

# Understanding Cancer

Understanding Cancer is a cancer information service based in the North of Scotland. It is owned and operated by Avril Morrison PhD. Avril is a research scientist and comments on the latest research findings and news on her blog "Understanding Cancer".

## Upcoming Events

By Avril on December 18th, 2009

This post lists some of the upcoming events happening in Aberdeen City/Aberdeenshire in 2010, including talks and lectures, fundraisers and professional classes and courses.

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This events list is loosely based on a scientific/medical theme.

If you would like to add an event to this list, please use the [contact form](#) to get in touch with me. The usual warnings apply, I'm not responsible for any errors, check with the organisers before travelling etc etc.

Several Local Charities have their own Fundraising/Events Websites

- [CRANES](#) – Fund cancer research in Aberdeen
- [UCAN](#) – Support and fund research into urological cancers in Aberdeen
- [CLAN](#) – Cancer Link Aberdeen and North – Support people with any type of cancer and their family and friends
- [Friends of Anchor](#) – Supports the work of the Aberdeen and North Centre for Haematology, Oncology and Radiotherapy at Foresterhill

Other Local Scientific and Medical Events

- [Satrosphere](#) – Aberdeen Science Centre
- [Aberdeen University](#)
- [RGU](#)
- [Techfest](#) – Aberdeen Festival of Science and Technology
- [STEM](#) – North of Scotland
- [STEM](#) – North East of Scotland

## 2010

### January

18th January – [Cafe Med](#), Foresterhill, Aberdeen – Osteoarthritis

20th January – Cafe Scientifique, [Waterstones](#) Aberdeen – Sponges Washing Powder and Cuddly Dolphins

### February

15th February – [Cafe Med](#), Foresterhill, Aberdeen – Diabetes

16th February – Cafe Scientifique, [Woodend Barn](#), Banchory – Black Holes, Interstellar Travel and the Origins of the Universe

17th February – Cafe Scientifique, [Waterstones](#) Aberdeen – Does God play Dice?

### March

1st-5th March – Aberdeen University – [Applied Epidemiology](#) Course

2nd -5th March – Moray Science Festival (there are also science festivals in Caithness, Inverness and Orkney)

15th March – [Cafe Med](#), Foresterhill, Aberdeen – Asthma

16th March – Cafe Scientifique, [Woodend Barn](#), Banchory – Sexy Science

17th March – Cafe Scientifique, [Waterstones](#) Aberdeen – Getting Around

### April

7th-9th April – [Today's Research – Tomorrow's Therapies](#) – AICR Conference – St Andrews

11th April – [Forget-Me-Not Walk](#) – Leukaemia Research – Dundee

12th April – [Cafe Med](#), Foresterhill, Aberdeen – Bowel Disease

13th April – Cafe Scientifique, [Woodend Barn](#), Banchory – Forensics on the Brain

14th April – Cafe Scientifique, [Waterstones](#) Aberdeen – Forensics on the Brain

### May

10th May – [Cafe Med](#), Foresterhill, Aberdeen – Heart Health

11th May – Cafe Scientifique, [Woodend Barn](#), Banchory – Why is snot Green?

12th May – Cafe Scientifique, [Waterstones](#) Aberdeen – Laughing at Language

## June

15th June – Cafe Scientifique, [Wooden Barn](#), Banchory – In Your Guts

19th June – [MoonWalk](#), Edinburgh

26th-27th June – Relay for Life – [Turriff](#)

## July

3rd-4th July – Relay for Life – [Huntly](#)

10th-11th July – Relay for Life – [Peterhead](#)

## August

## September

10th – 27th September – [Techfest](#) – Aberdeen

12th September – [Forget-Me-Not Walk](#) – Leukaemia Research – Aberdeen

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## Dates for your Diary – 2010

By Avril on December 17th, 2009

If you are in Aberdeen/Aberdeenshire and you are interested in Science/Medical topics here are a few dates for your diary.

In 2010 there will be THREE [cafe scientifique's](#) running, in Union Street, Foresterhill and Banchory (Woodend Barn).

These events are free (or by donation) and are open to anyone, the speaker will give a short introduction and then the floor will be open for debate, you don't have to be a scientist to go along and enjoy the event, they are open to everyone.

- [Aberdeen City – Waterstones](#)
- [Foresterhill – Suttie Centre](#)
- [Banchory – Woodend Barn](#)

There are talks on a wide range of subjects, astronomy, forensics, diabetes, arthritis among others. So if you get a new diary or calendar for Christmas make sure and pencil a few of the dates in. I was able to pick up some leaflets advertising all three Cafe's at my local community centre, so have a look around and you should be able to find some.

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## Can a CT scan give you cancer?

By Avril on December 16th, 2009

Can a [CT scan](#) give you cancer? Yes, occasionally. A research study published on the 14th of December 2009 looked at whether CT scans increase your risk of cancer, this was covered in the Press and Journal "[CT scans may increase risk of cancer](#)". CT scans (also known as CAT scans) use X-rays (a form of radiation) to build up a picture of your insides. Normal

X-rays can only show up bone, but CT scans can show arteries, organs (e.g. brain, liver, spleen) and abnormal tissue.

Radiation can damage (mutate) your DNA, in particular it can cause "double stranded" breaks in both chains of the double helix. These sort of mutations can (over time) lead to cancer. Usually, you are speaking about a long time 20-30 years. Generally, in the UK you are only given a CT scan if you really need one, for example after a car accident (to check for internal bleeding or damage to your bones); if your doctor thinks you may have had a stroke or a problem with your heart or to look for cancer (e.g. tumours in your liver or bowel). As a rule, the risk of getting cancer from a CT scan is around 1/1000, but as they are only done when absolutely necessary, for example to see if you are bleeding inside, then the benefits of the scan usually outweigh the risks. There is more concern in America, where CT scans are routinely ordered to protect doctors from legal action. In fact, some companies in America "sell" CT scans to healthy people, clearly there is a problem with this as the risk is much more likely to be greater than the benefit (i.e. it is more likely to cause cancer than find anything wrong with you).

The new research published in the Archives of Internal Medicine is called "[Radiation dosage associated with common computed tomography examinations and the associated lifetime risk of developing cancer](#)" and was carried out in 4 different hospitals in San Francisco, California. The article is well written and relatively easy to understand (well, for a scientific paper, anyway). The scientists studied 1,119 people. Scans to the abdomen and pelvis used the largest amount of radiation and also showed the widest range of dose (from 6-90 mSv). Interestingly, each of the 4 hospitals studied had the highest dose of radiation for at least one of the types of study investigated and they were all using the same make of CT machine.

In general, the research showed that woman needed fewer CT scans to cause cancer than men, for example they quote that:

*Based on the highest effective dose we observed, a 20-year-old woman who underwent a CT for suspected pulmonary embolism, a CT coronary angiography or a multiphase abdomen and pelvis CT scan could have an associated increased risk of developing cancer of as high as 1 in 80*

This means that for every 80 women who have (for instance) a pelvic CT scan 1 will develop cancer as a result of that scan. The authors argue, very sensibly that three things need to happen as a result of this study:

1. Hospitals need to make sure the way they carry out the scans uses the lowest dose of radiation possible
2. CT scans should only be carried out when absolutely necessary (this is already the case in the NHS).
3. Record and track how many CT scans a person has had in their lifetime and what dose of radiation was used

If you want to learn more about this study you can watch a video on [Insider Medicine](#) and listen to an interview with one of the principal investigators. This research was carried out in America and they point out that in the UK steps have already

been taken to minimise the amount of radiation used in CT scans.

What does this mean if you have had a CT scan? You will only have been given a CT scan if you really needed one, it seems in this case standard NHS care is better than normal practice in the US (where they tend to use scans much more frequently).

If you are due to have a CT scan discuss this with your doctor, scans on different parts of the body use different amounts of radiation and they will be able to advise you on the best course of action. Please also note that MRI (Magnetic Resonance Imaging) scans and CT scans are different. MRI scans do NOT use x-ray radiation. CT scans do use x-ray radiation. It is the radiation that can damage your DNA and give you cancer, having an MRI scan does NOT increase your chances of getting cancer.

Smith-Bindman, R., Lipson, J., Marcus, R., Kim, K., Mahesh, M., Gould, R., Berrington de Gonzalez, A., & Miglioretti, D. (2009). Radiation Dose Associated With Common Computed Tomography Examinations and the Associated Lifetime Attributable Risk of Cancer *Archives of Internal Medicine*, 169 (22), 2078-2086 DOI: [10.1001/archinternmed.2009.427](https://doi.org/10.1001/archinternmed.2009.427)

Other blog posts

[American Cancer Society – Dr Lens cancer blog](#)

[Nature Network – Martin Fenner](#)

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## MRI Scans at ARI

By Avril on December 15th, 2009

Some of the first MRI scans in the world were carried out at Aberdeen University, the first patient was scanned in 1980. Aberdeen University continues to research and develop MRI technology. If you are interested, you can read about the technical details of the scanners at Foresterhill on the [Aberdeen Biomedical Imaging Centre](#) website.

BUPA produce a good [factsheet](#) explaining what happens when you have an MRI, the NHS Choices website has information on [MRI scans](#) and you can also read the NHS Direct information – [MRI Scan](#) – online. Great Ormond Street Children’s Hospital website has information on [MRI written for children](#). An MRI can be used to study lots of different diseases, having an MRI scan does not mean you have cancer, it can also be used to look at the heart, the brain and your bones and joints.

An MRI scan doesn’t hurt, you lie on a table but no part of the scanner touches you. The table is moved into a short circular tunnel (the magnet). There’s not much to look at and it is quite a small space, you’ll soon find out how your socks feel inside your washing machine! You aren’t supposed to move during the scan as it makes the images blurry and as soon as you are told to lie still you’ll discover itches you didn’t know you had. It is noisy, mostly a loud banging, hammering, drilling sound that lasts about 5 minutes and then it will be quiet for a bit before starting up again. This is normal and a scan can last from 30 minutes to 1.5 hours. You can [listen](#) to the sound of an MRI machine on the [Royal College of Radiologists](#) website.

If you would like to learn more about the science behind MRI scanners then visit the Wellcome Trust Channel on

YouTube and watch [MRI – Deciphering Inner Space](#), they’ve also produced a video called [Steve Gets a Brain Scan](#), which describes how one of their staff felt when he had an MRI done.

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## VEGF – How can we stop the blood supply to cancer cells?

By Avril on December 14th, 2009

I haven’t written about VEGF before, not because it’s not important, it is, in fact VEGF has been shown to be important in a whole range of solid (i.e. lump forming) tumours, these include:

- Bladder
- Breast
- Cervical
- Colorectal (bowel)
- Esophageal (food pipe)
- Glioblastoma multiforme (brain tumour)
- Head and neck cancer
- Lung cancer
- Ovarian cancer
- Pancreatic cancer
- Renal cell carcinoma

Generally speaking, if you have a lot of VEGF it’s a bad sign (or in medical speak “a poor prognosis”). As you might expect given the list of cancers above, a lot of labs and drug companies are researching VEGF. It will also not surprise you to learn that VEGF biology is very complicated. None the less I want to write about a paper that appeared in the *Journal of Cell Science* called “[Expression of pro- and anti-angiogenic isoforms of VEGF is differentially regulated by splicing and growth factors](#)”. This paper is the work of several research labs in Bristol. If you want to know more about this research visit <http://www.ladomerylab.org>

Before I start discussing any paper, I like to make sure I understand the title, that’s where I’ll start.

So what is VEGF?

VEGF stands for vascular endothelial growth factor A.

Okay, what does that mean?

Vascular means a system of tubes to move fluids around your body, in this case the tubes are blood vessels and the fluid is blood. Endothelial is a fancy name for a type of cell that makes the inside of blood vessels. A growth factor is a chemical in the body that makes things grow. So in this case, VEGF is a protein that makes blood vessels grow. We all have VEGF inside us, we need it to live, for example if you cut yourself you need to form new blood vessels to repair the damage.

pro and anti- angio what?

Angiogenic is scientist speak for growing new blood vessels

- *Pro-angiogenic* means it encourages the growth of new blood vessels
- *Anti-angiogenic* means it stops the growth of new blood vessels

What does isoform mean?

Isoform means “different types”. In this paper it means different types of the protein VEGF.

Okay and what is differential regulation?

Differentially is a fancy way of saying different, and regulation is another way of saying control. So differentially regulated means that different things control what happens inside the cell. For example you could control the temperature in your house by

1. Turning down the temperature on your thermostat
2. Turning down a radiator
3. Opening a window

These are all examples of “differentially regulating” the temperature in your house, i.e. they are all different ways of doing the same thing (controlling the temperature in your house). Inside a cell you can control the amount of VEGF protein in different ways

1. By splicing
2. By growth factors

What is splicing? it sounds painful...

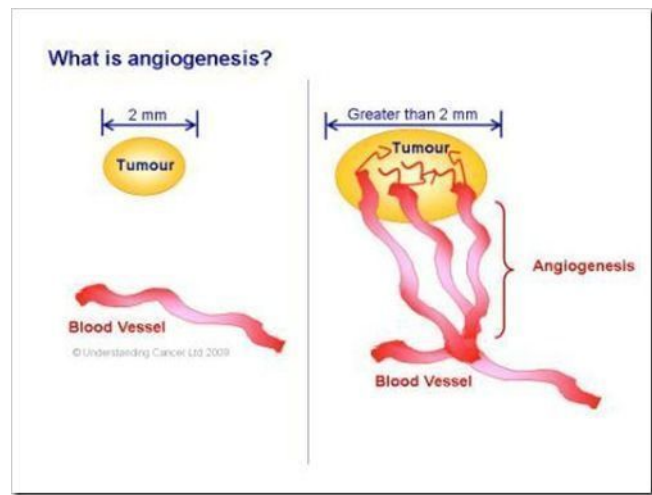
Splicing means joining things together to form a new combination. A fisherman may fix his fishing nets by splicing two bits of rope together or an electrician may splice two bits of wire together. Your body does the same thing with genes, it makes different proteins by chopping up DNA and rejoining them together in different combinations. The bits that are cut out are called “introns” (go figure), the bits that are left in are called “exons”. Different exons can be stuck together in different combinations. This all sounds very haphazard and random, but it’s not. It’s a very specific and controlled process.

So to sum up – Expression of pro and anti-angiogenic isoforms of VEGF is differentially regulated by splicing and growth factors means... There are two types of VEGF in your body, one that makes blood vessels grow and one that makes blood vessels stop growing. The type of VEGF in your cells is controlled by (at least) two different things, splicing and growth factors.

What has all this got to do with cancer?

Cancer needs blood vessels to grow. Most tumours would not grow bigger than couple of millimetres if they didn’t attract their own blood supply. When a tumour attracts new blood vessels into it this is called “angiogenesis”. There are new drugs available that block VEGF and stop tumours growing.

Unfortunately, after a couple of months the tumours get used to these drugs and start growing again. We need to understand why this happens and that is why this research paper is important.

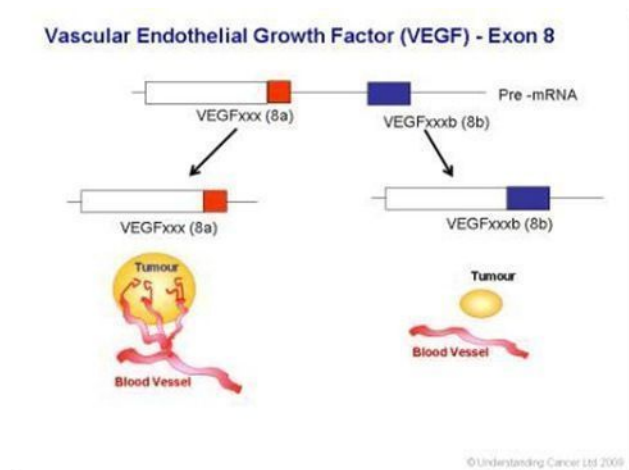


This picture shows the formation of new blood vessels (angiogenesis). On the left is a small tumour that has not attracted any blood vessels. On the right is a larger tumour that has attracted its own blood supply.

The research in this paper describes how VEGF can have different effects, some types can inhibit (stop) blood vessel growing and other types can encourage blood vessel to grow. Your body controls which type of VEGF and how much VEGF is inside you by controlling growth factors and splicing factors. The control of new vessel formation is complicated and involves at least 50 other proteins as well as VEGF.

So how do you get different types of VEGF?

You get different types of VEGF by a process called splicing, this is when the VEGF gene is cut up and reassembled in different combinations. In the picture below, the rectangles represent the pre mRNA (which comes from the VEGF gene). If the sequence in the red box is included then the protein will be called VEGFxxx and it will encourage new blood vessels to grow. If the sequence in the blue box is included then the protein will be called VEGFxxx<sub>b</sub> and it will inhibit new blood vessel formation (and prevent tumours growing).



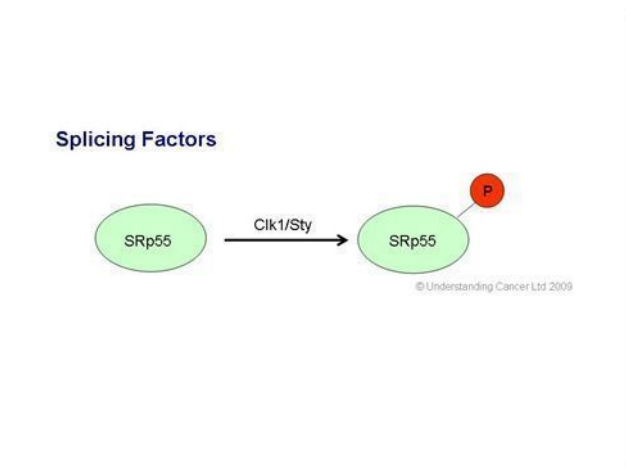
So if you have a tumour, you want less of the VEGFxxx with the red box and more of the VEGFxxx<sub>b</sub> with the blue box because this will stop the tumour gaining a blood supply. How does your body control this? How do you control this gene splicing?

There are a whole host of other proteins in your body that control splicing, this research is the first to show that splicing

factors can alter which type of VEGF your cells make. The scientists carried out experiments to show that something called SRp55 controls the amount of VEGFxxx.

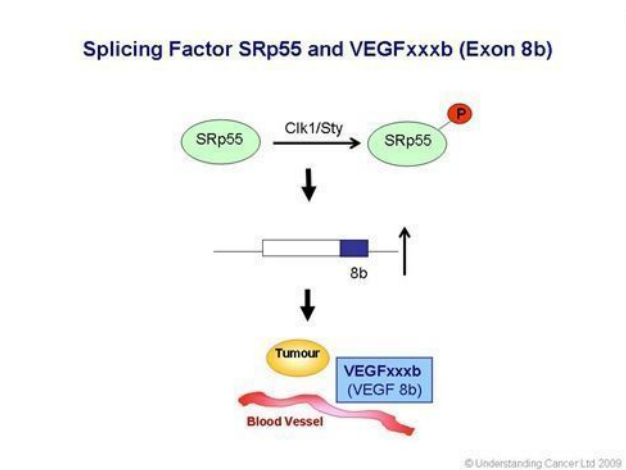
What does SRp55 stand for?

SR stands for serine-arginine, serine and arginine are amino acids and the SR class of proteins contain lots of these two amino acids. The “p” of p55 means protein and the “55” means that when you look at the protein in the lab, on a gel, then it’s size is 55 kDa’s. In the picture below the SR protein is shown as a green circle. This protein (like many others) is turned on by phosphorylation (shown in the picture by a red circle with a “P”).



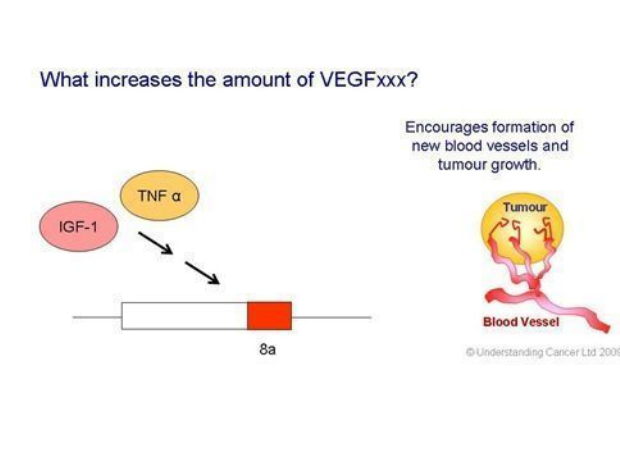
So what have we learnt about this splicing factor from this research?

We now know (because of this research), that splicing factor SRp55 increases the amount of VEGFxxx and that this type of VEGF stops new blood vessels growing. The scientists then went on to do other experiments to show that SRp55 is controlled by another protein called TGF beta via the p38 pathway. This is brand new research, nobody in the world knew that this happened before these experiments were done. We now know there is a pathway inside cells that leads from the splicing factor (the green circle in the picture below), to the VEGF mRNA (the rectangles) that affects the amount of VEGFxxx. This controls how much blood a tumour gets.



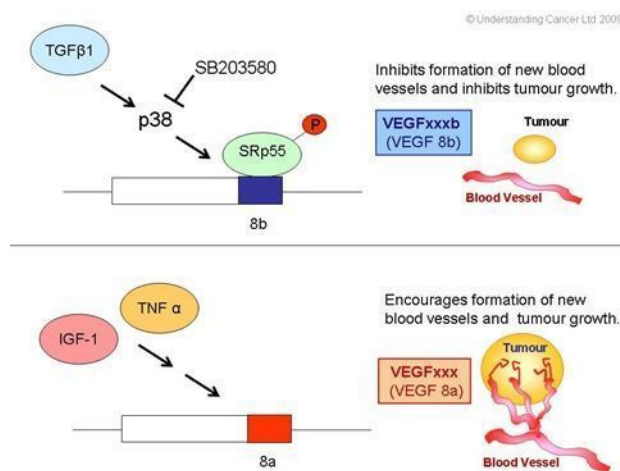
So what about the other one? The VEGFxxx what do we know about it?

The scientists show that different proteins control the amount of VEGFxxx, in particular two proteins called TNFalpha and IGF-1 were shown to increase the amount of VEGFxxx. This encourages new blood vessels to form.



So all in all what did this new research show?

This research tells us for the first time, that a splicing factor can control which type of VEGF you have inside your cells. The splicing factor that controls this is called SRp55 and this is in turn controlled by another protein called TGF beta via the p38 pathway. This research also tells us that a different form of VEGF (one that encourages new blood vessels to grow) is controlled by two other proteins called TNF alpha and IGF-1.



Why is all this important?

Lots of other proteins in the body are spliced. So it is likely that other proteins could have this “dual control” which means that sometimes they turn something on (e.g. blood vessel formation) and sometimes they turn something off. The ratio of these proteins is probably important, so if you have lots of VEGFxxx (the blue rectangle) relative to the amount of VEGFxxx (the red triangle) then your tumour doesn’t grow.

This is pure speculation on my part, but perhaps the new drugs that target VEGF, only work on the VEGFxxx (the red box). We have already discovered a way to stop the VEGFxxx working, maybe now we need to find a drug that can increase the levels of VEGFxxx (the blue box).

This sort of research is called basic research, because it is done in a lab on cells in a dish and it is trying to work out the basic

biology of how normal cells (and cancer cells grow). As you can see this sort of research is complicated and we need to fund more of it, if we want to find out how this alternative splicing affects cancer cells (see my post [We can afford to fund bankers but not scientists](#) for more on my views on science funding in the UK). This sort of study is not limited to cancer as other diseases are also caused (at least in part) by blood vessels growing where they shouldn't, this includes diseases like diabetes, kidney disease, arthritis and heart disease.

What if you are having treatment for cancer now?

This research was carried out in a lab, in cells in a dish. It hasn't been tested in people. This sort of basic research is at least a decade away from being used in a clinic or hospital. That doesn't mean it's not important, hopefully knowing more about how VEGF alters the blood supply to tumours will allow us to develop new drugs (with fewer side effects) that will stop tumours growing.

You can download a pdf of this post for reading and printing here. [How can we stop the blood supply to cancer cells](#)

Nowak, D., Woolard, J., Amin, E., Konopatskaya, O., Saleem, M., Churchill, A., Ladomery, M., Harper, S., & Bates, D. (2008). Expression of pro- and anti-angiogenic isoforms of VEGF is differentially regulated by splicing and growth factors *Journal of Cell Science*, 121 (20), 3487-3495 DOI: [10.1242/jcs.016410](#)

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## We can afford to pay bankers but not scientists?

By Avril on December 10th, 2009

This is a politics rant about cuts to the science and education budgets. One of the advantages of having your own website and working for yourself is that you can write what you like, please indulge me, I am about to have a rant...

Obviously, I am a scientist and have spent most of my working life in higher education in one form or another, so as you would expect, I think science is important, I think it is worth investing in. I also think it is worth educating our young people.

*The Chancellor has announced that £600m will be "saved" by 2012/13 from across "higher education, science and research budgets, including student support". <http://news.bbc.co.uk/1/hi/education/8405680.stm>*

WHAT? Hello? We can afford to pay bankers but not scientists? Who needs medical research? As long as there is enough cash in the banks our country is fine? Right?

I don't work in University administration, but £600 million sounds like a lot of money to me. Working in science is ALREADY tough, getting money (grants) to fund your research is a never ending process. I am a biologist, the government fund biology research through a grant awarding body called the BBSRC. In 2008/09 only [21 % of applicants were funded](#) (down from 28 % in 2005/06). Now I'm sure the BBSRC will argue that they only fund "the best" and the other 79 % of grants just weren't good enough, I honestly do NOT believe that.

Read this BBC [news report](#) and weep. It made me angry, this quote in particular

*But ministers point to a 25% real term increase in funding in higher education since 1997.*

To my mind, it reads like this: Lazy lecturers have had 25 % more money in the past decade (far more than hard working people in the "real world"), now it's time to cut back on this unnecessary waste.

Having worked in higher education for the past decade, I was somewhat aware that this "25 % increase" was not all it's cracked up to be, when I started my degree a decade ago a 1st year intake of 80-100 students was considered large, now lecturers regularly have 200-500 first years. This isn't like school, there isn't one lecturer per 30 students, there is one lecturer to 500 students. Ever tried marking 500 exam scripts in a week? Lecturers have an easy life? Right? You can get more info on the number of lecturers and researchers from the HEFCE website - [Staff Employed at HEFCE funded HEI's](#).

Anyway being a scientist, I realise that anecdotes are not data (see [Science and Evidence Based Medicine Vs Complementary and Alternative Medicine](#) for more of my views on this). So what does the data show?

The Higher Education Statistics Agency collect data on the number of students at University in the UK. You can download tables worth of excel data, showing how many students studied different subjects by year. So the bottom line?

- In 1996-1997 there were 1.7 million students in the UK.
- In 2007-2008 there were 2.3 million students in the UK

I am not a statistician and I am shockingly bad at maths, but I figure that's an increase of about 500,000 over a 10 year period. So, universities have had a 25 % increase in real term funding since 1997 have they? But, wait a minute, they've also taken 25 % more students. Why have the universities taken on more students? Oh yes, because the government wanted them to. It looks good in international league tables.

Anyway, now we need to bail out the banks and all this research, well it's just a waste of money, right? Lets cut back on those "wasteful" research grants and save money for important things, like shares and traders. Who wants new drugs and medical treatments (for cancer as well as other diseases) as long as we're all rich it doesn't matter. Does it?

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## Does loneliness cause cancer?

By Avril on December 8th, 2009

Yes, if you are a genetically bred rat. If you are not? Well the jury is still out. This story was widely reported in the Times, The Daily Mail and the [BBC News](#) website (among others).

As usual, the best place to find out more is the NHS Choices website "[Can loneliness cause cancer?](#)", you will also find links to the press coverage there.

What do I think of the study? It is a good piece of research, published in a high quality journal (Proceedings of the National Academy of Sciences – [PNAS](#)). I'm not convinced that it is directly relevant to humans. Cancer Research UK are quick to point out that overall the evidence suggests stress in humans is NOT related to breast cancer (click [here](#) to read their response). They argue that people under stress are more likely to take up unhealthy habits, for example, over eating or smoking and that this could increase your cancer risk (rather than the loneliness itself).

The rats used in the study were genetically in bred to develop tumours (unlike humans) and what counts as social and stressful for a rat is obviously quite different to stress in a human. The research found that [corticosterone](#) levels were high in the isolated rats but as NHS Choices points out, we don't know what (if any) link corticosterone has to cancer in humans. You can also read more about the study at [Science News Daily](#), where they argue the contrary, that rats ARE a good system for studying cancer in humans.

The bottom line? No one wants to be stressed or lonely and there are a whole host of moral and compassionate reasons for wanting to help people who are struggling. If you are stressed and lonely worrying that this is going to increase your risk of getting cancer certainly isn't going to help your situation.

Likewise, if you have just been diagnosed with cancer, stories like this make you think that you “caused” your cancer by being stressed.

There are many causes of cancer, some like smoking, we can control others like ageing happen to all of us whether we like it or not. So, while I think that reducing stress is a good thing, there are lots of other more helpful ways of reducing your risk of cancer or having it detected early. They aren't “trendy” but not smoking, keeping a healthy weight, exercising and going for any screening tests you are entitled to all have a lot more evidence to suggest you will be better off than if you try to prevent cancer solely by reducing your stress levels alone.

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