

# Protons for Breakfast



DECEMBER 2009

Week 6

Nuclear Power


## Feedback

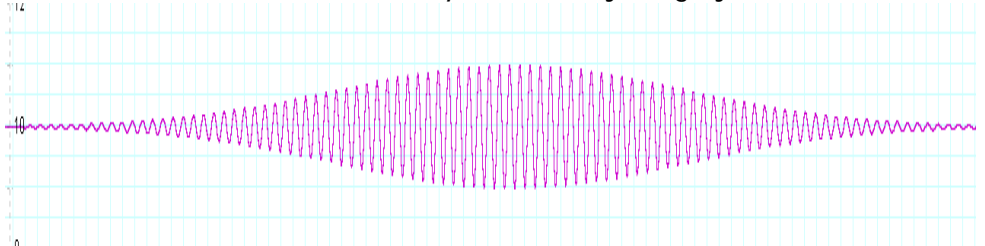
You said	I said
<p>Is research on SAR continuous so as to reduce radiation. Government such limit or slow down technology on mobile phone this will slow down people buying mobiles.</p>	<p>Not particularly. The exposure limits are set at level at which I CNIRP judge that harm cannot arise.</p>
<p>Have any studies taken into account the impact (or not) of mobile phone masts on wildlife? e.g. birds, bees, etc.</p> <p>Decline in bee population in areas in China has resulted in 'many hands' required to ensure pollination of crops. I wonder if their bee decline has occurred anywhere near mobile phone networks. My instinct is that they are not related (in this case).</p>	<p>Yes. A German professor – forgive me I cannot recall his name – and his team have shouted loudly that the problems with bees manifest in so called colony collapse disorder – are due to mobile phones. I have read his papers and I am unconvinced.</p> <p>I don't know for sure, but I think we have provided many greater insults to the insect and bird populations with whom we share the biosphere.</p>
<p>Does a computer when its on the internet give off more? Is there anything worse than mobile phones if so why.</p> <p>Thank you, very good.</p>	<p>Using wireless internet access exposes one to microwave radiation, usually at 2.4 GHz but occasionally now at 5.4 GHz. The so-called 'WiFi' transmitter in your laptop or <i>iPhone</i> has a peak power of around 0.1 W – around one tenth the power of a mobile phone. Usually the antennae is in the lid of the laptop – the part that forms the screen. Occasionally in the cheapest laptops, the antennae is placed in the base of the laptop and if this is used directly on one's lap, the SAR can approach that for using a mobile phone. Once you are more than a few centimetres from the antennae the SAR is negligible. The SAR from a phone is the highest that a member of the public is likely to encounter.</p>
<p>Another great one, certainly made me think! What does the signal strength of dbm refer to, what is high/low/safe? Is there any increase of cataracts (or other illness) over the last few years which may coincide with the proliferation of mobiles.</p>	<p>Great</p> <p>'dbm' is a unit used in a number of different ways. <b>dB</b> is short for <i>decibel</i> and is a measure of the <i>ratio</i> of two quantities. Typically 10 dB corresponds to a factor of 10. And 20 dB corresponds to a factor of 100. In the 'dBm' unit the 'm' usually means the ratio is with respect to 1 <i>milliwatt</i> or <i>millivolt</i>. I couldn't tell you more without knowing the context. People have looked hard to correlate the incidence of some diseases, particularly brain tumours and cataracts with mobile phone use. Any correlation is certainly small and may be zero, but the studies are only 10 years old. It may be that if we study people for longer that a trend may emerge: that is what we are doing.</p>

You said	I said
<p>Michael said the best thing at this stage - only time will tell as the dangers seem small at this stage but time may alter these results. Personally it seems to me that children now have an idol to worship! Bad! There is a wonderful God in control.</p>	<p>Yes, I think I would stick with that statement, the dangers do seem small at the moment but may change. On the other hand, they may remain exactly as they are now.</p> <p>I guess by 'idol' you are talking about mobile phones rather than me ☺. I envy your sense that God is in control, because as I look at the world things seem to be dangerously out of anyone's control!</p>
<p>Does <i>Sellotaping</i> a copper coin to the mobile reduce the hazard?</p> <p>Any health problems associated with conventional cooking methods?</p> <p>How many eggs are harmed in your studies?</p>	<p>Not really. Microwaves will not pass directly through a metal coin (silver or copper*). But they will go around the coin. If the coin significantly reduces the signal to the base station, the phone will automatically increase its power to compensate. So a coin could reduce or possibly increase the hazard.</p> <p>Yes! Cooking vegetables in boiling water many nutrients - and much flavour - are lost to the water. Steaming carrots in microwave with a tiny amount of water results in tastier carrots and uses much less energy than a conventional cooker.</p> <p>Eggs harmed? One for every presentation of <i>Protons for Breakfast</i>.</p> <p>*For the last twenty years or so, 'Copper' coins have been made of steel and coated with copper.</p>
<p>What would happen if you put a melon in a microwave?</p>	<p>Melon's have a lot of water in. If the melon was whole, with its skin in tact, then heating the water inside could build up the pressure of water vapour and cause the melon to explode (as we saw with Dr Egg). If the melon is parts then it will just heat up.</p>
<p>Now I know that the phones frying the egg was all a hoax. How did they do it?</p> <p>Now I know more about what mobile phones and what they do to our minds/brains I think I will continue to use them as I am getting a new one for Christmas.</p> <p>But it's nice to know so in 20 years time I'll know why I am brain dead and you can say you told us so!</p>	<p>How did they do it? I don't know. Is it a single shot on the video or is there a cut? Could be they had a heated plate underneath a table?</p> <p>How do you know what Santa will bring you?</p> <p>I hope you find solace in that!</p>
<p>If you hold a phone up to your head, how long will it take for your head to explode?</p> <p>P.S. Do you like pie?</p>	<p>It will never explode.</p> <p>Do I like Pie? Yes. In fact I will be having Chicken Pie for dinner tonight.</p> <p>Why do you ask?</p>
<p>How old was Dr Egg?</p> <p>Luv u Dr Egg!</p>	<p>Dr Egg was 37 years old and had been leading a successful career in our Microwave measurements team. His bravery bordered on the foolhardy. He will be missed.</p>

You said		I said
<p>Why did the chip packet shrink?</p> <p>Love you Dr Egg.</p> <p>P.S. Have you eaten a microwave ready egg?</p>	<p>Because it got hot. It got hot because it has a thin metal layer in which currents flowed.</p> <p>Plastic objects are formed by heating the raw plastic to around 200 °C. This makes the plastic rather soft. They are then pressed into dies at high pressure, or (for crisp packets) pulled into sheets. The plastic then cools and even though it is highly strained, it can't shrink back to its preferred size. When heated, it becomes soft, and the strain is relieved and the object shrinks.</p> <p>What is a microwave ready egg?</p>	
<p>Thanks - another informative and entertaining evening.</p> <p>Question: When walking in the Lake District or Scotland there is frequently no mob. phone signal. Is this because there are not enough masts or is it anything to do with the mountains blocking the signal?</p>	<p>You are welcome.</p> <p>Both. The microwaves used by cell phones travel through walls made most things relatively easily. But they can't go through too much rock (mountains), and they can't go through soil because of the moisture content. So the cell phone signals are blocked by mountains. It's a matter of opinion whether there are 'enough' cell phone masts.</p>	
<p>I didn't know that the Govt. was looking at the time kids spend on their phones.</p> <p>And now I know!</p> <p>Thanks I learnt a lot.</p>	<p>Not the government. MTHR which is paid for 50:50 by government and mobile phone industry. However MTHR are independent of either.</p> <p>You are welcome.</p>	
<p>Another interesting session.</p> <p>Does food cooked in microwave oven continue to emit waves when being eaten?</p>	<p>Good.</p> <p>Every 'thing' at a temperature above absolute zero emits electromagnetic waves. Why? Because above absolute zero the atoms are jiggling and because they are electrical they send out waves into the electric field. Objects at room temperature emit most waves at a frequency of about <math>10^{13}</math> Hz i.e. 10,000 GHz (compared to the 2.45 GHz of the microwaves in the oven). But objects at room temperature do emit microwaves and radio waves as well. So to answer your question, food cooked in a microwave oven does emit microwaves after it is cooked, but no more than if it had been cooked in a conventional oven.</p>	

You said	I said
<p>I t will be my <u>Birthday</u> on the final week! I will be glad to be at this lecture on my birthday as it is my favourite subject and I am glad that I have such a good teacher to teach me!</p> <p>1. What is the average brain temperature (in degrees Celsius). Thank you for a good and interesting evening. I will be sad to leave.</p>	<p>Thank you for those kind words. And Happy Birthday.</p> <p>I don't think Brain Temperature deviates much from core body temperature of approximately 37 °C. Interestingly, it has become a standard treatment for neonatal babies who have suffered brain trauma, to cool their brains to around 25 °C – its seems to help them recover. We became involved trying to measure the <i>internal</i> temperature of the brains of babies using a non-invasive technique. The technique we chose to try was to measure the microwaves <i>emitted</i> by the babies heads. It was a very challenging project and probably will never see the light of day..</p>
<p>One thing I'm unclear on: Is it microwaves that penetrate up to 5 cm or radio waves?</p>	<p>Microwaves. Waves at a lower frequency such as normal radio waves are only very weakly absorbed and so go straight through us. Waves at a higher frequency penetrate less and less far so that infra red and visible light are essentially absorbed in the first fraction of a millimetre.</p>
<p>Our microwave doesn't have a rotating plate what ensures that there are no hot spots?</p>	<p>Two options. If your microwave is very, very cheap, it could be that it just has hotspots! Alternatively, if you paid more than £19.99, then there will a hidden moving baffle which alters the way the microwaves enter the chamber and so moves the hot spots around. This has the same effect as moving the food through the hot spots.</p>
<p>I have a very simple mind and just cannot understand why radio waves (or any other waves come to that) seem to have a charmed life, i.e. that they do not collide with other waves, and thus get diverted or distorted or destroyed.</p>	<p>What a great question. By looking out at the sky at night, we can see light waves which have travelled uninterrupted for literally billions of years. Using radio telescopes we can detect radio waves and microwaves which have made the same journey. During that journey, other light waves will have passed 'through' the light wave we detect millions of times. Mmmm.</p> <p>What we observe is that each wave travels on exactly as it would have done if the all the other waves had not been there. In other words, each wave does not 'do' anything to the space through which it travels that might affect how other waves then travelled through that region. This was a really profound observation and has been exhaustively tested and found to hold to very high precision.</p> <p>Other waves do this too, but not so perfectly. For example. Water waves pretty much go right through each other, but not perfectly.</p>

You said	I said
<p>Is it true the quietest room in the world is covered in sponges because sponges absorb sound waves?</p> <p>Mobile phone companies should sponsor phone health research.</p>	<p>Yes. At NPL we have such a room – it is called an <i>anechoic</i> chamber (an-echoic = no echo). We also rooms (see below) which are anechoic for radio waves and microwaves which we use for testing antennae such as those used in base stations. Any radio waves or microwaves which strike the walls are either absorbed or reflect off the triangular baffles into crevices in the walls.</p>  <p>They do. But if they pay for all the research then no one will trust the results. So they pay 50% and the government pays 50% and MTHR does the work independent of either.</p>
<p>Told you it was magic!!! Love you Dr Egg. How many phones will it take to cook my brain? (ringing at the same time) What happens if I stick my pet gerbil in the microwave?</p>	<p>What was magic? I will pass your message to his relatives. Oh. Sorry, we ate his relatives for lunch ☹️ A phone ringing is not transmitting, but receiving. I don't think you could get enough phones close enough to your head to do you any damage. My guess is it would take around 1000 phones all transmitting (not receiving) at the same time.  Please don't even talk about that. The gerbil would die in agony.</p>

You said	I said
<p>What are the wave in the electromagnetic spectrum made up of? What is a photon?</p>	<p>What are water waves made of? You might say water, but that would be wrong. The waves are certainly <i>in</i> the water, but the wave itself is the <i>pattern</i> of movement and displacement. Similarly with sound waves: the waves are moving <i>patterns</i> of pressure in the air. In each case the entity that moves from one place to another is the <i>pattern</i> of motion: not the air or the water.</p> <p>Electromagnetic waves are similar. The 'medium' in which the wave travels is the electric field which fills all of space. Remember we saw in Week 1 how one electrical thing affects another electrical thing: it was a three step process: - first it affects the field, then the change in the field travels through space, and then the change in the field affects the second object. But the wave itself is really the <i>pattern</i> of displacement and motion in the electric field.</p> <p>The only way to create a wave in the electric field is by moving an electrical charge. We have learned experimentally, that we can only emit energy into the field or take it from the field in small finite 'chunks' called <i>photons</i>. So for example, when an atom vibrates at its natural frequency and emits a wave at a particular frequency, then each atom only vibrates for a finite time and the 'chunk' of wave that it emits can be referred to as a <i>photon</i>. Very roughly.</p> 

## Group Discussion: Mobile Phones: What should we do?

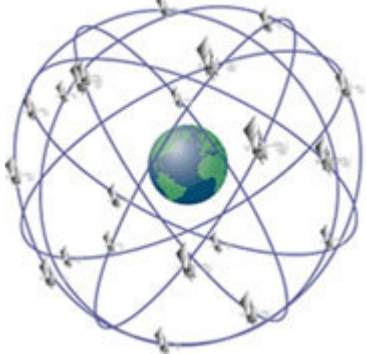
Group: Peter/Emma/David

### Any Confusions?

Flip Chart Said	Michael Commented
<p>Comment about oven having to have rotation in middle for even heating - mine doesn't, how does it work? <u>Expert</u>: Could have paddle, hidden that rotates and moves hot spots as we have in lab.</p>	<p>Yes. There must be some way to move the hot spots around, so as Dave said, there will be a hidden paddle to do the stirring if the food doesn't rotate.</p> <p>Incidentally, the hot spots arise from interference that we discussed in Week 2. The waves bounce of the walls many times and if there is no stirring, there will be certain positions where they always add up, and others where they cancel. The wavelength of the waves in the microwave is approximate 10 centimetres.</p>

Flip Chart Said	Michael Commented
<p>If damage to CD. Why doesn't it do that to walls of microwave?</p> <p><u>Expert:</u> Plastic arcing, not metal, walls reflect.</p>	<p>It's complicated and I don't understand it exactly, but this is what I <i>think</i> happens. It is the very thin metal film in the CD that causes the problem. As I mentioned, the electric field of the microwaves inside the oven is enormous: I calculate it to be over 100,000 volts per metre. This causes electrons flow in the metal film causing it to heat and in places burn and crack. When it was cracked, there were now massive voltages between the different metal 'islands' and the sparks you saw were where the electric field across the small gaps between the islands exceed 3 million volts per metre.</p>
<p>How does it not get out door?</p> <p><u>Expert:</u> Mesh. Size of wavelength/size of mesh holes.</p> <p>What grill made of / metal?</p> <p><u>Expert:</u> Metallic or impregnated/wires small holes. Could be silvered paint.</p>	<p>Yes. The door has a criss-cross pattern of wires embedded in the glass such that the gaps are around a millimetre or so, one hundred times less than the wavelength of the microwaves. The microwaves cause electric currents to flow in the wires and these moving electrons re-radiate the microwave energy back into the oven</p>
<p>Why don't bounce from wall to next?</p> <p><u>Expert:</u> It does. I imagine fast squash ball bouncing around random.</p>	<p>Yes, the microwaves are reflected many many times from the walls. If there is nothing to absorb the energy within the oven, then</p>
<p>Why doesn't produce light like CD?</p> <p><u>Expert:</u> That's from plastic.</p> <p>Shouldn't put in metal, like foil?</p> <p><u>Expert:</u> What with metal. You mustn't run without anything.</p>	<p>Why doesn't what produce light like a CD? It is not the plastic which gets hot (in general) or sparks. It is things which conduct electricity which heat up to the point where plastics and metals can vapourise and sparks and plasma balls can be created - very extreme and strongly NOT recommended for experiments at home.</p>
<p>Antennae. If 6° down - don't get reception in building that antenna is on roof of?</p> <p><u>Expert:</u> Not sure about cells, but guess get signal from neighbouring /overlap cells? Tracking is incredible..... magic.</p>	<p>Reception directly underneath the antennae is not zero, but nearly so. If the signal was zero, as David says, you would still be able to pick up a connection to the neighbouring base station.</p> <p>By tracking I guess you mean the way the central computer seamlessly tracks our location and can hand over the call from one cell to another as we are moving without us even noticing.</p>



Flip Chart Said		Michael Commented
<p>What about other rays hitting us? GPS/Tom Tom</p> <p><b>Expert:</b> Don't know freq. from satellite - will be out of absorption bands to get through. Probably very small.</p>	<p>The GPS signals come from satellites orbiting around 12,000 miles above us. They broadcast a signal to Earth at a frequency of either 1.2 GHz or 1.5 GHz. It has very low intensity when it reaches us.</p> 	
<p>Masts - What is the average distance between masts? Urban 2-3 miles.</p> <p>Trade off - if everyone had one or not, would be lower power.</p>	<p>I would have thought rather less than 2 to 3 miles. In central London it is much less than this - just a few hundred metres. Each cell can only handle a limited number of calls, and so cells need to be closer together in places where many people need to make calls at the same time.</p>	
<p>BT scheme using your own wireless internet rather than mobile phone masts.</p>	<p>Yes. There are now systems some times domestic 'femto-cells' which are like a local base station covering just a house. When you use your mobile phone at home, they recognise it as yours and route your calls in a cheaper way than the using the mobile phone network.</p>	
<p>Free laptop per child programme. Pioneered peer-to-peer networking system to phone hop across country. Where did it go?</p>	<p>I'm afraid I don't know about this. But you can always use <i>Skype</i> or similar if you want free calls.</p>	
<p>Why when near loud speaker makes noise?</p> <p><b>Expert:</b> Burst pulses picked up, not understood. Click on speaker.</p>	<p>Yes, if you leave a mobile phone near to a computer or some hi-fi equipment, the tiny currents induced in wires (which act as antennae) are amplified and can be heard through the loudspeakers. One can sometimes hear these just before the phone rings - as the phone exchanges information with the cell mast. Sometimes you can hear the pulses a propos of nothing - this is the cell phone system checking the location of all the phones its thinks are still in its cell.</p>	

## DISCUSSION

### How do you feel about masts?

Flip Chart Said	Michael Commented
<p>People nearer to mast experiencing higher signal in homes. If mast high and you're in a high building - eye level with mast in direct line of sight. Could this be bad?</p>	<p>Yes. If you are closer to the mast you will receive a high signal. Yes, I have seen</p>
<p>Constant source from mast - whereas phone</p>	

Flip Chart Said	Michael Commented
<p>you can turn on and off? So constant, additive. Small amount not a problem – but is constant, small amount worse than occasional higher power.</p>	
<p><b>Expert:</b> Is it on constantly? Not sure. Urban area. 100 calls per min. If you don't want phone close to you – don't put on vibrate as then closer to you.</p>	<p>The mast broadcasts are a mixture of a constant signal with intermittent activity depending on how busy the cell is.</p>
<p>Do we get microwaves off powered railway lines or electrical pylons? Large scale, high voltage transformers. <b>Expert:</b> Lots of safety for transformers/railways. Pylons – effects small, but worried at long-term exposure, e.g. above your bedroom. Problem to prove cause and effect with small effect of disease exposure.</p>	<p>No and No  The type of electromagnetic wave that comes from pylons is very low frequency 50 Hz (50 oscillations per second) rather than 1 GHz (One billion oscillations per second). There is currently no evidence at all of any harm arising from these waves. In most <i>domestic</i> wiring, electric currents flow in two wires but in opposite directions so the electromagnetic waves they generate almost perfectly cancel. However there are exposure guidelines from ICNIRP. How much of <i>your</i> money would like to spend asking scientists to look for possible harmful effects from these things?</p>
<p>Masts – how do you feel about them? What Michael told us is reassuring. But what if selling your house and mast at bottom of garden – hard to convince buyer “no problem” – “send buyer to PFB”.  How does mobile phone radiation relate to general background? <b>Expert:</b> If you look at spectrum in modern room, get lots of blips – CRT, lights, wifi.... phones amongst them.</p>	<p>Good. I think you should be re-assured. <i>MTHR</i> has stopped research into the effects of base station because there is the dose is so low compared to individual use of a phone. They are however funding research in which people wear monitoring equipment throughout a day to see exactly what a typical exposure of an individual really is. The issue with house prices and ‘property blight’ is interesting. I have asked people why they object to masts and they constantly say they don't have a problem with them, its how they think <i>other people</i> will perceive that bother them.  Yes, there are electromagnetic waves from natural and man-made sources all around us. Most of them go straight through our body without having any effect. Microwaves from mobile phones are one frequency which is especially strongly absorbed.</p>
<p>Stewart Report recommended precautionary with young children (&lt;12?) → What do you feel about that? Stewart report 5 years old. Assume phones better now</p>	<p>The report is available on line and you can read the rationale yourself. The concern was that children's brains are developing (we hope ☺) and that if there was a harmful effect, it might affect children more. Also, if any hypothetical harm were related to dose, then children who grow to be 80 (say) may then use for a</p>

Flip Chart Said	Michael Commented
than then?	phone for 70 years, whereas adults who are (say) nearly 50 (OMG) probably only will use a phone for a further 30 years.
<p>I s concern about children using phones because child's skull is thinner?</p> <p><u>Expert:</u> Rapidly varying field potential effect on nerve impact.</p>	This was another reason I forgot to mention in the previous box.
Should we not use our own? mobile phone near children.	The field from the phone falls off rapidly with distance so that the SAR falls to a tiny fraction of the standard SAR ..
Mobile phone and driving - doesn't stop.	Yes, and I read today that it is apparently even more prevalent than before the change in the law. This has definitely caused many deaths.
Damage to health from stress that you can always be contacted. I f turn off/	I think that can be very real for some people. Some people I know would hardy know what to do if they were separated from their phones for even a few minutes.
But feel safe, esp. that son can contact me - benefit outweighs worry.	I think it's the prevailing view and the reason that most parents give their children phones. It could be argued that this slows the rate at which children take responsibility for their own safety, but it does stop parents worrying.
<p>Phones are relatively new, but radiation (communication by microwaves) isn't - so are there earlier studies for other sources of microwaves?</p> <p>Come off phone and phone is hot - something there.</p> <p><u>Expert:</u> Partially you heating it by hand.</p> <p>Reply - my phone it's definitely heating itself.</p>	<p>Yes. The nature of the hazard became apparent when early microwave engineers stuck their heads inside huge microwave transmitter horns - the things you sometimes see on the side of towers such as the BT Tower in London. Eventually many of them developed cataracts - basically they 'cooked' the lenses in their eyes in the same way that heating eggs turns the clear liquid white.</p> <p>There is a fundamental law of electronics that every device which radiates power, has to itself dissipate at least that much power within itself. With phones the power dissipation is due not only the transmissions, but also the lights and the computer inside which handles your address lists and games and so on. So your phone probably uses up several Watts of power which is why it becomes warm. Also holding it in your hand also warms the phone. When measuring the heating effect of the phone, one needs to account all these effects.</p>
<p>Impact on wildlife - birds flying very near mast? Is this problem</p> <ul style="list-style-type: none"> <li>• bees are ???????</li> </ul> <p>Magnets in bees sending them towards</p>	I have not heard any evidence of harm. The issue of bees is interesting and I wrote to the professor in Germany who published papers on this. His experiments were weak in my opinion. I f I recall correctly, he placed a mobile phone base station inside several hives and found that bees didn't like it when it was switched on. There could be all kinds of reasons for that, and it doesn't really simulate the real

Flip Chart Said	Michael Commented
<ul style="list-style-type: none"> <li>• Not design criteria – birds like to sit on tall things.</li> <li>• Does industry scare birds intentionally away with clicks etc?</li> </ul>	<p>situation of rather small numbers of base stations. While the colony collapse disorder that has struck US and UK hives is not fully understood, it is associated with multiple parasitic infections and is very unlikely to have associations with mobile phones.</p> <p>I don't believe birds are deliberately scared away.</p>

### CHILDREN

<p>22 Children - Only 4 aware of guidance.</p> <ul style="list-style-type: none"> <li>• knowing the guidance made no difference</li> <li>• ~50% of children think lots of government guidance is misguided!</li> </ul> <p>Not affected by seeing spoof videos of mobile phones frying eggs or cooking popcorn even though they thought the video was real!</p>	<p>It is slightly shocking that only 18% of the children knew about the guidance.</p> <p>Basically the children just wanted mobile phones and simply didn't believe that any harm could come to them. Ahhh, youth.</p>
<b>THEY'RE GREAT!</b>	This is a simple summary of the children's position!
<p>Half great: – talk – text – pictures – facebook.</p> <p>Half bad: Expensive</p>	The bad side of mobile phones that children identified was their cost!
If scientists think is OK – then it must be OK!	Good point: most of the scientists in the helpers group have mobile phones.
Texting is cheaper.	I indeed, and has a lower SAR
Even if harm was shown – still keep your phone.	Like I said , nothing will stop them!

### ADULT GROUP LEFT (OF CENTRE) STEPH'S LOT

Flip Chart Said	Michael Commented
Swedish Research on Children impact –Stuart Report – longer term exposure – brains still developing.	Yes. The reasons for taking extra care of children's exposure is that (a) They don't have a clue how to assess such risks [see above!] (b) their brains are still developing and (c) they still have to live with 70- years of exposure whereas 50 year olds such as myself only have 30 years – ish left.
Protective shields any use? – useless – a con – absorb some output, phone ramps up signal, batteries run out faster.	Yes. The phone compensates for the poorer connection to the base station.
Texting better – not so close to body – quicker burst of broadcast.	Yes.

Flip Chart Said		Michael Commented
Base stations near schools? - Signals much lower but continuous exposure.	I spoke with someone the other day at a school at which a child has suffered from leukaemia. They were adamant that the death was caused by nearby mobile phone masts and they led a campaign to have them removed. However despite their unshakeable faith, they still used a mobile phone and allowed their children to use the too!	
Thermal effects far less than that of having a shower.	Yes. Or sleeping with one's head on a hot water bottle.	
Old fashion mobile phones - more or less dangerous? <ul style="list-style-type: none"> <li>• Think they were about the same.</li> <li>• Earlier police ones at lower frequency were much more powerful.</li> </ul>	The modern police and emergency system has the same SAR limits as mobile phones	
Radio waves from hundreds of TV/radio stations are going through our heads all the time - the difference is we have no choice about these?	Yes.	
Crook neck issue from holding phone on neck - suggest use headphone.	I can't help with that I am afraid.	
Bluetooth headsets? - power levels very low as range $\approx$ metres.	Yes, the peak out power is usually 0.1 Watt or 0.01 Watt compared with 1 Watt for a mobile phone.	
Other effects in addition to heating effect? <ul style="list-style-type: none"> <li>• transport of Ca across cell membranes</li> <li>• small effects no significant harm.</li> </ul>	Effects have been observed in experiments with cells in a glass dish, but no evidence of harm to people.	
Suggested increase size of aerial - 'antenna-coat'. So less power needed for base station.	The antennae are already quite cleverly designed.	
Police Walkie Talkie has affected car electronics (car wouldn't start!).	I am very surprised. Was that because of some interference with the computer system that runs your car?	
Is phone size related to power? - no.	There is no absolute link, but	
Mobile phones switch off at petrol stations? Hmm - NMO responsible for reducing effects of tweaking meters at petrol stations.	There was originally a fear that mobile phones could cause a spark. This stemmed from a case near a high power microwave radar which emitted a powerful (kilowatt) beam of radiation. This could cause sparks (as we saw in the oven) some distance away. More recently there are stories that the mobile phone signal affected the electronics in the display.	