



The Art of Breathing

Stressed out at work

Stewart Peterson

Stress, it's all around us, it's in the papers, it's on the news, we're a stressed out nation.

Chris Jameson

Right thank you that's enough, I don't want to hear another word. Okay right Craig.

Stewart Peterson

What could be more stressful than facing twenty eight nine and ten year olds every day, being responsible for their primary education, for looking after them, making sure they behave, and are safely delivered back to their parents. I'm Stewart Peterson, and I spent a day at an inner city primary school, with teacher Chris Jameson, to find out what goes on in the body when we're under stress.

Chris Jameson

Good morning everyone. and I've chosen a hymn which we all know for our first assembly together of the term, so I'd like to hear lots of lovely singing please.

[Sound: Children singing 'Cumbaya']

Stewart Peterson

Straight after morning assembly, Chris is on playground duty.

[sound of children playing]

Stewart Peterson

Well here we are, we've just caught up with Chris as he's on playground duty in the morning break, how's it going?

Chris Jameson

Not bad thank you yeah.

Stewart Peterson

All going well. I wonder if you could tell me, what sort of things in your job make you feel stressed?

Chris Jameson

I think, pressure to get things done on time, and you know you're always working to time limits even within a lesson. Also there's the stress to get things done for other people, other members of staff. Where like I'm responsible for the music curriculum and, other teachers are responsible for areas of the curriculum, so that can be quite stressful, to make sure they're done.

Stewart Peterson

What exactly is stress, and why does it exist. Robert Sepolski is a neuroscientist at Stamford University California. He's an expert in the physiology of stress.

Robert Sepolski

If you are some animal who's been ripped open by a predator and you're running for your life, your body does things. bizarrely enough if you are a westernised human sitting in a frustrating traffic jam, some of the very same things, and part of where stress related disease comes from, is the fact that our stress response is fabulous for sprinting away from the predator, and does nothing good for us when it's in the case of the traffic jam.

[sounds of children playing/talking]

Stewart Peterson

But what about acute stress, for example you're in a classroom, and there's an acutely stressful situation, how do you know, what's happened to your body that tells you that?

Chris Jameson

I think you kind of feel extremely tense and, I mean, I won't say you, you can feel your pulse rate go up but you would probably imagine that it is. There's only been once when I can actually remember feeling, this kind of almost strange sensation where it was after school, I went into the head teacher's office, she'd called me in to speak about something, all of a sudden I came out and felt, wow I was just in there and I can't remember what she said or anything, that's only ever happened once sort of about a year ago, and I said to one of my colleagues, and he said oh that's probably stress.

Stewart Peterson

A whole range of things in the environment and in our minds can act as stressors. Factors that induce the stress response. Patricia Ash is associate lecturer at the Open University.

Patricia Ash

Stressful stimuli, include physical trauma, prolonged exposure to cold, shock infection fright, sleep deprivation pain, and emotional stresses, and although there's a great variation in the types of stressful stimuli, the suite physiological responses to all of them, are essentially similar.

Stewart Peterson

So what exactly is involved in that suite of physiological responses?

Robert Sepolski

Everybody knows that that the key hormone of the stress response is adrenaline, known in the United States as epinephrine, adrenaline is the work horse of the stress response. It's in your bloodstream within a second of something beginning to happen. Somewhat lesser known is another branch of hormones that come out of your adrenal glands as well, called gluco-corticoids, and these are secreted within about a minute or so of the onset of stress, and Adrenaline and gluco-corticoids work hand in hand, they mobilise energy from your liver and your fat cells, they increase the rate at which your heart beats, the force at which it beats, your blood pressure goes up, they turn off the secretion of reproductive hormones, they suppress the immune system, they suppress growth, they suppress for example the deposition of calcium into your bones, things of that sort, they shut down your digestive tract, those are all the things that are absolutely critical for surviving a short term stressor, those are the things which in excess can give you stress related disease.

Stewart Peterson

Cortisol is one of the better known gluco corticoids, what does it do ?

Patricia Ash

Well basically it has two roles. First of all it mobilises fuel reserves, and then it protects the body from the damaging effects of stress. It stimulates the breakdown of triacylglycerols from adipose tissue, breaking up fat into fatty acids and glycerol, and then are transported into the bloodstream. Cortisol also stimulates the breakdown of proteins, releasing amino acids into the bloodstream, where they are taken up by the liver, and used for gluconeogenesis. Interestingly enough, the amino acids also provide precursors for protein synthesis, which may be required during wound healing. Essentially they help an animal or a person to cope with a very sudden stress, and this is called, the popular name is the fight or flight response.

Chris Jameson

Lesley come here now. Can you see what you've done to this poor boy, no I don't want to hear I didn't you did push him and I want you to say exactly what has happened, and why it has happened, because there is a child crying here Lesley, and you're responsible for that. Are you okay, maybe you'd better ask if he's okay.

Lesley (child)

Sorry sir.

Chris Jameson

Are you alright [child's name inaud.] no ? Right Lesley, you can take him in doors and make sure he gets to Mrs INAUDIBLE okay, hold his hand.

Stewart Peterson

I wanted to find out more about Chris's response to stressful events like these. So earlier, I wired him up with monitors to collect data on two indicators of stress, heart rate, and blood pressure. At the end of the day we'll take a look at the data they've collected. I wonder if Chris is likely to experience the same symptoms of stress as me. A question I put the Eric Brunna expert in the physiology of stress at university college London.

Eric Brunna

One of the most common that we can recognise is the tightening that we feel in our stomach, and that tightening is very much a physiological hormonal neurological response, and it's interesting how similar it is, in very positive situations, and in very negative situations, and that's an indication that there is a common stress response.

Robert Sepolski

The hormones that we recognise as central to the human stress response, exactly the same picture in primates, mammals, vertebrates a fair number of invertebrates as well, it's a very very ancient system. In terms of do we all turn on the stress response in the same circumstance, that's the critical point.

Break somebody's leg, maul them with you know a predator's canines, everybody will turn on the stress response. Get a psychological ambiguous situation, and only some of us do.

Stewart Peterson

Well we've just seen just some acute stress there haven't we with the little child.

Chris Jameson

Yeah I think so.

Stewart Peterson

So what do you do to deal with acute stress when you're...

Chris Jameson

Well I, do a few things I suppose. I'm a keen musician, I like to sing and play the guitar, and I find that very relaxing so, even at a lunchtime, once the children are out I might just for two minutes pick up the guitar, play that, I find that kind of unwinds me, I can let emotion out that way. Talking to friends and colleagues, usually not about school related things is quite a good way of winding down, and I suppose, you could also say that I like to eat and drink well, I like to come home and make sure that, I don't starve myself you know. I like to sort of take pleasure in things which I enjoy. Make sure I don't live and breath school all the time. Right it's time to blow the whistle.

[Sound of whistle]

Chris Jameson

Class five I want to see one line now, thank you, good, excellent Kaila you'll make the army. Well done. Brilliant, right in we go.

Is there anybody who doesn't have a sheet. Good. Right once you've got your sheet you need to close your mouths and start your work, because I'm going to be working with two children.

[sound of a heartbeat]

Stewart Peterson

Well here we are outside of Chris's classroom where he's looking after a class of 9 and 10 year olds who are learning about mathematics We're got him rigged up with monitors so that we can measure his heart rate and his blood pressure throughout the lesson, and we're going to see how they change during the different events that happen.

Chris Jameson

Right Dean, I want you to move up one and I want to sit there, thank you. Okay guys. Now, what we need to do, where's your maths you haven't even got them out yet come on wake up.

Stewart Peterson

All the children have buckled down to the tasks now, they've got their noses stuck in their books, and they're writing furiously, and Chris is wondering around making sure, that everyone has everything that they need.

Chris Jameson

How do you expect to get anything done. I don't know what the conversations are but they need to stop now, thank you very much, good.

Stewart Peterson

and now one or two of the children are getting up and moving around. He's managed to settle them down just by glaring at them, and they've all gone back to their places.

Stewart Peterson

Although obviously expert in that particular technique of control, Chris was under all kinds of pressures, and I wondered how they might be affecting his body, Eric Brunna.

Eric Brunna

There is a basic common underlying response, and that response starts usually in the central nervous system, and the signal that it sends to the body, is either a nervous signal, or a hormonal signal, or both, and this activates certain systems, which control the internal environment.

Stewart Peterson

How might repeated activation of these systems, affect the body in the long term?

Patricia Ash

Cortisol and adrenalin, effectively switch off growth, reproduction, and the immune system, and the body experiences excessive wear and tear, because of the raised heart rate. Aggregation of blood platelets which is a important component of the fight or flight response, can trigger a heart attack. Other prolonged reactions to stressful situations can lead to peptic ulcers, high blood pressure, stroke heart disease migraine. The prolonged exposure to high levels of cortisol, inevitably weakens the immune responses, and so it might increase susceptibility to infection.

Chris Jameson

I'm listening to all the conversations around me, all the time, you seem to forget I've got that skill, right.

Eric Brunna

The mind and the body are intimately connected, and the responses to the immune system are exquisitely tuned, to our mental state. Now, what's interesting is that despite that observation, it has been very difficult to demonstrate that stress really does have an important effect from a health point of view on our immune systems. However there is some evidence, for example that we are more susceptible to respiratory infections the flu and colds, if we've been more stressed than usual. and in animal studies, it's been shown I think very interestingly, that those animals which have close connections with their fellow animals, are less likely to show a weakening of the immune function, when they're subjected to stress.

Stewart Peterson

In fact it turns out that when it comes to stress, animals can tell us a lot, as is clear from Robert Sepolski's research amongst wild baboons.

Robert Sepolski

Well for the last twenty three years I've been studying population of wild baboons living in the Serengeti in east Africa, and if you're interested in stress, and issues of real animals in the wild, and who gets stress related diseases, you're going to have to deal with a non human primate, they're one of the only beasts out there that are sophisticated enough to generate psychological stress.

Robert Sepolski (cont'd)

If you're going to do it with any primate species, baboons are perfect for it. They live out in the open, you're able to anaesthetise them, take blood samples, examine them, they're not in danger, they live in these huge social groups, and for the particular baboons that I study they are perfect for my interest. Because out there in the world of you know nature, bloody and tooth and claw, a baboon living in the Serengeti actually has a pretty good life. Lots of food, you work about three hours a day for your calories, predators don't mess with you very often because of the big groups that you live in, and essentially what you have is, 8 or 9 hours of free sunlight every day, to devote all of your energies into making another baboon miserable, and they're very good at generating social stress for each other.

Stewart Peterson

So, how do you go about studying wild baboons?

Robert Sepolski

First branch is, you do your basic Jane Goodall number which is you observe the animals, and there's actually a very rigorous science, as to how to observe wild animals and, collect very objective quantitative data. The second half is trickier, because you have to capture the animals, you have to anaesthetise them, under circumstances where you can get measures of stress hormone levels in their bloodstream in the absence of stress, and what, I wind up doing is using an anaesthetic blow gun system which is actually quite fun to use, and it has a lot of constraints. You can't use an anaesthetic that messes up the hormones you're looking at, you've got to dart everybody the same time of day to control for daily rhythms of hormones. You can't dart somebody, if he knows it's coming. There can't be anticipatory stress, and finally you need to get a blood sample within a couple of minutes of the anaesthetic beginning to work. So given all those constraints, when it works right, you have an animal where that first blood sample tells you just what resting levels of all those hormones are, and at that point you can hold on to this baboon for a day or so, and do some of the exact same clinical studies you would do on a human. You wind up having to have dry ice, and run a centrifuge off of a G battery things of that sort and, once all over with the animal recovers, let him loose back out of the cage, and he's back to his troop the next day doing just fine.

Stewart Peterson

Hanging out with baboons in the Serengeti sounds like fun. But what exactly does it tell us about stress. Social status seems to be important.

Robert Sepolski

Rank has an enormous amount to do with physiology, and what you wind up seeing is, low

ranking baboons get the elevated blood pressure, the elevated levels of the stress hormones, the reproductive impairments, the immune suppression, and this makes perfect sense on a first pass. If you're a low ranking baboon, lots of physical stress, people take food away from you, you spend half the morning getting somebody to groom you and it gets broken up so you're covered with parasites. If somebody's in a bad mood, you're the first one who gets slashed by the canines, things of that sort, lots of psychological stress, lack of control lack of predictability. What these studies seemed to show was, rank is destiny. What turns out to be much more interesting and much more subtle is, rank is much less important than I was initially sensing. Lots of qualifiers, it's not just your rank, it's the sort of society in which the rank occurs, and being high ranking in a stable dominance hierarchy, is wonderful, you have all the social control, you've got the great physiology, being high ranking in an unstable society means, you're right in the middle of the revolution, and in those circumstances it's, the high ranking baboons who have the worst stress profiles. Next variable is, it's not just your rank, it's not just the society, it's your personal experience of it. So if you're an a low ranking baboon, and you happen to lock out and you're in a troop and you don't get your nose rubbed in it very often, your stress profile is going to be very different than, being equally low ranking in a troop that's horrible to its low ranking members. The final variable is probably the most important one, which is personality. Baboons differ as to whether they see watering holes as half empty or half full, and it makes a huge difference. Do you see provocations everywhere, how close does your worst rival have to get to you, before you take a vigilant stance. Do you have social support, how often do you groom someone, sit and social contact things of that sort. If you lose a fight, do you go an mope by yourself, do you interact socially, and what you wind up seeing is, after controlling for rank, baboons who see provocations everywhere, who don't have social support, those are the ones with the horrible physiology. It's not so much the rank in these animals as much as the personality, the way they view their station in life.

Stewart Peterson

How do we know if position in the hierarchy causes, or is caused by stress levels?

Robert Sepolski

Key question in looking at the historic correlations is the usual chicken and egg type thing, what comes first. Does high rank cause you to have the good physiology, does the good physiology cause you to have the high rank. Lots of people who've studied these issues in captive animals, have actually gotten a very clear answer, and it may not be in the direction that most people would initially guess. You look at behaviour, you look at hormones, which is more important which is more impressive, ah, hormones, that's modern science, you need to wear a lab coat to study hormones. Hormones obviously control the behaviour. What the studies show instead is, it's the other way around. The behaviour comes first, the rank comes first, and then the physiology follows from that.

Stewart Peterson

So what does this mean for us?

Robert Sepolski

Okay so the dread question. Is any of this useful to us at all as humans. The first thing to emphasise in that is, it is definitely not relevant, to go from the notion of a baboon's social rank, to the notion of a human's. Social rank in humans is a very very nebulous concept. In some ways, the problem is that humans do very sophisticated psychological things with their quote rank. So you have somebody who, in one setting is, quote very low ranking, and this person rationalises a way, why it doesn't matter to them etc. Another thing is we belong to a number of ranking systems at the same time. So you have some guy who's very low ranking in his occupational totem pole and this is the same person who, is the captain of his weekend football team, and you know which hierarchy he's going to consider more important. Third variable is in human studies, it's often not so much your rank as much as your interpretation of it, and you look at people for example in a marathon run, and where you come in in the race is not so much the predictor of stress physiology, as whether you better your own previous time. So you get some guy who is anticipating dropping dead somewhere half way through the marathon, and instead he staggers in and finishes, he's in a great state of mind, often great physiologically, and you get the guy who was slated to be in the top three finishers, and instead he wilts and comes in number four, and this guy is highly stressed. So the notion of transferring from rank in animals to those of humans, is very very suspect. One of the only realms in which it works is socio economic status, because that's big enough of a variable that, that really blankets lots of things, be of low socio economic status and, all sorts of aspects of health, especially stress related health are not going to be doing as well.

Chris Jameson

Right. We'll do this and then we'll go and have some lunch.

[Chris playing the guitar and singing along with the children]

Stewart Peterson

After a pretty varied morning, the children were off for lunch, and I had another chance to talk to their teacher.

Well here we are with Chris in the classroom ready to go off for his lunch after the lesson.

Chris

what were the highs and lows of that lesson, what went well, and what were you not so happy with?

Chris Jameson

I think as as I came in, I'd come in from playground duty, I was sort of fairly wound up from that. Then I think, once I'd done the main teaching and I actually sat down with the two children I was working with, I think for a while I started to relax a bit there, I think, even though I was teaching, I was only teaching two children. I was fairly confident that the other children knew what they were doing, and obviously I had to sort of keep an eye on them and make sure they weren't up to any mischief, but generally I think they were all on task.

Stewart Peterson

And how wound up do you think you have to be to do that well?

Chris Jameson

You need to be wound up, you need to have extension activities in your mind for the children that finish early. You need to have strategies, and not only strategies, but time to give to the children who are going to struggle. I think you need to be very conscious of time, and you need to be very conscious of all the different things going on around you.

Stewart Peterson

Chris went off to join his colleagues for lunch. I was interested in what he said about needing some stress to work properly. Eric Brunna.

Eric Brunna

It's good to react, there is a useful function to the fight or flight response, and to other stress responses. What's important is that we can then return to base line, we can then return to the

resting condition, and that there will be some interval between the stress challenges.

Stewart Peterson

Could the hierarchical effect seen so clearly amongst the baboons, also be at play in the staff room.

Eric Brunna

The way that we need to study this, is very much to take a large group of individuals, follow them, see which ones feel that they're being subjected to chronic stresses of one sort or another, and to see how their physiology changes, and ultimately whether they develop the diseases which we think are linked to stress.

Stewart Peterson

In fact, this is exactly what Eric Brunna and his research group are doing, analysing stress levels across a large group of civil servants in the Whitehall 2 study.

Eric Brunna

The Whitehall 2 study has made, a couple of really important observations. One is, the step wise gradient in coronary heart disease. For each step you go down the employment grades, the risk of heart disease increases. It's not a threshold effect, it's a gradient right across from the top to the bottom, and it's interesting that this is a group of people, none of whom are short of money in a in a very serious way, and yet, we still see this gradient. and it could be, that stress is one of the explanatory factors in that gradient. One of the other, unrelated observations is that, if we try to explain this gradient from a statistical point of view then, the three conventional risk factors, smoking, blood pressure and raised cerium cholesterol, do not explain even half of this gradient and again, this provides room for, alternative explanations which would include stress and, dietary factors both of which we're examining in the study. What we're hoping to do in the future is to answer two main questions. Does stress cause heart attacks in healthy people, and secondly, how much of the social gradient in the risk of developing heart attacks among healthy people, is due to stress.

Stewart Peterson

Back to lessons, and the children are busy working together in groups, learning about solids liquids and gases.

Chris Jameson

The last one is the main test for strength, it involves sharp things. If I scrape it I'm good boy scratch. The best test in the world, to see how hard something is..

Stewart Peterson

They seem to be going fine. Chris seems pretty relaxed, but will the monitors he's wearing tell a different story, and if they do, just how important should we consider stress as a health issue.

Robert Sepolski

I most certainly would rather deal with a traffic jam every day, than be some medieval peasant, or some farmer in the developing world watching locusts devour my crops. Why you get more stress related diseases in the west is, for the very simple reason that we don't die of the typical harmonied infectious diseases and diseases of poor nutrition or poor hygiene, for most of harmonied history what getting sick and dying is about is, getting some horrible diarrhoea disorder when you're at age 20, and dying of dehydration 24 hours later. And we have this luxury instead of, slowly clogging up our blood vessels, slowing killing our brain cells etc. Certainly we are not more stressed in the West, we simply have the luxury of having the time to get the stress related diseases.

Eric Brunna

Life expectancy at the beginning of the twentieth century was about 45, by the end of the century, it was about 75. So, if we look at the big picture we can say, stress may be important, it may be important for psychological health, and it may also be important for physical health,

but that did not stop the most enormous rise in life expectancy, that humankind has ever seen.

Stewart Peterson

The day is over, and the children are on their way home. Chris and I sit down to have a look at the data. Now we've got on the screen in front of us a plot of how your heart rate has varied, from the beginning of your teaching day, until the end. and you can see it's gone up and down quite a bit, for a minimum of about 70 beats per minute, to a maximum of over a hundred beats per minute. Now we've got the first hour here, and we've got a heart rate which starts off at about 20 past 8, at around about 90, and then at about ten to nine, the heart rate goes up to a hundred and twenty. What happened at ten to nine.

Chris Jameson

At ten to nine I went out into the playground, and blew the whistle which was a signal for all the classes to line up, and then their teachers would lead them in, usually straight direct route up to their classes. However this morning, because we've got carpeters and painters in at the moment, it was brought to my attention by the head teacher at ten to nine, that I had to take my children through a different route, through the hall then outside across a different playground and in. So that may have altered my heart rate in some way as a kind of added stress. and, as they entered the classroom, they're in a habit with me where they takeout their reading book, and read silently whilst I would then into, into doing the register.

Stewart Peterson

What we can see very clearly on the trace is that, between about nine o'clock and ten past nine, your heart rate is at its lowest in this particular frame, around about 80 beats per minute, but that when you start to ask the class to do things your heart rate begins to rise. Well the next trace shows that from about twenty past ten for about fifteen, twenty minutes or so, your heart rate peaks quite high and goes up and down, what was happening then?

Chris Jameson

Right well, that had been the end of my literacy lesson, I'd walked the children down to assembly where the whole school meets, and I was responsible for providing the guitar accompaniment to the hymn during that time.

Stewart Peterson

So you were actually performing.

Chris Jameson

Yes I suppose I was.

Stewart Peterson

Are you conscious of your heart rate being high when you're performing?

Chris Jameson

No I don't think I am.

Stewart Peterson

It was, so you can see that again, performance.

Chris Jameson

Added pressure.

Stewart Peterson

Pressure to the system. So you can see that, the fluctuations in your heart rate, are well correlated with what you've been doing. They part, because of changes in your physical activity, but also in part because of the emotional response to the activities that you were undertaking. and that prepares you in, as an adaptive response, to deal with those sorts of situation. Well now we've down loaded the second set of data which is looking at the changes in your blood pressure during the day. Now the blood pressure machine, measures your blood

pressure every fifteen minutes during the day, so we've got very many fewer data points. But we can look to see just in general how things change. and if you look at the beginning of the day your blood pressure is exactly what we would expect it to be, normal for someone of your age. But then we find that it begins to go up and down, in association with various activities. For example if we look at about half past ten, or just before half past ten, your blood pressure was really quite high, what was happening then.

Chris Jameson

That was the assembly period in which I was playing the guitar in front of the whole school.

Stewart Peterson

Yes that's right, and then if we come about ten or fifteen minutes later your blood pressure was higher still, and that was when we were interviewing you in the playground.

Chris Jameson

Yeah that's right in the playground.

Stewart Peterson

That's right absolutely so you ...

Chris Jameson

and of course one of the young boys was crying because someone had pushed him over, that's what I had to deal with.

Stewart Peterson

That's right, I remember we had to interrupt the interview didn't we, and you had to go off and deal with it. and you can see that reflected in the changes in your blood pressure. Clearly we don't have moment to moment fluctuations in your blood pressure here, so we can't tie it to particular events as we did before. But in general terms, your blood pressure changes are reflecting the changes in your heart rate, as you moved through the day.

Chris Jameson

I see.

Stewart Peterson

Going through the data it was clear that Chris's natural stress response, his fight or flight response, was being stimulated regularly throughout the day, this means that hormones like adrenaline and cortisol, were probably at quite high levels. Fortunately, Chris is the kind of person who makes sure he unwinds regularly. Playing music, eating well, seeing friends, all activities that help bring hormone levels back to normal, I'm sure he'll be fine. Life may be more difficult elsewhere, but the fact is, that stress levels in our society are sky high and rising, and as we've discovered, stress can affect our bodies, and make us ill. Most of us get stressed out at least some of the time, should we be worried?

Robert Sepolski

What it comes down to is once again, we are not getting stressed because the locusts are eating our crops, or because we've got to wrestle people for canned food items in the supermarket, we're getting stressed because the psychological variables, feeling an absence of a sense of control, a sense of predictability, a sense of outlets, feeling as if we lack social support, feeling as if things are getting worse, and those are the variables that need to be manipulated.

If you were in circumstances in work, that are for example stressful, figure out which of those you cannot change, and learn how to accommodate them, and of the ones you can change, figure out what you can do about it. Figure out which coping outlets work best for you, and do

them on a regular basis, don't save your stress management for the once a year two week vacation, for each weekend, you need to do something every day. You don't do your stress management when you're put on hold on the telephone for fifteen seconds, you need to set out time for it, and probably above all else, what the studies show is, the single biggest important variable in stress control in people is, have social support. Being socially isolated for a primate such as us, is a horrible aching stresser and, a huge risk factor for health.

Stewart Peterson

So next time you feel your stomach tightening and your pulse racing, remember that stress response cascading through your body. Make sure you find a way to relax, get those stress hormone levels down, and put your stress in its place, goodbye.

[sound of children playing/talking]