mrrah admit of making misstakes – might get sued if u make a mistakes

Proff can't monitior, no gov, no momenturm.

c- not a profit of doom – concern and anxiety. Analogous to nuclear power. Under a degree of supervision. There are recipes for progress.

How do we monitor?

C – the structure is wrong, humans are the ginipigs

Animal testing is it worth continuing

Drugs that killed, In the usa were the drugs tested

c- they are tested, drugs killed same as killed in the Vietnam war,

c – i feel uncomfortable about it but not outright ban – provided sthe test are useful if they can not then they are not proper. Altenatitive is tested on the third world people.

2-10 results coming out the animals

c – little but not enough about the

things are mess why into new ones

c – trade benefits and health risks. Form the health, developing new tech, is low priority

is the gov't new teer technology that can't be used on the grond.

C – everything is happening to fast. Gov't creating a climate tax advantages and protection gove behindit

Q – a over population problem

C – in the long term there would be an over pop problem, life expectancy in some countries is half of this county.

Q – is nano involved in immortalisation

c- closer they get to it, not a good ending

Q – if this new tech can be safer or shall we be investing in it

c – it could be disastrous, good important application – depends how we use it and who controls it.

Q – how do we stop nano being the next nano

C – u have to monitor - it would be difficult to catch the problem until we reach the dark side. How do u stop it – demand transparency and demands democratic framework

Q – asbestos drummed in to it very dangerous

C – 1928 – should have been addressed

Don't know how nano was invented and doubt if u could date it.
I got into it to by it, b4 tom approached I knew very little.

Are there a lot of Frankenstein labs, we know of the one that are regulated, if there are big labs through commercial labs, that are not regulated.

My model people not sure that they are try to do damage

We won't know about the damage is done.

Q - is mrsa down to cleanliness rather than technology

C – Yes, I wouldn't want to go to hospitals if it is not clean and the lack of hygiene is a basic thing,

It is the lack of hygiene that it causing g to spread. Affects the very young, or the vulnerable

Q – will nano shape your work

C – inevitable that I will be doing more on nano

Q – what sources did you use.

C – seasoned enough researcher and used the internet. The challenge after google is to try and find the strategic bits.

Tony Ryan, Univeristy of Sheffield, 8 June 2005

1. Energy

At the moment we burn oil.
The biggest problem we are facing is the number of people that will want to consume energy in the next 50 years. It is not sustainable. At the moment we have to burn nitrogen to give us ammonia to give us fertiliser to grow enough food to feed everyone. If we run out of oil, 6 Q , half of the population, the poor half, is going to die of starvation.

Nano tech will have a role to play in catching the carbon dioxide and burying it again. Alternative sources of energy such as wind and wave power are there, but I don't think there are enough of them.

I think we ought to begin building nuclear power stations again. Cos nuclear power stations can be safe and clean. If we had a device that could capture the suns energy and it was 10% efficient we would only need 0.2 of the earths surface for energy production.

Solar power is the future. In 20 yrs time I will be driving round in a car powered by hydrogen cos we are going to move from a fossil fuel based economy to a hydrogen economy. Nanotech has a role to play in storing that hydrogen safely. Fuel cells burn hydrogen and oxygen to make water. That's what biology – we – people – do. That burning makes energy. In fuel cells it burns them to make energy, nanotech can be used to collect the energy. We are trying to make the right membrane to store the energy and make it last.

We use oxygen in the atmosphere and hydrogen in the water but to do that splitting you need an energy source, could be gas, oil, but it is going to be solar energy. We can make solar cells that are very efficient, but not cheap, can make cheap, but not efficient. When we can make solar panels that are efficient and cheap you will have solar panels that will trickle energy into the mains. One sheet will take energy from the sun and make it into energy.

Learning from nature – what nature does is photosynthesis – leaves takes energy from the sun, splits the water, and when they join again makes energy.

When we use solar power in this way we will be able to have our own hydrogen source for hydrogen economy.

Bulbs are florescent, those in homes are incandescent – high resistance to electricity – LED is solar cell working backwards, electricity in and get light out – to make white light need red green and blue. When blue led was invented could make white light that was a led. LEDs hardly use any power. If we converted all the traffic lights in England to work on LED all the energy in Birmingham would come for free. So role to play for nanotech there.

2. Information technology.

Digital cameras driven by consumers. 500 million transistors can now be fitted on my thumb nail. That shrinking has been done by nano tech.

Its you the consumer that drives technology rather than scientists, cos you want an ipod.

In 1998 to get technology that you can buy in curries you had to go to the American government.

Technology is going to be everywhere – what you wear – devices such as ipods will disappear, cos nanotech will allow your clothes to play music.

Nanotech wont do everything, but they wont turn the world into grey glue. Copper minors wont be put into work, one technology doesn't put others out of work. Cables are made from aluminium, not copper.

Can't make more elements – cant Q ent them – can't create more atoms cos would need fantastic amount of energy which isn't currently available.

All of our bodies work cos our molecules work in a certain way, we are the best example of nanotechnology – all we have to do is learn how to do things in a certain way.

3. Questions

Are you speaking for all scientists or for yourself when you say copper will die out?
It's a cost balance issue. Best material at the moment is copper. Cant make electrons move as quick in plastic as they do in copper. Will always be some areas where the material of choice is the traditional material. Always have to make some compromises when you make these choices.

Fiona: Will use of plastics decrease?
Use of plastic in packages is mainly consumer driven.
But cardboard cant be airtight

But cardboard is often environmentally more damaging cos of the process by which it is developed.
But plastic isn't biodegradable.
At some point will run out, cos plastic is based on oil. I think people will begin digging up landfills to get plastic bags out cos it is a very pure form of hydrocarbon.

Is it right to say something so wholesale about these materials – you can make cotton with nano-tech?
You can improve cotton with nanotech
But will we still farm cotton?
Who knows? Can't be a hostage to fortune and say we will grow it forever, cotton is a very desirable material – consumers can demand it stays around – and its renewable, grows in the ground. Cotton and wool will be around for a long time

Q - If plastics are solid hydrocarbon – how close are we to recycle them to turn them into oil?
Not prepared to pay for it, but could happen tomorrow
Science is there – but vested interest to keep pumping it out of the ground
Yes, but in our interest as well, not willing to pay extra 3% tax to pay for the cost of recycling. Could happen now, bp could put recycling plan near refiners.

Q - Some of questions your having is cos other witnesses have said different things.

Q - When you were saying about whats to come in the future, do you think nuclear will come before solar?
Yes, but solar is drifting in – see road signs with solar panels. At the moment made in horrible conditions which are very expensive. But Q jones and I are working on making solar panels through printing. Then it will be very cheap. That could take 50 years. But know nuclear power works now cos France makes 80% of its electricity through nuclear power. When you begin to pay very high energy Q s then nuclear power may begin to look more attractive.

4. Questions from groups.

Nuclear
Just like mobile phones – could nuclear get into the wrong hands? All drug related crimes were committed through phone boxes – now dealers use mobile phones – has become a negative instead of good.
Yes. Inventors are always faced with this problem. The person who invented anaesthetics – next thing people are being put to sleep with chloroform. Society needs to deal with the problem of human nature, not scientists.
But technology is available everywhere and can be used against people.
I agree. Same with guns. Wife uses car to take kids to school but could be used by ramraider to break into shop – can be used by any technology.

How do you regulate it?
Is it too dangerous to use so broadly.
Nuclear? Nuclear is big – put a fence round it and put guards round it. Nuclear is safer.

When are they going to begin building nuclear stations
When we let them. Imagine it will come under this gvmt as policy. We trained a lot of nuclear engineers that are all retiring now, but we haven't trained anymore. I would advocate we build a station to train them and keep the technology alive.

Is wind power policy gvmt cover up in face of what to come? Why do they keep telling us about it
Not a cover up. Tell us cos wind power is free.
If nuclear is the next big thing why bother with wind power? Only 0.8%, why bother with it?
Not sure they are a waste of money cos wind energy is free. Don't have to put fuel into wind farm. But would have to pay for the power that comes out of the energy harnessed.

Vicious circle – if you want it you pay for it – what with?
To come back to issue – isn't a cover up. Mixed economy of different energy sources is the way forward.

Have moved away from nuclear – most people led to believe that nuclear is bad – wind is all sweetness and light – how are we going to go back to nuclear?
Had to mention nuclear cos I think it is the interim. I really don't think that all of a sudden someone is going to say we are taking the micky

Chernobyl and Bhopal – nuclear and chemical plants – to this day after decades still suffering – though on the surface it is – but if something happens we are not going to survive it.
Don't want to down play Chernobyl. Should never have happened. Was due to the downfall of soviet system and using it as a toy, doing an experiment that went wrong. Yes that land will be poisonous for a long time. nano tech has a role to play in cleaning that land up.

Poverty in the third world

In the past other technologies didn't manage to feed the poor of this world, how will nano-tech?
What didn't feed the poor of this world were big business and politics cos they choose not to use it appropriately
But the same businesses and politics are investing in this now so whats different
The population of the world have increased the number we can feed through fertilisers. The whole wealth in terms of quality of life has increased – still are vast number of people that are hungry. I would say tech feeds more people then it starves. If it hadn't created that population explosion those people wouldn't be there.

How do you mean?
Slavery – what stopped slavery was steam engines not politicians. Cos wasn't the need to drive the economy through human power, steam engines took away the need for slaves.

What level of disruption is acceptable – e.g. copper mining – will definitely decrease, need wont be the same, so as a result, the effects it will have on those countries – what do we think is acceptable in terms of what they are going to go through as a result?
Am sure it will have a profound effect, the price of copper wont fall through the floor, tail off will be gradual – economies are adaptable and something else will turn up, people will move.
Just that effects can not be measurable?

Wont be that profound, and will be long term.

How will this nano tech be made available to the poor and how will it be made affordable to them
More and more houses have fridges, radiators, in third world more radios, better health care – technology becomes available. Nano tech will be no different. All the new technology will go to market the way they do now.

When you said we wont be able to feed 6 Q ion – so much technology – nanotech will blend in with others – but still more people are dying of no clean water etc. how will nano tech help?
There will be all sorts of nano tech contributions to cleaning of water – all sorts of ways – they are available now
But costs attached cannot be afforded by the poor
Cost to everything – what we are talking about is the way in which we distribute wealth?

If you have not got fertilisers it is of no use.
I agree with you.
They are trying to make all seasons the same. One season.
Can get multiple crops in greenhouses that

The way in which wealth is distributed is appalling. The reason people are starving isn't technology it is people. Butter oil being thrown away that could be feeding kids.
All the wastage in this country amounts to Q ion of pounds.

Could nanotech clean water – in poor countries – and the lack/scarcity of water
Could make a reverse osmosis machine – if you have a solution that is salty and connect it to pure water and have a membrane, water will go through to dilute it, but if you squeeze the salty water it will send pure water out – nanotech is the membrane – expensive, but could generate that through things like hand turned

Water scarcity is about population density. Nano can only help by recycling water and purifying it.

If you combined oxygen and hydrogen and made water could probably run Halifax for an hour – awful lot of energy required to do that – so couldn't deal with scarcity through that.

Nano and transport

Hydrogen cars – where are we at
Nano and transport – not a subject we have touched on yet
Most of the big manufacturers have fleets of cars that run on fuel cells.
Commercially – how long will it be when we get rid of the engine cars
Difficult to say, but I would say could get fuel cell cars in 10 years – they will run in tandem with one another – some hydrogen powered busses in London
Is there anything coming in the future that reflects whole transport thing – have major transport issues in this country
People will go back on buses cos of price of petrol. Have to compute the amount of energy you consume per journey per person per mile. Eventually price of petrol will be so high, there wont be so many people that will be able to afford to run a personal transport module.
So market will control transport rather than nano
Nano will only change things if it makes them cheaper. Nano tech is part of a bigger economic argument.

Limits of nanotech
How far can you take experiments with nano tech? in every sense?
If your asking me should the gvmt say you cannot research here? The catholic church tried to say that to Galileo – we shouldn't stop people doing research

Are we going over the laws of nature – when things go horribly wrong – usually in poor countries – cos not enough checks have been done on this – always the poor that suffer – sometimes technology goes too far and doesn't do enough checking
The way the world works at the moment the poor are always the ones that suffer, but we need to change the way people work the world. For example the Bhopal accident happened cos costs were being driven down, people make short cuts, accidents happen. The original plan that Bhopal was copied from never had a leak.

Have you researched possible side effects for future generations, once we have got deeply entrenched with this technology then we will find out about the issue

Nano tech will make the rich richer and the poor poorer – relatively – any tech does – the gap may get bigger, but if the wealth of the poor is still increasing is that a price we are prepared to pay. Am happy as long as the bottom layer getting higher.

Biggest question is the two extremes – I think the truth will be somewhere in the middle. What do you personally see as the danger/middle ground

Biggest source of nano particles come out of diesel engines. Factories produce them by the gram, engines by the tonne. New tech will be used to improve the damage done to the environment in the past. I know I sound sanguine about technology – but I share your concerns, about wealth, to oppress people, crime, and they are in my mind.

Q - Captain scarlet – use technology to zap clouds to make it rain is that possible?
Yes, but nothing to do with nano.

Do you have an objective of where you want to use your research, or do you research on an overall scale?
Some of the stuff we do is very speculative – do stuff we do to see if we can. But another area – i.e. plastic solar cells – is cos we believe future of earths energy supply is solar cells – cheapest route to collecting energy from the sun. some speculative and or egotistical. Some very applied and done for the right reasons cos we think we can create this energy that will release us from fossil fuels and nuclear.

Everything you have said is most positive side. Anything negative?
Small particles released cause illness. Asbestosis and asbestos working. Nanotubes may be just another case of asbestosis.
Have you looked into this?
Yeah, the great thing we are doing here is, as well as this discussion, huge range of people looking into things like toxicology or ethics – many researching into the negative sides.
That's exactly it – haven't heard from anyone that is in the middle ground.
All the negative things are about the effects on people. Both the economic and health effects. Lots of stuff going on to look at the health effects. Economic effects not my bag – all of our responsibility. Yes there will be new poisons.

Whats scary about nano-tech is cos so small will permeate skin etc.
Did you see that thing on doc who? I can see that as being scary.

Is nano a step back – generations like Hitler trying to make ideal person – look what happened – possibility of going back to minors and coal – in a way is bringing in this nano are we going to be stepping back?
In terms of exploiting people?
Economy in general – coal – oil etc.
Yes, but there would be positive effects on pit villages – I wouldn't necessarily see that as going backwards actually
But was difficult to get out of it – these generations wouldn't go into it
Coal mines now would take far less people to run.

Would hate to be part of something that would go to gvmt and tell them to hold things back – richer we can make this country more philanthropic we could be.
What could I do to go to gvmt and ask them to invest more into nanotech and make this country forerunners in nanotech
Future of uk is in high tech knowledge based economy – cant compete in terms of labour costs, need to invest in training people

What sorts of jobs would nanotech produce to make new jobs
Exactly the kind talked about in mobile phone area. Health care will be an issue, ageing population, nanotech can help in diagnostics etc. you heard from bea.
Won't be many people to keep healthy if we don't solve the energy prob. Need to invest in areas that uk has a lead in. uk is a leader in solar power.

Has Blair pulled funding?
No, healthier then it has been in my lifetime.

Last week heard from one witness that periodic table would change, you said it wont who do we believe
Me cos I am a chemist. I carry a periodic table round with me. Number of new elements on it v. small. They don't last long cos of radioactive decay. No one can invent an element. And if they do create a new element that they can Q ent they wont last long enough.

Nano tech is bigger than atoms. It is made from atoms. I wont give you financial advice, but I can absolutely tell you nanotech doesn't mutate atoms. Alchemists do – change atoms into gold.

Solar
Why is solar power so expensive?
Cos of way solar panels are made. At the moment make it same as computer chips. Will become cheap when we can print it which is what we do.

Solar v. wind
Enough sun for solar – weather in the north etc. wind is fine – but do we have enough time of sun for solar
Energy storage is the biggest problem.

How is it going to be stored
Batteries. Hydro-electrics. We need to learn to recycle batteries. Cheaper to throw batteries away and start afresh. Energy storage and energy harvesting are fundamentally linked. Way you store it is convert energy into hydrogen and can burn it when you like.

In hebdon bridge breaking down plastics – why go back to these things, can't nano tech find a way to break down plastics
If you go to sainsburys and tescos – the carrier bag does now break down and self destruct. Now additive in plastics that breaks it down. Wont be trapped in hedge forever. Plastics waste, stuff we take to the recycling area is mixed waste, all different kinds of plastic, not a lot you can do with that. We should burn it in power stations. The total energy cost of a plastic milk bottle is less than making a glass bottle, taking it back and refilling it. Put more co2 in air by renewing bottle.
We should collect the plastic and burn it.

For people like yourself its about breaking into new ground, but wouldn't it be better to make more efficient things we already have rather than making more Science is a very big community, and there are people doing what you are suggesting, one of my researchers works on making foam from soya oil, one on

Do companies hold back technology cos old ones are making them more money – should there be a law against it?
Yes and Yes

Who else will be able to read the body of my information ?
Depends on the module you have put in. sensors and reading things that are sensed. I can't access your mobile phone and read your information. Same applies to nanotech

Will nanotech shift balance of power between nations?
Nanotech is not that important in terms of that dynamic. Hopefully, if it keeps everyone's standard of living rising, the social pressure to shrink the gap and share our wealth, and if there is more around generally then maybe we can get out of it better, won't be a defining moment, a paradigm shift.

How do we stop nanotech owned by a handful of nations? Aren't we heading towards one super nation owning entire wealth cos nanotech will be owned by those investing in it?
We need a Revolution! Technology is intimately involved in the way wealth is distributed, but ultimately it is people that distribute wealth, not technology.

How and what part can nanotech play in military forces and will it make this world a safer place to live in?
Like all research, whats called defence drives a lot of research and tech. there is all sorts of nanotech applications in defence or offence, surveillance, intel gathering, when people want to make wars tech will be abused. Could make a law to stop it happening

Are there bigger forces at work than the ones you talk about – global politics
There's no bigger law than the laws of thermo-dynamics! [Seriously], it's the way in which wealth is distributed. And as a person, I don't absolve myself of that responsibility. Am committed to equalising wealth distribution.

We were talking about soldiers being made more super – a super human race – with that in mind and imortality – how are they linked to nano
As a practic ing scientist can see ways in which a garment could transform into a splint because it has recognised that arm is broken, or exogarment that allows people to carry more weights.
Soldiers given nanoparticles that they know which drugs they need in field
Not beyond possibility
Immortality?
Tougher.
Isn't there an argument of whether virus is a living being?
The Jury is still out on that.

David Bott, EotR Solutions (formerly ICI).

David Bott introduces himself. Scientist all his life, father was an engineer, did PhD and decided to be an industrial scientist to make things real. 8 years with BP, 8 years with courtaulds, ICI, 4 years acrylics, 2 years National Starch, now consultant for the DTI, and involved in two companies, one involved in making drinking water from polluted water.

Nanotechnology – the drive to make things small. Always been around – ideas of scaling. The bow-legged hippotomus as an illustration of the importance of size scaling. Approximations of the science and technology that scientists make. Miniaturisation started in the 60s, to fit more and more and stuff in to things like mobile phones. Driven by people wanting more stuff- more songs on the iPOD, smaller hearing aids.

Business is about making things that people want to buy. Disrputive changes are driven by markets changing – people wanting to buy different things. Stuff isn't foisted on people by industry; industry is paranoid about whether people are going to want to buy their products.

Are small particles more dangerous because of their size? Scaling laws tell us that particles have much more surface than big ones, so it is possible that these particles interact more with the human body. But there are many natural nanoparticles, like the products of burning wood, and bodies have got used to living in a rather dirty environment.

Regulation of new materials – a strict set of rules about introducing new molecules, but if you've been using them a long time regulations are less strict. In a laboratory, you are governed by rules called COSHH, which ask you to consider all the ways in which a new substance could enter the body. The Royal Society recommended that regulations should be amended to account for size.

Nanotechnology is not a wholly new set of technologies, it's a continuation of things been going on for a long time. It's driven by the demand of consumers to buy more products. There are some issues that arise, and these things need to be taken account of in new technologies.

Immediate questions.
Q1. Zinc oxide in nanoform was treated as an existing substance, but the absorption properties might be different because they are small.
A. 70 nm seems to big to be absorbed, so he's not completely convinced that it is a big issue. We should however look into the question of how big particles should be before they don't get absorbed.
Q2. Could these particles escape into the environment and cause trouble?

A. The natural tendency of small particles is to stick together because the surface is so important. In fact the reason it's so difficult to make particles very small is that they do tend to clump (agglomerate).

Q why do big words need to be used when you're talking about nanotech?
A They don't. it's just that you need more small words to say the same thing.

Q do you think scientists communicate well with the man in the street?
A no. it's a source of sadness. Because scientists use jargon internally, they get into the habit and find it hard to use small words. Need to think about your audience. Difficult to understand how other organisations work. It's what you're familiar with.

Q how do you talk to your wife?
A I try to explain. My wife knows when to ask for better explanations. My children were a big driver in trying to find ways to explain and think about environmental effects and so on. IN industry we don't have to communicate so we lose the habit. We need to get better. There has been a whole process where a new technology comes along, then society thinks about effects, then govermnet regulates. But since innovation is getting faster and faster, it's hard to keep up.
Q : a very big part of science is argument with other scientists. You do that in person and in writing. Because you're arguing about details/ minutiae, you have very specific & precise language.
Q can this lead to a form of complacency? Thinking that the rest of the world doesn't want to know about this?
A yes. But because you get used to talking that language, it's very hard to snap out of it. And you have to say zinc is zinc.
Q should the scientific community have some kind of middle-man to communicate with the public? Someone who could understand the science and be able to communicate it?
A it would be nice if scientists could do this. Having people who sit between us – eg scientific journalists – is good but there aren't enough of them.
Q Tomorrow's World was quite a useful way of communicating.

Q why is the governmetn not open with us? Nanotech argumetns for and against – me as a man on the street had never heard of nanotechnology until this process though I come from an engineering background. Some of the scientists and witnesses have come in here and scientists have told us things that are about to happen, they're discussing energy and the environment. I don't believe that the government are coming forward enough, they're not telling us enough. Eg with nuclear – they are telling us that it's done, it's over.

A I don't think they're always deliberately like that. I think a lot of people in government don't understand the issues. Scientists don't talk to people in government any more than they talk to people on the street. On nuclear – the government have been backpedalling and modifying their positions and have

been doing the sums that we can't have the amount of energy that we use without some other form of energy source.
Q the trouble with the respective governments is that they take someone out of one job and put them in another without the faintest knowledge of the subject. It would be much better for the people if the people in charge understand what they're talking about.
A civil servants are the experts. The ministers are there to look after the direction of the policy and politics.

Q how did you get into science and what is your speciality?
A what I actually discovered at the age of 15 is polymer science. Polymers are plastics that you know about, in paint and cars, carpets, walls.
Q someone said that nanotech could make trainers that are always white. Is that polymers?
A no it's probably a coating.

Q particles from diesel cars have been around for years. Would that impact on the environment have happened by now? We didn't know they were nanoparticles at the time but we do now. Is there enough evidence about the effects of nanoparticles on health and environment to decide what to do?
A there's a fair amount of evidence about the soot particles. They cause defence mechanisms in the body eg asthma. The human body is an amazing defence mechanism against invasion.
Q can nanoparticles be absorbed in the skin?
A the skin is pretty tough. But inhalation is more worrying. Inhaling organic vapours – eg paints used to have lots of solvents which nowadays you wouldn't tolerate. The primary impact was in the lungs. I still don't know about different sized particles going through the lungs and whether they pass through or not.
Q what's the Royal Society
A the Royal Society is a top club for scientists. They did a report with recommendations. Firstly that regulations took account of science. Secondly that there should be a centre on nanotoxicology. The government

Q After nanoparticles are used and discarded, how do they know that they are no longer harmful to anything? And – how do you kill nanoparticles?
A nanoparticles are destroyed by linking up to become bigger particles or a continuous material. They become like the materials that we know and have used for years. The only thing that we need to worry about is whether materials in a small form have different properties and whether there is an issue or not. It depends where they go. If we throw them into landfill, they'll probably be taken care of by the usual processes. The worry is if they get out in sufficient quantities and can be breathed in. So does it give a chemical reaction in the body, does it get through the lung barrier into the blood, and how much are you

In water nanoparticles almost certainly come together to form agglomerations

Q you say that nanoparticles stick together – can they separate again?
A It is hard to separate them.

Q What is the process of making nanoparticles? How are these then used as materials
A Two directions to make nanomaterials: top down and bottom up. Grinding down – or chemical reaction that makes up the nanoparticles.

Q how do you take nanotubes to make them into useable materials?
A it's a hard one – no one really knows.

Q How should UK become a world leader in Nanotech. Will other countries get ahead of the UK?
A Many countries doing very well. USA is the leader and Japan is clearly second.

Q What is the UK investing in nanotechnology
A About £80m a year from DTI. I would guess about £100-£200m spent by the government. It is also difficult to decide what is nanotechnology and what not.

Q Do you think that industry is over regulated at the expense of invention?
A No – regulation is very important – and industry needs good regulation to succeed.

Q Is industry acting in public interest?
A Industry needs society more than society needs industry. Consumers buy

Q Other witnesses have put forward the idea that industry is trying to introduce nanotechnology as a conspiracy.
Big companies want profit – take sugar industry – too much salt and sugar in our foods. But
A But we go out to buy the the foods.
Q But what about cigarates? Don't the companies also have responsbility?

The goal of industry is to make money for its shareholders – we don't need to think of conspiraries. And society has goals too – need to have incentives.

Q What's the name of the one company that will succeed with nanotechnology?
A I cannot think of one.

Q Are companies close to getting any of these nanotech products to market?
A Science and technology research is a linear process – we won't see major revolutions. Things are getting faster

Q – We want to spend more time on the last four questions

Q Has there been a problem with anti-ageing products?
A I think this a problem caused by L'oreal over claiming. It is not surprising if there is ocasionally a problem of putting chemicals on your skin. I don't think that was nanotech.

Q You said that disruptions can be seen in the "Rear-view mirror" should we not also look ahead.

A Yes I agree – we need to try and anticiQ e the problems and also what we want out of live.

F – what do you mean by being a disruptive technology?

F – If consumers only have the ability to buy then they are not looking ahead. This relates to the philosophy of the jury – to allow people to look ahead in ways other than as a consumer.

A consumers have big influence by the decisions they make – which are also decisions about the world they want to live in.

Q lets talk more about the example of oestrogen.
A This is not about nanotechnology – but it does raise important question. Life-cycle analysis is an important tool. When the birth control pill was introduces people were not thinking ab

F – but nanotechnology – people have not done life cycle analysis, have they?

A but they will do

F – they will do – does that mean they are not in existence at the moment.

A Going back to the evidence we heard about targetting drug delivery. That means that smaller quantities of any chemical will need to be used.

Q How do you know that we are not closer to the introduction of nanotechnology.
A I am an optimist – but things always take longer than I initially expected.

Q Finaly do we have to be scared about nanotech in sunscrene or other products.
A I don't think so. Based on the evidence I've seen, which is not conclusive, I would not worry too much. Consumers have to make decisions – it is a matter of balancing risks and benefits.

Q But we never questioned things like what sunscrenes are made of.
A As the inovation cycle in society gets faster and faster it requires consumers to ask tough questions.
A Labelling is getting better – that's another thing that the government has introduced.

Q But the trouble is that we don't understand what the lables mean.

F – Thanks and house keeping.

Ends

Grace Maiso, REFLECT/ICT project, Uganda.

How one project has tried to make new technologies benefit everybody.

Maiso in my language means eyes.

Project manager for a project which is trying to work on technologies for the poor. It is part of actionaid uk which works in partnership with actionaid uganda and xxxx

My background is research – worked in a number of fields – development, hiv ec. By training I am a historian and

Project:

When – project started in 2003. idea was there was a community learning process called reflect started in 93 by action aid – people look at their environment and study issues in their environment and use that as a means to learn to read and write. Can we use that and introduce and element of technology. Info is a resource. If you are a poor person who wants to manage their environ info is a resource, can't have info without technology. How do you link learning to survival in society – need info.

Combine adult learning and the lement of technology.

3 interrelated but distinct phases 1) how do we go about combining learning process and choice and use of technology – started by setting up rules who should be involved, where and how – called that the norming (standard) phase 2) Perspective phase – do we all see the same thing in the same light – are we approaching the issue in the same direction. Carried out a community dialogue – kind of cj – but at different levels of society – how do you relate to each other, how do you communicate, what kinds of tech are common, what is the difference between tech in different times, intorduced the issue of new tech and how they come in, what kind of circumstances bring about new technology 3) project – visioning phase – how we put the rules, implementation of project into practice – how do we move forward.

East african community – uganda - smallest of the three

Project based around western side of the country – that borders the democratic repub of congo. On the foot of masuri mountains. One of the groups that are marginilised are in the mountains. We analysed the info during the kingdom period – the source of info through out the period of the king originated from him.

We have the highest 1.1 million subscribers to mobile phones. Uganda has liberalised the telecommunications industry. We don't pay taxes on computers or any telecommunications.

Av. Income is $4 a month (£2.50). if using measure of $1 a day for pov, there is widespread poverty.

Most people are farmers who produce for consumption.

Project is working right in the middle of the poor – not the town. We sit with them, eat with them, drink with them, ask them what they think.

Reason for this – initial proponents of project thought if reflection as a process would make people understand hnow to read and write, if we intro tech this will change – so can we link the learning process to use and understanding of tech. this project is action research – we are trying to see if this project works – will learning improve thru tech, are peoples livlihoods changing thru tech, basic reason why this project was started.

Habe had a number of changes

Who: number of partners
Community level – men and women who are poor – learning process was initally in the poorest of the ppor. That is where the learning process started. Intro tech in the poorest of the poor
Local council leadership – people chosen by people
Local admin – representative of the government – people who intro gvmt programmes.

Reflect circle – these people come together to discuss their oproblems and look for solutions from a communal pwerspective. Sometimes can't give solutions at this local level so need higher partners. Then is the question of power, can they influence local government. Nmeed informaiton to have this influence. Need to have done your research. So need for info.

We have about 14 in this circle – majority of which are women who have their discussion. Then had informaiton and power study –
who holds the power?
Who has it?
How do they exercise the power?
In what way do we see this power affecting

We identified major problems – one of the biggest is HIV – one in every 10 Ugandan is HIV posittive. Uganda is one of the world leaders in dealing with HIV. People are no longer scared, they are open about their status.
Project wanted to introduce it in the fight against HIV – improve the position of 60 women who are widows of HIV.
Using tech to promote the interest of the poor – basically capture the critical issues of the poor and making these available to the planners and policy makers. Advocating womens access to resources, access to drugs and treatment in general, in uganda drugs are free but politics of access means people are unable to afford to come into the town to get the drugs, or do not know who to go to to get the appropriate drugs.
The other issue is local content – allowing the people to express indigenous knowledge. Eg. In mountains takes 2 hrs to travel to nearest health centre. If you have acute malaria in 2 hours (walking) you will die. Then another ½ hour queing to get attention. Health care sys is time consuming and difficult to access. People will use traditional herbal medicines. Man called alex who came and said you are doing good things, but knowledge is dying. How can we use tech to help preserve local knowledge. This album of herbal medicine is being transferred technologically to preserve the knowledge.. it will be lost, cos he is a very old man.
We have school knowledge groups – students discuss the probes they face and how tech can help them improve

How helping?

1) using video – community have dialogue, film the issue and then take this to the gvmt, telling them what the community is saying. In some community prioriyt was a road, the gvmt saying isnt. When we went to capture community priority – we can say you are mixing up your issues or you havn't made enough consultation

2) have a community knowledge centre – could call it cyber café, information centre. We called it knowledge, not info for sake of info, if your coming to centre its cos you have a prob that you have thought about, who ever comes there, if we ar giving them the info then they will contextualise it in their circum and utilise it. Get info from internet and translate it into relevant community lang, to enable learning process.

3) mobile info perspns – discovered it from local people – people who like gossiping – we said using analogy of insect carrying infectious disease, if loaded fly with info and ofloaded it – its beautiful. Community id'd people that spread gossip, we give them free access to centre, they come and hear, and they go off into the community and disseminate the info.

4) wireless technology – have now put different low cost tech in villahges – so one village can contact another – not individual mobile – exchange of info from community – they can leave messages in mailbox, and someone will check it and disseminate. Us company we are working with.

Old woman v. sceptical about technology. Always questioning the police about why they are using these little gadgets. She pressed her own language, and was surprised that it could speak her language. She is now the biggest proponent. Sometimes when technology is put into peoples own context they tend to learn to appreciate it.

Comparison between mobile phone and what were doing here
One of the negatives of the mobile phone is low income of households. Most mobile phones are so expensive. I use av. Of 30$ a day, beyond income but addiction. I feel naked without the mobile. Crazy yearning for mobile phone in villages – but they are increasing the level of poverty. If can't afford it then consequences are clear. Reason why we are introducing wireless phone tech is to prevent this dependancy on mobile phones as well as increasing info from ugandan government. Can punch in 198 on the phone and in a second will know the price of any item through out the country. That is an absolute benefit at local level. But wider consequences is people are digging deeper and deeper in their pockets to make sure mobile is on, not for info, but for social reasons. Question is how many people will have gone into poverty for mobile phones.

Have you had good interaction with other groups – i.e.. The group over the mountains?
Currently no prob between those in the mountain and those on the ground cos they speak a similar dialect/lang. despite the historical conflict, group are based around village level. Discusion centred around same problems they have – i.e. accessibility of health facilities, so came together over common problem.

30 health professionals from mountain and ground region have come together to see how they can preserve their knoeledge for future generation through technology. Critical prob in area transcends differences of ethnicity

Do you have a problem in keeping mobile phones out as people do in trying to bring them in
Gvmt has liberalised it so virtually anyone can import them. They are everywhere and handsets are very cheap. So anyone can access it. But people have difficult in maintaining them. Can get a handset for price of 2 goats.

Can you explain what you mean by industry is liberalised?
No more taxes – gvmt doesn control supply, use of this info, anyone who wants to deal with them can come into the market. Means you have plenty of phones and services. Every 5meters you get a telephone booth. In the villages have single booth for av. Area of 500 metres, or kilometre.

Why is there so much poverty, how do people get any income and how does a family get 4$ a month
It's the issue of power, those in leadership are not accountable to the local people, he who gives you the money plays the tune, determines hat you should do. In terms of aid we have been given Q ions and Q ions. 5 Q ion us $, but if you ask what it has been doing, it stops at the highest levels of society cos terms and conditions of that money dictated from outside, poor don't see it. Poor people don't have access to markets. There is a lot of production but where do you sell it. The pther problem is attitude. There are so many young men just sitting, they don't go out looking for jobs, they will go home plpenty of food in the garden, they go home and eat. People in th mountains, many sending their children through schools cos they feel that it is thru education that they can fight their oppression.

Income thru the sale of alcohol – musa'boom – musa is a type of banana, distill it. But over the years, that species died out so no longer have it, that is why they are now poor. Now major source of income is petty trade – agriculture produce, potatoes, peas, beans, in small household gardens, - labourers in nearby tradings and towns.

Who would be buying the alcohol that was being produced?
Most of alcohol being sold to congo – has a higher per capita income – so they are the ones buying the alcohol. And in campala city.

What sorts of jobs are availabl for youngsgters?
Tea growing factories, digging on peoples plantations, commuter transports

What are the different wages for different jobs?
In transport sector av. Of 10-5 a day – richest category of empoyment
If digging in garden – depends on size 1$ - 2$ for the whole job
Brick making 1$ for the whole job of one heap of bricks

If people are fully educated what jobs they can get? The people in the villages

They would have to leave the villages to get jobs. Another trend is many educated developing voluntary organisations to help, but a lot of fundraising to maintain yourself. Have about 8% industiral growth. Many of the jobs are in the service sector i.e. petrol stations. Many people are leaving the country to look for jobs – any jobs – odd jobs, not professional jobs. If I save for about 5 years I would be able to buy some land.

Is there any voly org in your village
Yeah, depending on which interest. Have voly org for those disabled by war/landmines, those for hiv positive people, widows, children, depends on which prob. Quite a flow of funds for voly org. Coming from development NGOs such as Action Aid.

How are you focusing on the poorest of the poor?
We did a wealth ranking study in the area we are working. We ask "who are rich" "who are the poor" "who are the poorest of the poor" so criteria come from the local communities. Such as the rich are those who have a mobile phone, the poorest of the poor only have one meal a day. We then ask the poorest of the poor to take part in our "circles". And they get richer through particiQ ing.

What would you like to see come out of G8 meetings?
One of the biggest problems at the national level is debt. We pay $200m a year – just servicing the debt. So we want G8 to canel debt. But also make justice in trade. Sell fresh fruit in the UK – openning up new markets. Like coccobutter.

Is there much corruption in the Gov't?
About 65% of aid goes on corruption. That is a worry about debt cancelation. This corruption is going on – such as high ranking army officials. So we want to see trade justice, cancellation of debt and then also access to HIV/aids drugs.

Is the a problem with drug companies – access to drugs and costs? Can the Ugandan government play a bigger role?
Some drug companies import drugs for the poor – but they are then re-exported. This is also a problem of gov't and company corruption.

So could the govt use distribution of drugs to control the country?
There is a big problem if people only get partial course of drugs – which causes huge problems.

You mentioned that drugs are exported – who would buy those?
They could be rexported to the UK – then sold back at much less than market rates.

Access to health centre – why not spend money on better transport?
But the problem is that we are talking about very mountainous area. And there is not enough money to spend on all priorties. Transport infrastructres get missed out.

Why not spend money on bringing the health centres to the people in the rural/marginal areas?

Almost 40% of the budget goes to defense.
Peer outreach plans – train people in villages to be "drug distributors". But there are again problems with corruption – or they are not paid, so they have to sell the drugs.

What are the threats that mean that 40% of budget on defence.
Internal: bandits, terrorists, eg Lords Resistance Army
External: arms race in great lakes regions

Are mobile phones more important than basic things like health care.
If you look at ICT as an end – then yes, you are right. But if you look at IT as a means – then you can get access to information that can improve social position, access market information.

Is it a good thing of a bad thing [mobile phones]?
If I were to weigh it at the moment I would say it is not good – it is causing poverty.

Who buys the phones?
It is the men. At a local level women do not own mobile phones. Women work hard – takes produce to market. But then she gives the money to the men, who determin the distribution of the resources. They spend money on alcohol.

Is theft of mobile phones a problem?
Yes, it is a problem.

Is there a problem of people stealing other technology?
There is a group of Ugandans who come to the UK – they steal UK phones and sell them in Uganda. This is related to the market.
Going back to women having - Is this (voice mail etc) what they want?
We have asked women what they want. They are lacking information at the household levels – problems of domestic violence. We have provided solar power radios. This has gone down very well. "One man said that by giving radios to women you are causing domestic violence. Women are challenging the men – they have access to better information than their husbands."

What pressure is put on companies to reduce call charges?
This is what the government is trying to achieve, but the govt has just increased taxes. But they are also introducing a third competitor – to try to bring down prices. Pressure is from govt.

Moving on to nanotechnology

Where does nanotechnology fit in to the conversation tonight. How do you see nano impacting on Uganda? Nano is much broader than mobile phones. Nanotech can produce benefits. But the question is how? The example of GMOs shows that there are not simple solutions. We have started anti GMO campaign – because it distrupts local farming. Nano can assist – if human values dominate profit motives.

Increasing food production?
National agriculatural advisory services (NAADs) pro-high tech solutions to farming “demonstration gardens” new species of bananas – but now nobody bothers to adopt these technology. The particiQ ory approach was not followed to find out what people’s own interests and priorities are.

The area where I am working is very fertile – using natural means to look after the land. Do not use artificial or modern pesticides. Use cow urine as a pesticide. People use local knowledge to farm. Another debate is about the use of DDT to tackle malaria. Local people want to get rid of malaria – but other people warn that there will be environmental problems.

Any burning issues – we are running out of time.

Yes, what about the kings?
They were reintroduced in 1993 to have a ceremonial function. Where I am the king is a young boy – about 13 years old.

How did you start working in this community?
I answered a national job advert.
Before that I started my own organisation in conservation – working in game parks.

What changes have you made since you started working?
My understanding has changed – I now understand what it means to be poor. What the value of community development. I now try to start to look at a new problem from the point of view of the peasant. Not consulation through blue prints.

The ICT aproject has legaitimacy because it has involved the communities from the beginning.

The next stage is to start to come up with reccommendations. We have not covered all the issues that have been raised at the half-way point. We as facilitators have also been trying to “mug up” on nanotechnology.

If you want to go back to the basics about what the kinds of nanotechnology are. We could add an hour – an hour earlier tomorrow? Say from 5-6pm?

Tomorrow we have a full programme – we have learned from phase one how to handle lots of information. But there are more elements to this one – such as uncertainty – and global aspects.

Final thanks to Grace for coming from so far to take part.

ENDS