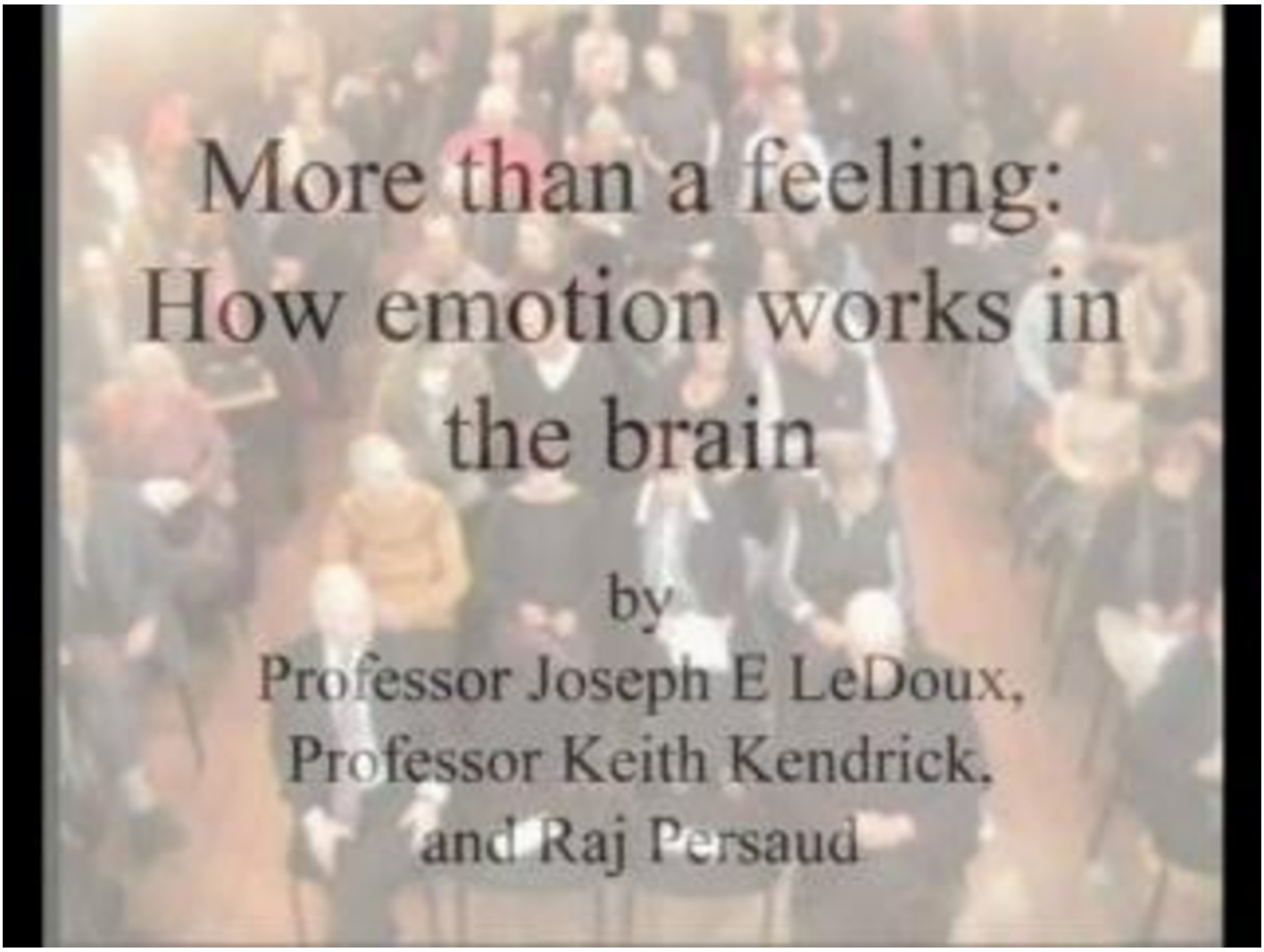
More than a feeling: How emotion works in the brain
Transcript

Date: Thursday, 22 February 2007 - 1:00PM

Location: Museum of London



22 February 2007

MORE THAN A FEELING:

HOW EMOTION WORKS IN THE BRAIN

Professor Joseph E LeDoux
Professor Keith Kendrick
Professor Raj Persaud

Our first speaker is Professor Joseph LeDoux from NYU in New York. He is Professor of Neural Science and Psychology in the Center for Neural Science at New York University. The title of his talk is 'More than a feeling: conscious and unconscious emotion'. He is an eminent researcher in his field and has made many contributions to scientific work involving conscious and unconscious emotion. He is published in many peer reviewed journals, and he also is a writer of books. He has two currently available: The Emotional Brain and the The Synaptic Self, and following his lecture, the curiosity may take you wanting to follow further his work.

Professor Joseph E LeDoux

The title really says it all. As individual feeling people, we tend to think of our feelings as the most important component of an emotion, but I hope to convince that the feeling, the conscious aspect of emotion, is relatively late in the game, and that there are more fundamental processes that we need to understand as well.

When we see or experience any kind of emotional event, not only are we consciously feeling something, we are also expressing emotions, and those two aspects of emotion create a tension that has been the subject of much research and debate over hundreds, if not thousands, of years. What is the difference between a feeling and an emotional response, and how do these interact in the brain?

There are body systems that allow the brain to control emotional responses. There are systems that control the release of hormones, and we will hear some of that from Professor Keith Kendrick later, about hormones involved in attachment behaviour. There are pathways that connect to the spinal cord, to activate the autonomic nervous system. This causes our blood pressure and heart rate to rise, and muscles, respiration to increase, and then there are connections also to muscles that allow our muscles to tense up to prepare for the flight or fight response. These two aspects of emotion, the feeling that we are experiencing, and the response that we might be expressing, how do they relate to one another?

I want to address three questions in this lecture. The first is 'Do feelings cause responses?' This is the standard way we might think: we feel angry, therefore we fight; we feel fear, so we run away. William James took on this question over a hundred years ago and rejected that option. He said that we do not run from the bear because we are afraid, but instead that we are afraid because we run. Not everyone has accepted James' conclusion that running away causes us to be afraid, but most researchers today accept that the feeling of fear is not necessarily the reason why we run away. So the question is 'Why do we run away?' This is a question that has been ignored over the question of 'How does the feeling come about?' So how does the response come about? That is a more fundamental question and something we need to address. If it is not the feeling that causes the response, what does cause it, and can we use emotional responses to tell us what someone is feeling?

As I said, the commonsense view is that conscious feelings cause us to respond in a certain way, whereas the modern science view would be more that emotional responses are products of the brain that function unconsciously, so we detect danger and we respond to it, and then we feel afraid. So you are walking along the street here in London, you jump back, the bus goes flying by. You jumped without being consciously aware of the bus, and only after the fact, you see the bus flying by and you feel your heart beating. The brain has the ability to detect danger and to respond to danger before you even know about it. Every animal has to be able to do this to survive, and not every animal that can do this has the capacity to be aware of its conscious activity or to be conscious of its activities in a complicated way such as the way humans are. The idea that conscious feeling, that a stimulus elicits a feeling that causes a response, is replaced, in a sense, by the idea that there are unconscious systems in the brain that process the incoming stimulus information and produce the responses.

There are mountains and mountains of data that support this idea, both in psychology and brain science. For example, subliminal presentations of stimuli can elicit emotional responses without the subject being aware of what the stimulus is. You can also lead to the activation of brain areas known to be important for emotion, such as the amygdala, without even knowing what the stimulus is. So your brain and your body can respond to these stimuli in these experimental situations without any conscious participation in the awareness of the stimulus or the production of the responses.

So much of modern research, certainly on fear, has emphasised the role of the amygdala as being a kind of translation centre in the brain for detecting emotional events in the world and producing emotional responses on the basis of that detection. There is considerable evidence also that the amygdala is activated in an unconscious way, as I just said, and this is research by my colleague, Liz Phelps at NYU, Ray Dolan here in London, by Paul Waylan at Dartmouth, and a variety of other researchers, showing again that the amygdala can detect emotional information that the person is not consciously aware of, so the emotional response is being triggered in an unconscious way. This, I should point out, does not mean unconscious in the sense that Freud had in mind when he talked about repression of conscious things that were anxiety-producing and shipped to the unconscious. These are things that never make it into consciousness because the brain is not wired in this way to first become conscious and then produce the response. It is wired instead to produce the response on the basis of the stimulus and to be conscious of it afterwards.

Given that we are not necessarily consciously aware of the stimuli that are driving our behaviour, what role does these responses have? Can we use them to assess whether a person is in a conscious state? I have some colleagues that I have severe arguments with on this topic, because they say if a rat and a person are behaving in the same way, then they are feeling the same thing. I would say that is hogwash, that rats and people can behave in the same way without exactly feeling the same thing. I would like to give you some examples.

If we have got two people, both expressing a kind of rage response, the chances are we would be on pretty safe ground guessing that they are feeling something that is similar.

But if we are at the level of a bunch of little microbes, bacterial cells living in a Petri dish, and if you squirt some acid in that dish, they will all move to the other side. If that were a swimming pool with people in it and you poured acid in the pool, the people would also move to the other side and may be get out. Are the bacteria feeling what the people feel when they do this? This is an extreme example of the dangers of making an assumption about internal subjective states on a simple observable behavioural response.

So how then do we study these fear reactions in the brain? I have spent my entire career trying to understand fear in the brain without ever addressing the question of what is that fearful feeling. It is not that I do not think the question of where feelings come from is interesting, I do think it is interesting, but I think that that question has gotten in the way of a more fundamental approach to understanding the brain mechanisms of emotion. So what we are trying to understand is how a simple emotional reaction occurs. To do that, we study rats that undergo fear conditioning, where a rat is given a tone that is paired with an electric shock. The rat only has to get the tone and shock one time, and the shock can be relatively mild, and as a result of this, the rat will develop a series of fear responses, such as freezing behaviour, changes in blood pressure and heart rate, and a variety of other responses that indicate that it is in this emotional state.

This is not the kind of learning that you can practise until you get it perfect. Both a rat and a person will learn in a single exposure to a traumatic, dangerous situation that that is a dangerous situation. If you had to learn this through practice, you would not be able to get very far. An animal in the wild does not have the opportunity to practise until perfect the escape from a predator. If it does it right the first time, it learns how to do it on the basis of that single event, and then it stores that information in a permanent way. It is too valuable a piece of information to not store the first time and to ever forget - fear is for ever. You may bring it under control under certain circumstances, through therapeutic processes, through self-training and so forth, but it is always there waiting to be reactivated. So a patient who is successfully treated for a phobia, when the patient's mother dies, the phobia comes back, so stress is very, very potent as a way of reactivating fears and phobias and other forms of anxiety.

These are some of the responses that I said: freezing, increases in blood pressure, heart rate, stress hormone release. All of these occur in the rat when it is afraid, and they occur in a human when he or she is afraid. This kind of learning occurs throughout the animal kingdom. It is not specific to humans. It is not even specific to mammals. It is not even specific to vertebrates - it occurs in invertebrates as well. So it is a very fundamental form of learning that has been preserved throughout evolutionary history in animals with diverse nervous systems, and each nervous system has figured out, or each animal has figured out, through evolution, how to create a nervous system that can do this kind of learning because it is such a fundamental aspect of survival.

The way this kind of learning occurs in the brain is through the part of the brain called the amygdala. I will just briefly describe the role of the amygdala as the centrepiece in the system, where the stimulus comes into the brain and the responses come out. There are two pathways to get information to the amygdala. One is directly from the thalamus, so the thalamus is a gateway to the sensory cortex, and in the cortex is where we have our conscious awareness of external events and our thoughts and so forth. When the stimulus reaches the cortex, it begins to be processed in a way that can be engaged consciously. But, on its way to the cortex, the information can exit the sensory system from the thalamus and go directly to the amygdala, so you can have a very rapid fear response this way. In the rat, it takes 12 milliseconds. That is, take a second, divide it into a thousand parts, and it takes the first 12 of those parts for a sound to get to the amygdala. That is it. It is very, very fast. It takes much longer for that information to get there through the cortex. It is a slower system. So the sub-cortical pathway is a quick and dirty route, it is a low road; the high road takes much more time, but it gives you much more information.

If a bomb goes off in the room, we will all freeze and tense up. We will start to consciously process the

information, decide we have got to get the hell out of here and so forth. You see the transition between the low road and the high road in that kind of sequence.

So the hiker is walking through the woods, he is about to step on the snake. Through the low road, the image, a crude template activates the amygdala, causes him to freeze before he steps on the snake. He then consciously evaluates what it is that is there. It is a stick, so he keeps on walking, or it is a snake, so he stops and backs up or does other things. This is a very primitive kind of system. It is prone to over-generalisation. The idea is you are better off treating sticks as snakes than snakes as sticks, and so take your chance that way.

Over the years, I have been interpreted to mean that the high road is a pathway of consciousness and the low road is not. I think both of these inputs to the amygdala are basically unconscious processing routes. The sensory cortex is not necessarily the seat of consciousness. The information in the sensory cortex has to be transmitted to other area, most notably areas in the prefrontal cortex, in order to be conscious of it. The point is that the information processing channels that detect and respond to danger are separate, disassociated from the channels that then give rise to a conscious experience of that stimulus and ultimately to a conscious feeling about that stimulus.

There are lots of different parts of the amygdala and not all of them are required. Only the lateral and the central nucleus are required for fear conditioning and the expression of fear responses, and it fits into a larger set of circuits, whereby information about neutral stimuli, like a tone, can come in through these two pathways to the amygdala, and information about aversive stimuli can come in through similar pathways, and all of this can be integrated in the lateral nucleus, where plasticity can occur to control the central amygdala to express the responses. This goes back to what I was telling you: it takes 7 plus 5, 12 milliseconds to get to the lateral amygdala through this thalamic route, and much longer through the cortical.

It is slightly more complicated, because even within the lateral amygdala, there are two classes of cells: some that learn quickly and then reset back to baseline; but then they teach a second set, called storage cells, that hold on to the information in a permanent way. These may be the cells that are responsible for the reactivation of fears and phobias in a patient in whom the fear is not being expressed now but then stress comes back in and reactivates the circuit.

There is a lot of biochemistry known about the way this kind of learning takes place. In brief, neurotransmitters are released when the tone comes in. If the cell on the post-synaptic side is also receiving input about the shock at the same time, molecular changes take place that activate MAP kynase. This results in the synthesis of proteins by the cell nucleus, and those proteins basically glue the synapse back together, and that is the way learning, in this system and in many other systems, take place.

All of this applies to the human brain. There are patients with damage to the amygdala, and these patients have difficulty undergoing fear conditioning. There is functional activity in the human amygdala during fear conditioning, again showing the relevance of the animal research for the human brain, because the basic circuits are the same in the animal and the human.

What about the conscious feeling, how does that come about? I said I have spent my entire career trying to keep consciousness out of the sequence of events because I wanted to understand the more fundamental mechanisms, but it is an important and interesting question. One hypothesis that we have been working on is that the conscious feeling that is created in a situation of fear is created in a way that is not that different from any other conscious experience. One of the key things in conscious experience seems to be the representation of the information in something called working memory. This is a function of the prefrontal cortex that allows you to integrate diverse sources of information and to hold them in mind for a short period of time while you are thinking about them and then to store that information into long term memory if it is relevant. So if you are looking at a beautiful painting, as the external stimulus would be represented in working memory, you would also be retrieving information about that painting from long term memory so that you can interpret it, and you would be drawing upon your past experiences, both personal experiences and your book knowledge that you may have about that painting or paintings in general.

That could be an emotional situation for you, it could be a very pleasant situation, but let us go back to the fear-arousing situation. The same thing is going to be happening: so there is an external stimulus that is activating emotional responses; the external stimulus is represented in working memory, which is retrieving relevant long term memories about that stimulus.

Say it is a snake, so you retrieve facts about snakes: snakes are dangerous, certain snakes are more dangerous than others; personal experiences you have had with snakes - I was bitten by a snake when I was five years old. All of that is creating a working memory, a conscious representation of the situation you are in right now. My proposal is that fear, conscious fear, the conscious feeling of fear, results when that information is combined with the fact that your brain is in an aroused state and your body is in an aroused state, so it would be the integration in working memory of the stimulus, memories you have about that stimulus, and the fact that your body is emotionally aroused.

This is a testable hypothesis. We have not done any experiments on it yet, but there are some data that seem to support this that have been done in other contexts. For example, if human subjects are put in an FMRI

scanner and prevented from being conscious of an emotional stimulus, the stimulus still activates the sensory cortex and the amygdala - or the sensory system and the amygdala; whether it is the thalamic or cortical or both, is not important, but you get sensory processing and amygdala activation when you are unconscious of the stimulus. But when you are allowed to be conscious of that same stimulus, in addition to sensory cortex and amygdala activation, you also activate the prefrontal cortex and very likely these working memory circuits.

Audience question

You mentioned just now about the input from long term memory into the working memory to process, if you like, the consciousness of experiencing the emotion, but there seems to me something that surely must be missing. The stimulus gets to the amygdala - I've forgotten what it goes via - immediately and you do your response, freeze or scream or whatever, but surely there must be some kind of memory somewhere involved in that? If you think, a small child will touch a candle or fall down from a height or whatever, what then - must it not be accessing some kind of memory of experience in order to know that what you are seeing is something that needs you to freeze or scream or run?

Joseph LeDoux

Perhaps I went too quickly over that, but that is the whole point of this fear conditioning, to study that. We have implicated the lateral nucleus of the amygdala as the site of plasticity, where the learning and memory of that event takes place, unconsciously. So the stimulus that does not produce a fear response before, after the training produces a fear response because of synaptic changes in the lateral amygdala. So that is a memory, in the implicit sense of memory rather than the conscious sense of memory.

Audience Member

So in a way, you said that the animals could not learn by experience otherwise they would be dead, but they have to in some way learn from experience, otherwise there would not be any memory formed?

Joseph LeDoux

I'm not following you, because all I've been talking about is learning from experience and memory, and the whole point of this is that the amygdala learns and stores a memory. Without the learning and the memory, there is no response.

Audience Member

And can the learning come, as with young animals and young people, from another person instilling into them that sense of fear - 'Don't touch it?'

Joseph LeDoux

Certainly in primates, in people, you can learn fear through observation.

Audience question

I would like to ask you about the felt emotion, the fear, the conscious fear. I think I followed the 'how' question you asked about it, but I wondered if it addressed at all the 'why' question. I could not see any obvious reason why people ought ever to feel any emotion at a conscious level. It does not seem to have any causal value in terms of response. It might be what some people have called a dangler. Is there some survival value in the emotion as felt or some causal role it can play?

Joseph LeDoux

There are two answers to that. The simple first answer is that once you are conscious, then it obviously plays a role. So as soon as you are consciously afraid, that can influence the brain and body.

But the other aspect of the question is the more interesting one, and you, being a philosopher, would be sensitive to this. It is just the question of why does consciousness exist at all? That is not a specific question about fear or emotion. It is about why do we have any consciousness since we can do so much, and many animals probably do quite a bit, without ever being aware, consciously aware, of what they are doing. I do not have the answer to the mind/body problem. It is a general problem.

Audience question

How do you de-condition an inappropriate fear response?

Joseph LeDoux

Well, you take the rat to cognitive behavioural therapy, and you use the standard procedures called exposure therapy, which is what we call extinction in behavioural research, where you give the tone in a safe context, without the shock, over and over again, and the rat learns that it is no longer a fear-arousing stimulus. But, if the rat is returned to the previous context, the fear comes back, just as it comes back in a phobic patient when the patient is stressed.

There are other ways that we are working on to get rid of fears, and it involves something called the blockade of the reconsolidation of memory. This is the idea that when you take a memory out, you update it and change it a bit when you take it out, and then when you put it back in, it is not exactly the same thing that you took out. I think Keith Kendrick described this as the kind of colouration, better colouration of memory over time. We have done quite a bit of research on this showing that when you take it out, unless your brain creates new proteins, synthesises new proteins, during that retrieval process, and re-stores it through protein synthesis, that memory no longer is available to you. So reactivation of a memory can be very dangerous in terms of the survival of a memory.

Audience Question

A slightly philosophical question. I heard Susan Blackmore talk last year about this, the brain working in the context of making decisions before you are conscious of them, and her claim would then be that we do not have free will. What would your position on that be?

Joseph LeDoux

Well, that is another big topic, and I am just looking at little old fear responses in rats! You know, I wish I had an answer for you for the mind/body problem and its related cousin, free will, but I am afraid I am not a philosopher and I do not have the answer. Sorry to beg out, but I do not want to waste your time with things I do not know anything about.

Audience Question

What would you say to the suggestion, from what I think I understand, that fear is proportional to the uncertainty of how to deal with a problem, and inversely proportional to the knowledge of how to deal with a problem, and also proportionally to the consequences of the fear? For example, the snake bite: you know well how quickly a snake can move, what its toxin can do, and how quickly it can kill you if you do not get to the point of being able to take the anti-toxin etc. So how would that sequence of reason meet you, proportional to the uncertainty of dealing with a problem, inversely proportional to the knowledge of how to deal with the problem, and proportional to your mental and physical abilities of how to cope with uncertainties like that?

Joseph LeDoux

I do not have the mental and physical ability to do all those calculations, but you know, the things you are talking about I think probably apply more to anxiety than to fear, which is a worry about what is about to happen rather than a response to what is immediately present. Fear is a response that is often triggered by the stimulus, either because of an innate relationship with that stimulus to the brain, or because of past learning which creates a path that allows that stimulus automatically to activate your brain. Anxiety would be more about calculating the risk and so forth and worrying about what to do over time.

Audience Question

I was interested in the fact that you gave a time span for the various responses, and I was wondering whether the time span that you gave is the average of the normal time span or how much variety there is, because, for instance, to get a good outcome you need a certain time span. Supposing the response is very quick but they are all interactive, but your retrieval is fairly slow. You can then get quite a poor outcome because of that, and how important this timing is and what variety there is.

Joseph LeDoux

You are talking about the 12 milliseconds?

Audience Member

Yes, that is right. For that, you gave a specific time, but then there were also the immediate memory, the more long term memory, and how you come to a conclusion as to how to act. I was just wondering what variation there is, and if there are people whose time responses are so slow that they actually end up with poor outcomes?

Joseph LeDoux

I think there probably is tremendous variation, but within an emotional episode, there are lots of things going on. We were able to calculate these time sequences for the very first components of it, but as it begins to unfold, it gets very complicated, and, certainly in terms of mapping what is going on in the brain, it would be very difficult to follow in a linear way, because by the time this rapid stuff is over, the brain is no longer in a sequence but more into a parallel system of processing where many response systems are being engaged. But yes, there are individual differences in all of these things and, you know, at each component, you can have an individual difference, so there are many opportunities for people to differ in their effectiveness.

Audience Question

Let us suppose you are very frightened of a situation, so you decide to jump off a bridge, and then let us say that you get to jumping off the bridge, and you find you are more frightened of jumping off the bridge than of escaping the situation you are trying to escape from. So you end up in a sort of limbo of frozenness, and you can neither go forward nor go backwards. Would you like to have a comment on that?

Joseph LeDoux

I think that this is an important topic because in complex, real-life situations, people do tend to get immobilised by fear and highly conflicted about what to do, because it is not simply a tone that is predicting a shock, but there are many, many aspects of a complex situation. So from the therapeutic point of view, research points to the effectiveness of treating patients to respond by doing rather than by simply passively responding to a situation. For example, the exposure therapy is a kind of passive coping response, whereas teaching patients actually to interact with their fears and to engage them and to control them is somewhat more effective. This is in part based on our research and therapists have picked up on in and developed therapies on the basis of this. What we have shown is that if a rat is taught to gain control over the tone, so it can actively perform a behaviour that prevents the tone from coming on, it does not recover its fear the way a rat that has been extinguished does. So a rat that has simply been given the tone over and over again will undergo what is called spontaneous recovery, and the fear just comes back in time; whereas a rat who is taught that if he takes control and runs across to the other side of the room, the tone will never appear, the fear never comes back in that rat. So active engagement is very important I would say.

Audience Question

You stated that the amygdala seems to learn fear as a conditioned response. The amygdala itself does not learn something, but in conjunction with the rest of the brain, let us assume that what you were saying is that you have to learn the fear first and then it responds. It is very well known that new born humans and other animals have fear responses that they could never have learned at all because they were born with them as responses rather than fears. A good example is when you hold a monkey over a glass sheet, it seem to think there is a

drop there, so it will not go on it, and certain animals are frightened of snakes from birth. So we have a difference between memory and conditioned response. You cannot transfer memory genetically - that would be ridiculous. So what are your criteria for not conflating conditioned responses with actual memories, because it seems to me that we are conflating them here. The amygdala seems more in control of conditioned responses, mainly that you already have, than learned fears, and learned anything, I should assume, is actually learned in more developed parts of the brain in the cortex. So my question is how do you discern the two and what are your criteria for not conflating those two?

Joseph LeDoux

I think you are mixing up the difference between learning and responding. We are not saying that the animal learns or responds. People and animals come into the world knowing how to be afraid and what conditioning, in this case, does is teach them what to be afraid of. So the same system that allows a rat to be innately afraid of a cat is involved in the conversion of stimuli associated with a cat into activating that same system. A place where a cat attacks a rat will activate the amygdala, just as the cat itself does, so it is a stimulus switching at the level of the amygdala. Innate fears activate the amygdala automatically. I am using fears in the loose sense, threat is the proper word. Innate threat will activate the amygdala directly, without any learning. Novel threat, novel stimuli, can become threatening by gaining access to those innate circuits that control the responses.

Audience Member

Would that be the secondary path? The learned responses would be the secondary path?

Joseph LeDoux

They are not learned responses. The responses are innate hard wired.

Audience Member

Learned memories, but the initial response, the innate response would be that shortcut path that you were talking about?

Joseph LeDoux

No, they could be, but the learned pathway goes through there too.

Chair

Our next speaker is Professor Keith Kendrick, who is head of Cognitive and Behavioural Neuroscience at the Babraham Institute in Cambridge, and is also a Fellow of Gresham College. His talk is entitled 'The Chemistry of Social and Emotional Bonds'.

Professor Keith Kendrick

This is a seminar about the chemistry of social bonds, particularly the role of oxytocin and vasopressin. In a sense, the whole title of this seminar, 'More than a feeling', is still relevant to this because a lot of what I am going to describe to you involves sub-cortical pathways, sort of relatively automatic pathways, that are dealing even with complex social and emotional responses.

But let us first of all consider what they are for: why do we have these social, often called affiliative rather than emotional bonds? In the first place of course, they are emotional dependents, if you like, between individuals, and that promotes reproductive success and survival - the very obvious thing right from the outset.

There are some key advantages in having these social bonds: protection against predators is obviously one of them; ganging together, if you like, to get food - certainly very important for primates. Stress reduction - there really is an increasing amount of science looking at what are often called social buffering effects, that have been shown quite clearly in animals, where a very stressed animal, if it is placed together with an animal that is unstressed, gets over its stress an awful lot more quickly, and this is thought to be pheromonially-based, odour-

based. Disease resistance: because you are less stressed, your immune system is improved. Of course survival of the young is very important, but also the maternal bond is something that I am going to talk about a lot, which again helps with survival.

Social learning as well - some of the most powerful forms of learning are transmitted from one individual to another, either by imitation or demonstration. And of course, importantly, the thing that drives this is that these kind of social, emotional bonds are linked to the brain's reward system. They do perhaps have the impact, certainly in humans, of making us feel good, although it is not necessarily a massive powerful feeling, like for example, a sexual orgasm.

So what operationally defines these bonds? You have to recognise the individual that you are bonding with, and so you will find that a lot of these bonding hormone systems are promoting learning social recognition. Recognition is associated with this positive emotional effect that stimulates seeking the proximity and also physical interactions between individuals. When individuals are separated, they do not like it and they look for each other. There is also the other side of the coin, you also get more aggression in species that bond with one another: that is, they are much more reactive towards individuals that intrude on that relationship. And there also of course has to be some element of reciprocity: it is not just one sex doing the bonding, both sexes have to do it. Finally, of course, the relationships have to be extremely long term, and yes, reduce stress as well to the environmental and social stresses. So they are all good things, the reason why species might have social bonds.

The problem is though that very, very few animal species actually show bonds of this kind. In terms of social monogamy, I am sure many of you will know, only something like two to three per cent of mammals actually show any kind of pair bonding. That contrasts markedly with birds, where that does happen far more often.

However, there are far more frequent examples of mother/infant bonds, and this is an area that I have looked at particularly in relation to the bonds that mother sheep form for their lambs. One of the things that we have also looked at are the behavioural consequences of these very strong emotional bonds. I'll go through this quite quickly, but it is a nice example of how the relationship between mother and offspring can have an enormous impact on what that offspring will subsequently find to be attractive socially and sexually in a member of the opposite sex. This was originally based on work by Lorenz, which looked at imprinting in ducks and geese, but he also found that if you reared one species with another, that when the foster species, as it were, grew up, it actually preferred sexually and socially members of its foster mother's species rather than its genetic species. So clearly the experience of this early bond had completely changed what it found attractive socially and sexually in another individual.

This was thought perhaps only to be happening in birds until, some years ago, we did a huge study in sheep and goats, the first real mammal to be tested for this. We did exactly the same thing: we fostered between two related species - sheep and goats - and to cut a long story short, found exactly the same thing, that what was important was the who you were bonded with, who your mother was, in terms of what you grew up to find socially and sexually attractive. So if you were a sheep and you were raised by a goat, you grew up to actually be socially and sexually attracted to goats, even if you had sheep around you the whole time. The effect is much, much stronger also in males than in females, and as far as we could tell, it was pretty much irreversible. Even if you put the animals back into their own species for four or five years, it did not change - it did change things in females, but it did not change things in males.

Sheep also have face recognition, and we found that they also showed, through this cross fostering experience, attraction to face images of members of their foster mother's species compared to their own species. Again, the effect was much stronger in males than in females. Normally reared species will only show interest in faces of their own species.

What about humans? Well, as soon as we published this, quite a lot of studies came out trying to find out whether there is similar impact of parental bonds with their offspring on what they find sexually attractive when they grow up, and a number of studies have confirmed it is not a very strong significant effect, but it is significant, that things like parental hair and eye colour do have an influence on what you find attractive in a partner, and also the age of your parents as well.

Perhaps the nicest study, more recently, gets rid of the genetic confounds, and so you are only talking about step-parents here. This is the relationship between a stepfather and a daughter, and it was found that the best predictor of whether the daughter's partner looked like somebody else was they were most likely to look like the stepfather rather than the woman herself or her mother. More importantly perhaps even than that, the effect was positively correlated with the strength of the emotional bond between the stepfather and the daughter, emphasising that it is actually the bond that is quite strongly affecting what even humans find socially and sexually attractive when they grow up in a partner.

Of course, no one really wants to ask the obvious question, which is whether men do get attracted to women who look like their mothers. Indeed, one study, right the way back in 1929, did ask this question. It is really based on an n of 100, so please do not regard this as good science - it really is not. However, the outcome of this was it appeared that men did not normally end up marrying women who looked like their mothers. But they did have the sense to ask one further question, which was whether they were happy or not - leaving aside for a

moment how you want to define happiness - and that made a very, very big difference, because the ones who said their wives did resemble their mothers were, by and large, a lot happier than the ones who said they did not. There is a worrying category of those who did not know, but we will not go into them!

I am afraid, when it comes down to it, even these kind of hard wired systems, through an emotional bond, it does not really matter whether you are talking about humans, they could equally be, instead of Bogart and Bacall, 'Here's looking at 'ewe' kid,' they are just like sheep and goats!

On to the chemistry of bonding. Some of you will have heard me mention the Big Four that have the acronym of DOVE. I could not actually make it into love, but it is as close as I could get! You have dopamine, the main brain reward transmitter. There are two hormones, oxytocin and vasopressin, that I am going to concentrate on, but there is also the brain's natural opiate system, endorphins, which also seem to be very powerful in terms of influence on emotional bonds.

My work has studied particularly the mother/offspring bonding in sheep, and we know an awful lot now about what goes on in a sheep's brain as it gives birth and shows a remarkable change in its behaviour. It suddenly becomes maternal and, within about 30 minutes or so, forms a strong and exclusive bond with the lamb that it has given birth to, and it forms a different bond with each lamb that it produces. It is not just a global bond. They have a separate bond for each individual, in the same way that we would.

We can actually induce a hormonally primed sheep to show both maternal behaviour and this bonding behaviour at the same time, and the easy way of doing it is just to mimic birth, by stimulating the vagina and cervix. In fact, that is what we gave to farmers to get them to allow ewes to adopt orphan and triplet lambs. It cost them nothing. However, if you infuse into their brains this neuro-peptide, oxytocin, you will generate exactly the same response within 30 seconds. It is a remarkable, very, very powerful effect. If you infuse, at the same time, an antagonist to oxytocin, you reduce that effect.

These oxytocin pathways actually come from a very, very small, a few thousand, cell bodies deep in the brain, in the hypothalamus. These send off projections to a number of regions of the brain, but we are beginning to understand that this is a very different form of chemical communication within the brain, because there are receptors for these, both oxytocin and vasopressin, almost everywhere, including in the near cortex, including in the frontal cortex. We know that there are very, very high concentrations of oxytocin within the cerebral spinal fluid when animals give birth, and also when sex occurs - they are similar kinds of relationships. The hormone is capable of affecting the whole brain through diffusing through the cerebral spinal fluid system, which is quite an unusual way for chemical communication.

You can produce this just simply by putting oxytocin directly into one structure, where most of the cell bodies are, because the hormone will promote its own release. So you can produce an orchestrated effect just by a single direct infusion into the hypothalamus of oxytocin - I will not go into detail - and you can mimic it with other components of the oxytocin molecule and it is the same as you get with vaginal stimulation.

What we found was that when we looked in detail at what oxytocin does within the brain, it is a very, very powerful neural modulator. It affects a lot of the classical transmitter systems that control a whole variety of behaviours, and that includes the reward transmitters, dopamine, it includes neural adrenalin, which is very important for attention and also for learning, as well as amino acids like glutamate and gaba, and of course it actually can stimulate release of itself. So it is a phenomenal molecule. It can create a massive co-ordinated change of chemistry within the brain, and that is why we think it has such profound effects on social and emotional behaviour.

In a sheep giving birth, the vaginal stimulation gets translated through the oxytocin region, and you get oxytocin feeding back on itself, you get influences from sex steroids, and also from opioid hormones. The bottom line is it causes a release of oxytocin in a whole wide range of structures, and also classical transmitters, and all of these changes affect various aspects of behaviour automatically, which are important in a maternal context. You do not obviously want to be sexually receptive at the time you want to be looking at babies. You need to pay attention to them. You do not need to be running around, so you need to be immobilised. You need to feel positively motivated towards them. You have got to feel pleasure. You have also got to show all the gamut of maternal behaviours towards them. You also need to learn very quickly to recognise them. This is all being coordinated by the release of the peptide through its modulation of all of these classical transmitter systems. It is a really beautiful orchestra going on in there.

Moving slightly away from oxytocin for a moment, because I do not want to give you the impression it is the only thing that is important, the endogenous opioids are also released at this time, and there are interactions with oxytocin. One of the most potent things that we found for stimulating, as it were, an exaggerated social bond was if animals did not just receive oxytocin, but they receive vaginal stimulation when they were given morphine into their brain, the opiate which affects particularly the neuro-receptors. They showed a huge number of low pitch bleats, which are strong maternal behaviours, and also linking, and if you used the opiate antagonist, you completely abolished all of these things.

On the other side of the coin, when you take the lamb away from its mother, there is a bond formed and she is going to be unhappy and she shows protest bleats. The strongest responses you get are when the animal has

actually been treated with morphine as well. So there does seem to be an interaction between the oxytocin system and the endogenous opiate system involved in these strong emotional bonds.

Much less has been done on other species, I hasten to add. Some work has been done on rhesus monkeys, and the effects of oxytocin have not been looked at in the maternal context, although they have been looked at in a social context, and they tend to increase proximity-seeking, lip-smacking behaviours, physical contact, and also watching one another. There is a decrease in anagonistic vocalisations. Indeed, one of the most powerful effects of oxytocin is as an anxiolytic - it reduces anxiety. It is primarily, in this case, only shown towards individuals that they are already socially familiar with, again promoting this idea that it is a social bonder.

In terms of what happens with the opiate system, in adults, if you antagonise this system, you tend to increase proximity seeking and grooming. What has been argued is that by reducing the tone of the opiate system, you create a need to boost it again, you feel uncomfortable, and therefore you seek social contact. For that reason, naltrexone, which produces this effect has been, for example, used in the context of treatment of autism, although it is still very early days. Morphine has the opposite effect.

So what about oxytocin and social recognition memory? Here we know a lot, and I will not go into a lot of detail about this, but mice that lack the oxytocin gene do not form social recognition bonds - based on olfaction - with any other mice, but they have no problem in learning to recognise the non-social smells. Again, infusions of oxytocin have been shown to promote social recognition memory. It is very specific to social recognition context, and we know that this particular aspect is primarily mediated through oxytocin's modulation of neuro-adrenalin, the classical transmitter.

A lot that we now know about how this molecule works, and also vasopressin, comes from studies on voles, either the monogamous parental types, pine and prairie voles, or their closely related cousins, who are totally asocial, promiscuous and show no paternal care at all. Researchers, particularly in the United States, at Emory University and also Washington, have looked at detail at why you have very closely related species that either show these social bonds or they do not. They found that oxytocin infusions into females would stimulate the choice of a partner in the social species but not in the asocial species, and they found that what distinguished them was that oxytocin receptors were somehow rather hugely expressed in the dopamine reward centres within the brain. We had already shown that oxytocin was capable of releasing dopamine, so the assumption is that what is happening is that when these species show a release of oxytocin in social contexts, it rewards them, it may even make them feel good; whereas, in asocial species, it just does not do that.

Just to show you that this is mediated through the dopaminergic system, if you inhibit the dopamine D2 receptor, you also block this preference for the social bonding effect, and you can induce it by giving an agonist for the D2 receptor. The same is also true if you use vasopressin receptors. We are now moving to males rather than females. In the social species, they are expressed very heavily in a dopaminergic reward centre in the brain. If these animals are given vasopressin, they show social responses, whereas if the species that are not social are given vasopressin, they do not. It has been found that there is a variant of the structure of the vasopressin receptor gene that has expansion repeats, making it a longer form, simply, that is present in the social species, and that seems to be responsible for causing the receptor to be localised in the reward centres of the brain.

They even went as far as expressing the gene from voles in a mouse into the dopamine reward centres, and they found that whereas these species do not normally bond at all, if you give them vasopressin, they become social, where as normally they do not.

Of course the ultimate test was done by a group in Emory a couple of years ago, where they transfected the version of the gene that is found in the social bonding species directly into the reward centres of an asocial, non-bonding species, and they completely changed it into a bonding species - a single gene. These effects are totally dependent on the dopamine D2 receptor. Vasopressin and oxytocin are exerting their effects primarily through influencing the dopamine system as far as bonding is concerned.

We do not really know an awful lot about how sensory stimuli can release oxytocin. We know that in humans, and indeed in other animal species, sex will release oxytocin. It is particularly associated in humans with orgasm. Indeed, at least one web site I have seen says that oxytocin should be the O in orgasm! It does not really make you feel that good, I am sure, but it is released at that time. But it is released in sheep when they are actually looking at a nice male, along with just face stimuli, in this case, dopamine and in fact also serotonin, but only when they are sexually receptive.

What about humans? Well, all of this has stimulated a huge amount of recent interest in the role of oxytocin and vasopressin in the human brain. Up to this point, there were only a few groups of us in the world working on these hormones. They were not really regarded as being particularly trendy, but they have suddenly taken off big-time, so there are lots of papers now looking at the role of oxytocin and vasopressin in humans.

One of the first things that came out was that the activation patterns you see in the human brain when you look at someone that you are either in love with or mothers looking at their babies, the regions that are activated are almost all containing vasopressin and oxytocin receptors, and many of them are sub-cortical.

The longer form of the vasopressin gene is found in humans. Polymorphism in humans. Some have the long form and some do not, and that might explain perhaps why some humans are more prone to bonding than others. But if you look at a closely related species, chimpanzees do not have the long form. They are obviously a very social species, but they are not necessarily known for their romantic bonds. However, the closely related binobos, which are a very, very strongly sexually motivated species and very, very social, do have this long form of the vasopressin receptor gene, just like humans and social voles do. And yes, it has led to all sorts of speculation that may be with genetic engineering, we can make even the people who show the least propensity for forming bonds form them!

On a more serious note, of course you would expect that if they really are that important for emotional bonds, that you might start to perhaps find some kind of dysfunction in them associated with affective disorders, and that is now also coming out, so there are, again, polymorphisms in the vasopressin receptor gene that are significantly linked to autism. It is particularly strong in individuals who do not have language impairment.

There was a similar recent study showing a positive link with the oxytocin receptor gene. Autistic individuals tend to have a significantly depressed level of oxytocin, at least in their bloodstream. If you give oxytocin through nasal sprays, you will increase an individual's resistance to psycho-social stress, that is their anxiolytic in a social context.

One much-quoted study recently shows that if you give intranasal infusions of oxytocin, which is the only way you can get it, in a human, directly into the brain unless you want to put it directly into the cerebral ventricles, that actually promotes trust, at least in an investment type context. You are more likely to trust someone sort of trying to sell you like an insurance policy if you have just sprayed oxytocin up your nose. Unfortunately, this has already been latched on to, so there is a company selling this 'liquid trust' to help you form trust and everybody will do everything you want. Unfortunately, I think they misread the papers because they are telling you you should spray it under your arms. Unfortunately, I promise you, that will not work!

Back to the science, if you infuse oxytocin, again up the nostrils, that can reduce activation of the amygdala, that Professor LeDoux mentioned, in response to fear, either as a result of seeing angry or threatening faces, or scenes that evoke fear.

There has only been one study on vasopressin, but it is showing a sex difference between its effects in men and women. Vasopressin is very much related to aggression as well as bonding in males. Naturally, aggression tends to be more when males are interacting with males than males interacting with females, and this study only looked at the impact of what happened when men were looking at the faces of other men, I am sure either people they did not know or they had happy or angry faces, or women were looking at the faces of other women. They did not look at the opposite sex pattern, which could be very different. But the bottom line is that one of these muscles here, the corregator muscle, is the one that is activated when you show threatening, agonistic faces. That is more strongly activated after vasopressin in men; whereas in women, you get exactly the opposite effect. So it seems to be that vasopressin is reducing agonistic displays in women, but increasing them in men. Conversely, the zygomatic muscle is more important for a sort of smiling, nice face. That is not affected in men looking at men, but in women, it is more active when they are looking even at strangers. So again, it seems to be promoting pro-social, trusting type emotions.

What can we conclude from all of this? Clearly, experience of parental bonds during early life can profoundly shape subsequent social and sexual attraction, and this is obviously very much an unconscious thing. You do not go around wondering, 'Do they look like my father or do they look like my mother?' If you did, you would not do anything at all.

For females, bonds with babies, and also with males, seem to involve oxytocin. For males, bonds with females certainly involve vasopressin, although it seems in humans vasopressin may also actually play a role in females as well.

In both cases, bond formation requires some kind of interaction with either the dopamine or the opiate reward systems deep in the brain. Small changes in the structure of the receptors for these peptides can actually completely change where they are distributed in the brain and facilitate this interaction with the dopaminergic reward systems and therefore promote social monogamy or bonding, if you like, social bonding.

In humans, seeing someone you love also activates both vasopressin and oxytocin receptor regions in the brain, and they increasingly have been shown to play important roles in the ability of humans to form emotional bonds, and therefore they are, potentially, quite exciting therapeutic targets for the treatment of affective disorders. One of the advantages that we can think of is, so far, nobody has shown anything that impacts on these systems to be in any way addictive, whereas if you start doing things with the dopaminergic or endorphin system, then unfortunately most drugs that affect them tend to be addictive.

However, we still know very little about how sensory and emotional cues from partners or offspring can actually influence the release of these very important peptides.

Audience Question

I took from what you said that oxytocin receptors are basically in women and vasopressin ones in males, but is there some amount in each? Did you say they were enzymes or peptides?

Keith Kendrick

They are peptides.

Audience Member

Peptides, right, but do each have some?

Keith Kendrick

Yes. There are sex differences in the distribution of the receptors. The effects of intranasal vasopressin in women do show, at least in humans, that vasopressin can have pro-social effects in women. So far, as far as I am aware, whether you are talking about sheep or voles, vasopressin does not seem to have that effect in female sheep or voles, so it may be that humans are slightly different in that respect. So there is not perhaps such a strong sex difference for the oxytocin and vasopressin system in humans as in other species. It is important to emphasise that vasopressin is also very important for stimulating aggression, and it seems to be certainly the case in humans as well, at least in men. It does not seem to do that, interestingly, so far, in women, so there seems perhaps that link is missing in females.

Audience Member

Just a quick follow-up, from what you said, oxytocin is not addictive.

Keith Kendrick

We do not know that for sure. Although it is released in very strong emotional contexts, like human sexual orgasm, so far, there have not been reports that people taking it feel some kind of huge great high. It is probably more like what Raj Persaud would call 'type 2 happiness,' a sort of satisfaction. Indeed, it was at one stage called by an American neuroscientist the satisfaction hormone. It is clearly not a 'big wow'; it just makes you feel okay.

Audience Member

I was just wondering why it is not being used therapeutically?

Keith Kendrick

These studies hae all been in the last two years, so it is very, very recent. These are very old hormones, and they are obviously very important in physiological contexts as well. They are released into the bloodstream. So oxytocin is causing uterine contractions, and vasopressin is also known as the anti-diuretic hormone - it affects the kidneys. So it has had all these kinds of effects, and it is only just recently that we have begun to be more excited by what they are doing in terms of affecting behaviour as well as what they can do downstream. We have also had a problem in that there are drugs that have been developed that can target these peptides, and it is extremely difficult to get them into the brain.

There is use of intranasal applications, which have been around a little while, but are beginning to be used increasingly in humans, to get substances that would not normally cross the blood/brain barrier. You cannot just give an intravenous injection of oxytocin, because it will have all sorts of peripheral effects, but it will not get into the brain. The blood/brain barrier just shuts it out. But if you give it through the nose, the blood/brain barrier is very weak, and it can get directly into the brain.

So all of these things are coming together in the over last few years, and we will have to see whether they do end up being very important therapeutic targets, for treatment of people who have affective disorders or at least

social bonding problems.

Audience Question

I did not hear you mention anything about the longevity of bonding. I may have missed it. But I understand, with herd sheep, once a lamb has dropped, whether it is dead or it is removed, the memory in the ewe is of a very, very short duration. Is that normal throughout the animal kingdom?

Keith Kendrick

You have to say what you are defining as memory in this context. Yes, it is true of sheep, and indeed many other species, that as soon as the offspring reach weaning, Mum gets on and reproduces and produces another litter and she is no longer maternal towards the offspring she produced the first time. She is still bonded with them, it is just a different kind of bond.

Audience Member

What about her memory immediately after birth? The lamb is removed or is dead?

Keith Kendrick

It takes half an hour to form. In some cases, it is longer than that, especially with first-time mothers. It takes them half an hour to learn to recognise the smell, in this case, of their own lamb. Oxytocin, when it is released at birth, is floating around in the brain for a long time, because the chemicals that will break it down very, very rapidly in the blood are not very concentrated in the brain, so it can actually promote changes going on within the brain for may be half an hour or more after the animal has given birth. It is that that is probably contributing towards the recognition bond forming, which then allows the sensory signals, in this case the smell from the lamb, to have a direct effect on the brain dopamine reward systems, and therefore that reinforces the relationship between mother and lamb.

Audience Question

Do you think we could have a long term state of happiness by manipulating the production of hormones?

Keith Kendrick

Manipulating things artificially is never a great idea.

Audience Member

Or just controlling them in some way?

Keith Kendrick

All I am promoting is that if you have levels of these hormones that are abnormally low, you might need help. Therefore treatments that boost their activity, at least in the short term, can make you feel better. But I am sure any psychiatrist or psychologist will tell you that you kick start the system to make people feel better, but in the end, they are going to have to find a way of doing it for themselves without taking the drugs, or at least that would be the preferable way around it. So yes, I do think they could help, but I only really see them in the context of people who are emotionally out of control and they need to get some control back.

Audience Question

You referred to the relationship of oxytocin and vasopressin with dopamine. Is there any evidence that the presence of those two hormones can influence certain diseases, like Parkinson's disease?

Keith Kendrick

No. In terms of motor problems, which is associated with Parkinson's, you are talking about a different dopaminergic system than the reward one that I have just been describing to you, and nobody has looked at whether oxytocin might promote dopaminergic activity in systems other than these reward ones. I do not think so, because, as far as I remember, the receptors are not particularly strongly localised, for example, in the substantia nigra, although there are some.

Audience Question

I do not quite know how to put this - it might be an over-simplistic question - but I am thinking of ways in which the average boy and girl, man and woman, can influence his or her chances of successful living in terms of increasing the quality of the living, ending in successful sexual reproduction and the production of a family, which is what life is all about. Do you think the individual, hearing all the complexities, biological or chemical complexities, can permit the average man or women, boy or girl, to affect the outcome in, for example, appropriate education and awareness of all these things? Perhaps a particular balanced diet or extra materials from the diet or anything like that? What comment would you pass on that please?

Keith Kendrick

Well, of course people can do things about that. You have to work at relationships, and you know, the kind of bonds that I am talking about are not the sort of 'all or nothing'. Things keep on having to stimulate oxytocin to reinforce the bonds, so you are going to have to keep doing things together which please one another. So it is not a magic formula for somehow or other keeping people together; you are still going to have to work at it, and people often do not, and that is why relationships fall apart.

In terms of things like diet, diet affects so many aspects of life. It would be easy just to get out of it and say, well of course, some aspect of diet is going to influence it, but it is more the way you behave, it is more the way you interact with a partner. If you are never there, obviously the bond will disappear. This happens with all species. So you need to do things to promote it, and you also need to reduce what I would call damaging stress levels. Stress in itself is not a bad thing, but if it is extensive, then of course that will also have a negative impact on these systems and therefore will also act to break bonds. So lots of things that you can do will damage bonds, and equally you must not accept that once the bond is formed, it is always going to be there. You are going to have continually to reinforce it through proactive behaviours.

Chair

We are pleased to welcome Dr Raj Persaud, who is a consultant psychiatrist at the Maudsley and Visiting Gresham Professor of Psychiatry. He too has published a great deal in peer reviewed journals and has written books and articles. His latest book is 'Simply Irresistible: The Psychology of Seduction'. Having heard about conscious and unconscious emotion, and the chemistry of social and emotional bonds, we are now going to hear from Dr Raj Persaud about the emotional control.

Raj Persaud

I am delighted to have been asked to take part in this very interesting and fascinating academic collaboration across the Atlantic, between New York University and Gresham College. Some of you would have been previous lectures when I have talked about emotional control and the fact that this is an interesting new concept in psychology. I distributed a personality test, where people filled it out who were in the audience, which measured your levels of emotional control, your ability to control your emotions. Many of you might not have been there last night - if you want to fill out that questionnaire, or similar ones, you will find similar ones in one of the first books I published called 'Staying Sane', which is all about how to look after your mental health and ensure you never need to come and see someone like me, a psychiatrist.

My talk today is going to be emotional control, part 2. Previously, we talked about the amazing benefits of having superior control over your emotions, and some new research has indicated that there is a huge amount of variability in the population in terms of our ability to control our emotions. Those of us who are scoring high on scales that measure our ability to control emotions have been shown by fascinating recent research to perform in a superior way in academic testing - you are going to get better grades at school and university if you can control your emotional state more than others; you are going to commit less crime; you are going to have better relationships; you are going to be able to stick to your diet, so you are going to be slimmer and more

beautiful; and you are going to be able to say no to that third or fourth drink before you get in your car and drive. So there seem to be these amazing benefits for emotional control.

What I am going to be talking a little bit about today is taking on the subject a bit further, and thinking about where emotional control comes from, and some worrying evidence that there could be declining levels of emotional control in the population at large. The other thing I hope to do if we have time is show you a clip of me playing in a televised poker game, where £20,000 was at stake. It was genuinely at stake. It was not my money, thank God, it was put up by the TV company, but I am going to use the clip, if we get the time to show it, to illustrate some important principles about emotional control. In the game of poker, because deception and bluff are involved, the ability to control your emotions is very important. In fact, people will say that is the essence of the game. So when you get dealt your cards and you look down and you see aces, it is fairly important you do not rush around the room punching the air, looking really pleased with yourself. In fact, if you get great cards, and your opponent knows you have great cards, then you are not going to benefit from those great cards at all, so emotional control is very important in the game.

Just to pick up on a couple of things that have already been said, which is very interesting, we had a comment on why do we have consciousness. Most other species in the animal kingdom do not seem to have consciousness in the way we do, and yet they seem to evolve perfectly happily without it. I am going to argue that in fact the whole point of consciousness is that it gives us an added dimension to control our emotions. Because we can be consciously aware of, let us say, being hungry, but then postpone eating because we have higher goals, that gives us much more flexibility and power over ourselves, and that is the key benefit of consciousness.

We had another interesting question from the audience, about free will, where people stood on the free will debate. Of course, that goes to the heart of this question of emotional control - are we free to control our emotions or are we the victim of our emotions? I read out the case history last night of a female astronaut who drove 900 miles and appeared to be attempting to murder a love rival and appeared to be in the grip of emotions. Well, and I'm going to gently tease our American colleagues, I am sure, being in America, her lawyers, when it goes to court, will claim that she was not responsible for her actions and that they will wheel out some tame psychiatrist to say that she was the victim of her mental state and she should not be held responsible for her actions. This goes to the heart of a lot of the debate within psychiatry and the law at the moment.

I think the best comment to make about free will came from Isaac Becker, the singer, who said, 'We must believe in free will. We have no choice'

But our journey this afternoon, in terms of emotional control, begins very far away. It begins in America, back in May 2000. Back in May 2000, a multi-state lottery that was shared across seven states in the US, called The Big Game, had rolled over week after week for just about as long as anyone could remember without being won, so that finally, the final jackpot prize, by May 2000, that it was possible to win with a purchase of a $1 lottery ticket, had reached the giddy sum of 340 million US dollars. Many of you will know that I write a lot about Zen Buddhism, and I use philosophy that comes from Zen monks, but even the most hardened and aesthetic Zen monk has been known to go slightly weak at the knees at the thought of $340 million. Historically, up until this moment, this was the largest sum in the history of world lotteries that it was possible to win with the purchase of a $1 lottery ticket.

Earlier on, in Spain, there had been a lottery called the El Gardo. The equivalent of a billion US dollars was shared out in one final jackpot prize, but that was shared out I think around a thousand people, so that the final sum that each got was a lot smaller. Earlier, in Illinois, seven Illinois machinists had shared amongst themselves a jackpot prize of $117 million.

So, up until this point in May 2000, this jackpot prize was the largest it was possible ever to win in the history of world lotteries. The draw was due to be held on the evening of May 9th. On the evening of May 8th, a very ordinary, Detroit, lower middle class coupled called Steven and Pat Roberts are watching the TV news and having supper. The big news on the TV in the Detroit area is the fact that, because the jackpot prize for the lottery had reached such a giddy sum, people were queuing round the block in the last minute to desperately try and get a ticket, because they wanted to get a ticket before the draw on May 9th. Because so many people were rushing out to buy more tickets, the jackpot prize was going up and up, had got into a positive vicious cycle.

Steven and Pat Roberts were watching this on the TV news, and they were watching it rather sceptically, because they never played the lottery. In fact, they teased any of their friends or relatives who have the temerity to say they had bought a lottery ticket.

Steven and Pat Roberts know a little bit about statistics and probability, and they view themselves as rather hard-headed, and they think it is highly irrational to buy lottery tickets. In fact, they did a bit of reading and calculated that your chances of striking oil in your backyard are actually greater than winning the lottery, so they would say to anyone who bought a lottery ticket, 'Why aren't you digging for oil in your backyard, because it makes more sense?' So they are really anti-lottery/

Having told you that about Pat and Steven Roberts, about the fact they have never bought a lottery ticket, I think you can take a wild guess as to where this story is heading!

All of a sudden, Pat turns to Steven and says, 'You know, Steven, $340 million is a lot of money, and I'm wondering, if you get a chance tomorrow and you get a spare moment, why don't you get us a lottery ticket?'

Steven goes slack-jawed with incredulity at Pat's amazing turnaround in her anti-lottery stance, but he knows, as all husbands know, that the secret of any marriage is, first of all, to stifle your emotional reaction - you see, emotional control coming in there - to anything incredulous or obscene that your partner might suggest, and that also, you must always obey your wife. But he is a bit worried, because Steven knows he has got a very busy day the next day. He has a swimming pool refurbishment business. He has got a list of appointments, and he is not sure he is really going to get a chance to stop and buy a lottery ticket, and also, he can see from the queues round the block on the TV news that there is a massive queue to get a ticket these days. He is even more worried because he does not think he is going to have the time to spend all that time queuing, but he agrees to try and buy a ticket.

The next day, he is carrying on his work as usual, and in fact, he has forgotten all about his promise to Pat to buy a ticket. Around lunchtime, he gets a bit hungry and decides he is going to get a hotdog and a Coke for lunch. He is driving down one of the high streets in the Detroit suburbs, and he spots a store that sells hotdogs and Cokes. He pulls in at the store, gets out, goes in, is about to buy a hotdog and Coke, when he suddenly notices that this store does not just sell hotdogs and Cokes, it also sells lottery tickets and, miraculously enough, there is no queue. He remembers his promise to Pat the night before, reaches into his wallet to buy a lottery ticket, and discovers he only has a single hundred dollar bill. Rather irritatingly, the man behind the counter refuses to make change, so he is a bit torn, but suddenly, in a mad impulse, he says, 'Okay, I'll buy a Coke for a dollar, buy a hotdog for a dollar. Give me the change of $98 in lottery tickets.' So having gone from never bought a lottery ticket in his life, he suddenly buys 98 in one go, stuffs them into his wallet in his jacket pocket, and then promptly goes about the rest of his day. It is a very busy day, he forgets he has bought the lottery tickets, goes home that evening, forgets to tell Pat that he has bought the lottery tickets, they go to bed early, they do not stay up to see the draw.

The next morning, they get up, have breakfast, watch the TV news, and the big news in the Detroit area that morning on the TV news is someone in the Detroit area somewhere has won $280 million from the draw last night, but mysteriously, that person has not rung in to claim the prize, and there is a lot of speculation on the TV news as to why that might be. May be they are a bit worried about the publicity, lying low until the publicity blows over, and then they will ring in and claim the prize. But the technology available to the lottery company allows them to know where the winning ticket was bought, and the TV news camera crews have converged on the store where the winning ticket was sold, and they are interviewing the guy who sold the winning ticket.

All of a sudden, Steve looks closely at the TV screen and says, 'You know, Pat, that guy looks a lot like the guy who sold me my ticket.' Their eyes lock across the breakfast table, they rush over to the sideboard, they scramble amongst the tickets, and they find that winning $280 million ticket.

So they ring the lottery company. Some people will know, because I have told this story at a previous lecture I gave, the answer to this question. Does anyone here know what the lottery company tells you, the first thing they tell you when you ring up to claim a big multi-million dollar prize? No one here is a multi-million dollar lottery winner? Because I was rather hoping to make my career on the psychiatry of the stress of sudden wealth! The first thing the lottery company tell you is whatever you do, do not lose the ticket. I think it is fascinating they tell you that, because immediately you know that someone somewhere in the past has lost their ticket, from the time of ringing in to having to produce the ticket. Can you imagine having that conversation with your spouse? 'Excuse me darling, have you seen that $280 million ticket because I can't find it anymore?'

The really interesting thing about Steven and Pat Roberts is, having gone from never, ever playing the lottery in their lives and then suddenly winning $280 million, every single week since that fateful day in May, they have played the lottery every week. Having gone to never playing it, they now play it every week, and they do not need to play it, because they are multi-millionaires many times over. Psychologists have an interesting theory as to why they are doing that.

Some behavioural psychologists would say, look, they performed the behaviour they had never performed in their lives, and they got massive reinforcement for it. In fact, this is probably, in the history of human behaviour, the most reinforced piece of behaviour! You do one small thing, and you get $280 million! That is one theory.

There's another theory. Pat and Steven now believe in this thing called luck. They believe in this mysterious force abroad that determines destiny called luck, and they believe they're lucky and they're special. They do not believe that it was just sheer chance they won the ticket, because they argue this: look at the sequence of chance events. They happened to be watching the TV news the night before draw, and Pat happens to say to Steven, for the very first time in her life, 'Why don't you get a ticket?' Two chance events. Steven happens to decide to buy a hotdog and Coke the next day. Suppose he had decided to have pizza, he would not have gone to that particular store, right? Third chance event. He happens to be at the store, and there happens to be no queue. If there had been a queue, he would not have had the time to buy a ticket; fourth chance event. He happens to reach into his wallet, and he happens to have only a hundred dollar bill. Suppose he had had $3 - he would have bought one ticket and it might not have been the right ticket. Incredible chance event if you think about it. It is a series of chance events beyond the billion to one chance of actually buying the winning ticket. Steven and Pat do not believe that is all chance, they believe in this mysterious force called luck. This is very

important in modern day psychological thinking, because psychologists believe that what determines your future is your beliefs about the forces in play that govern your destiny. Some people believe in luck; others do not.

To condense all the various theories about the forces at play in your life that determine your future, there are two key belief systems into which psychologists believe you can be categorised: you either fall into the group of being an internal; or an external. Basically, an external is someone who believes that we are the victims of circumstance, that there are forces beyond us that determine our future, and we have very little power to determine our future. Internals believe that we are in control of our destiny. They believe that through the process of hard work and diligence and exercising their intelligence and doing this and doing that, they will determine the outcome of their lives. Psychologists have been measuring this personality variable of internality and externality and discovering you can classify people into one of these two categories fairly reliably.

This has dramatic implications for your life. If you go to a job interview and you fail the job interview, an internal comes away and says 'I need to work harder, I need to get better qualifications - the fact I have failed is my fault, my responsibility. I need to take responsibility for what happened, and change my future by acting.' An external, in contrast, comes away from a job interview where they have failed and they say something like, 'You know what, I never stood a chance. They were against me from the word go! I didn't stand a chance - it's their fault that I didn't get this job. There's nothing therefore I can do about this circumstance I find myself in.'

Whether you are internal or external has dramatic implications for your behaviour. There is a lot of evidence that internals tend to work harder, that externals, because they do not believe they can do much to influence the outcome in the long run, tend to take shortcuts in life, and therefore they are more prone, for example, to commit crime and they tend to have poorer mental health. If you are an internal and a bad thing happens like you fail a job interview, because you take responsibility for it, you tend to feel bad in the short run; whereas an external, because they can blame external circumstance, they tend to feel good in the short run, but in the long run, we believe in psychology, it is better to be internal in terms of motivation and achieving difficult, long term goals and obstacles.

Jean Twenge, a psychologist in Florida, has been doing the meta-analysis of all the research that has been going on since the ealy 1960s, in terms of what is happening generation after generation in terms of internality and externality. She has found a dramatic thing, which is that in the Western world, young people aged between 16 and 21 are moving dramatically in the direction, across the spectrum of internality and externality, towards becoming much more external in orientation, to the extent that the average young person between 16 and 21 alive today is more external in orientation than 80% of young people of the same age alive in the early '60s. This is a dramatic shift in externality and has dramatic implications for human behaviour and also for emotional control. If you are external in orientation, if you blame the world and circumstance for your situation, you also do not tend to believe that you can take control over your internal emotional state, because the starting point of actually determining your destiny is taking control over your life and over your own emotions, for example.

Psychologists will say this is a very worrying social shift. It explains, for example, why there might be declining levels of voter participation, why people are voting less today, because they may be more external in orientation and therefore they do not believe they can have an impact, and they do not see therefore the point of voting.

One of the key questions is why is the shift occurring? The first group of people we could blame for this shift - and obviously, in finding a group of people to blame, I am doing an external thing, because we must find other people to blame when things are going wrong - and the first group of people I would like to blame, being a doctor, I am going to pick a group of people that are not very popular with doctors, and this is lawyers.

I do not know if you have had this experience, because I have this quite a lot. I'm at a cocktail party and a lawyer will come up to me and say, 'Raj Persaud, I can't help noticing how morbidly obese you have been getting recently. Let me sue McDonalds for you, because clearly it's these fast food corporations that are making you so grossly overweight.' There is a sense in which lawyers now offer to sue people when things go wrong for us, and that seems to lead to a rise in what we would call the blame culture. You step out your front door, you trip over a broken paving stone, and a lawyer will magically appear and press his card into your broken arm and say, 'Let me sue the local council for you for leaving this broken paving stone here which has led to your serious injury!' So may be it is the rise of the lawyers. I think there is some statistic that one in 200 people in America now is a lawyer. It is a profession that is dramatically increasing in size and may be that has implications.

The second group of people that I think we could blame are people like myself, psychiatrists, psychologists, social scientists. The idea here is that it is the rise of the 'social science' explanation that is leading to this dramatic shift in externality, because when you do a bad thing today, we say, 'It's your genes that made you do that bad thing. It is your toilet training. It is the terrible parents you had, that dreadful school you went to, the under-funding, the Government not spending enough on the education system. That is why you did that bad thing.' In other words, a whole set of reasons have now developed which were not there 200 years ago to account for your bad behaviour.

While at no point do I want to dismiss the idea that there are genes and they have an impact, and there are hormones - we have been hearing about them today - and they have an impact on behaviour, is it not possibly the case that one key determinant of our behaviour - which is our personal choice, the fact that may be we should take personal responsibility for our choices - that that thing is getting squeezed out gradually in accounts

of human behaviour? Whenever you hear on the Today radio programme any human problem being discussed, everyone immediately tries to find someone to blame. No one says, 'It may be that we have a problem with young people and guns because young people are choosing to go around with guns and need to take some responsibility for that.' Instead, we hear about how the Government is under-funding community projects, and there is always an attempt to blame someone else other than the individual actually perpetrating the behaviour. I am not saying that that means we should blame everyone all the time for everything. What I am asking is, is it possible that we are squeezing out personal responsibility in accounts of human behaviour?

The third group of people we could blame are politicians. Have you noticed, when there is an election campaign, politicians never say, 'You know the reason the country is in a bit of a state? It is because you, the electorate, are not pulling your finger out and working hard enough!' They always find someone else to blame: it is the asylum seekers massing at the border; it is the Russians; it is the Communists; it is the Iraqis, etc. etc. We always have to find an out-group to blame for our problems, so politicians try to engender externality over a long period of time.

We could come back to that in discussion. as to why this shift in externality is occurring, but let us move on now to one key reason why we need to develop more emotional control. That is, although we talked about the fact that there are many goals you can have in life - like getting good grades, or for example, doing better in your diet, drinking less - there is a key set of goals that we have in our lives which are called social goals. Whatever it is you want in life - whether you want to get the Nobel Prize in Physics, you want to date Brad Pitt or Jennifer Aniston, you want to get the gold medal in the 100 metres in the Olympics, you want to earn a billion dollars, you want to live alone on a desert island - whatever it is you want in life, these are social goals. What I mean by that is other people have to give this stuff to you, so the central conundrum in life is how do we get other people to give us the stuff that we want, be it sex, be it money, be it regard, be it respect. How do we do that?

In order to accomplish these social goals, psychologists would argue life is, at its heart, transactional. There is a sense in which we have to give in order to get, but another way of putting that is maybe we have to get other people to give us stuff and how do we do that.

There are three basic ways we can do that. There is power, the naked exercise of power. I could pull a gun on you and say I want you to applaud at the end of this talk, and that would be me exercising power by forcing you to do it. The problem with that, though, is every time I pull a gun and say, 'You must applaud at the end of my talk,' gradually resentment builds up at my exercise of power, and eventually, sooner or later, there would be a rebellion amongst you and you will storm the stage and take the gun from me. That is inevitably what happens when people try to exercise power that way.

The second key thing we could do is use persuasion. I could mount a big advertising campaign on the sides of buses here in London: 'Come to Gresham College and applaud at the end of lectures.' The problem with the persuasion tactic is you are aware you are being persuaded and therefore you can guard against it. You can decide not to come to Gresham College and applaud at the end of lectures.

The third and perhaps most powerful technique is manipulation. Manipulation occurs where I get you to applaud at the end of a lecture: I get you to come, without you realising that was my goal all along, and because I do it without you realising it, you cannot guard against it. Maybe in the discussion later on, we could talk about some manipulation techniques, but whenever we talk about manipulation, we get into what is called the Machiavellian mindset - Machiavellian after Machiavelli, a Florentine prince from the 16th Century who wrote a book called The Prince about the exercise of power. Machiavelli-s name has become associated over the years with the notion of deception and guile in the pursuit of power in human relationships. It has got a bit of a bad name. They say that The Prince, Machiavelli-s book, is on the bedside table of every dictator in the world. Machiavelli himself actually was not advocating the exercise of power in human relationships. He was merely observing that, in order to get what we want in life, often we have to exercise power, and he was often sad about that, but he was just accepting it as a human reality.

One of the interesting things is that people vary in their ability to manipulate, and there are psychology scales that have been devised that measure your ability to manipulate others. These are called Machiavellian scales, and they can classify whether you are High Mach or Low Mach. High Mach individuals are very, very good at getting you to do what they want without you realising. My favourite, though, is not High Mach or Low Mach, but -Big Mac-. They say, in psychology, as an in-joke, if you are a Big Mac, would you like that with lies or without, because Machiavellians are often lying in order to manipulate you!

If you are going to go down the Machiavellian route, one of the things you will get into is a very interesting branch of psychology called theory of mind. There are three orders of theory of mind. There is first order theory of mind, which is knowing a bit about what is going on in your own mind. Second order theory of mind is having an idea of what is going on in someone else-s mind you are trying to negotiate with or seduce. Finally, and this is the order of mind that very few people get to other than arch-Machiavellians, is the order you have to reach to be adept at manipulating people and achieving your social goals, and that is not just knowing what is in your mind, not just knowing, as in second order theory of mind, knowing what is going on in another person-s mind, it is knowing what they are thinking about what you are thinking.

Let me illustrate that with a story that comes from the game of poker. Poker is a game of deception. Cards get

dealt out, there is betting and then, finally, you can win the pot if you bet aggressively, if everyone else folds their cards. The key thing about poker is you can win the game without ever having to show your cards. So manipulating people emotionally is a key part of the game, and therefore deception is part of it, and therefore the Machiavellian mindset, and exerting, as we said before, emotional control.

There is a famous story that is told that, back in the San Francisco Gold Rush of the 19th Century, gold prospectors in San Francisco would get their gold nuggets, and then have to sit on the slow boat to New York in order to cash in their nuggets for cash. Of course, what is there to do on a slow boat to New York other than play poker? So they would often play poker with their gold nuggets, and small fortunes would change hands.

One day, a group of gold prospectors are playing poker with their gold nuggets and a small fortune is beginning to amass with the heavy betting that is occurring in the game. The final round of cards is dealt to each player, and one of the gold prospectors catches a brief glimpse of their card when a gust of wind blows it overboard. This player immediately dives overboard to rescue their card. Sodden wet, the player is dragged back on to the deck of the boat by his fellow players. Clutching the sodden card to his chest, he makes a big raise into the pot. Everyone else around the table goes, 'Mmm that must be a great card. I mean, the guy nearly died trying to rescue that card.' So everyone else around the table folds, he scoops the pot, and of course the card was worthless. What this person was doing was third order theory of mind. He was thinking what the other person was thinking about what he was thinking.

Ultimately, that is the ultimate level of emotional control, being able to control your emotions, to display certain emotions in order to communicate with other people.

I am going to show a short film clip, but I will just explain about it first. It shows a televised poker tournament. Nine players were in at the beginning, we are down to the last three, so we are very close to the £20,000 jackpot that the TV company put up. The game of poker we are playing is called Texas Hold 'Em. In Texas Hold 'Em, everyone gets dealt two cards that are face down. You look at your cards and you put them on the table face down. There is a camera under the table that allows the viewer at home to see the cards. So the viewer at home and you will see the cards as they are played out. Remember, you are seeing them but the other players are not seeing them. The other players have to do 'theory of mind' and try to work out what we are holding, in terms of our emotional reaction and their behaviour. There is an important third order theory of mind moment that occurs in this clip and I want you to look out for it.

In this game we are playing, the cards are dealt, and it looks as though someone is developing a very strong hand, which is three of a kind, three Kings I think, but three Kings is beaten by a Straight in Poker - a Straight is a sequence of say 9, 10, Jack, Queen, King - and it looks as though that is developing, but then later on, an even stronger hand looks like it is developing.

[Clip plays]

The pot is £300. There are two Kings that come in the community cards that we all share. She looks at her cards, and she has got a King, and she has got three Kings now. So she is asked what the minimum raise is. She is betting everything. These are the chances of winning at the moment.

I think that is a very, very astute demonstration of emotional control by myself right at the end there: devastation that the final card that came, that she won, despite the fact statistically that was a very unlikely card to come.

So, low emotional control demonstrated right at the end there. The point I am trying to make is that emotional control seems to be a key skill we need in our lives, not just in terms of goals you might have for yourself but, crucially, in terms of social goals. But it is becoming even more interesting because, all around you, all the evidence indicates, people are declining in their emotional control. So if you have more emotional control in today's society, you are likely to do even better, given the declining levels of emotional control there are around us.

Audience Question

Regarding externality, I notice, if you look at the people in the media, the most highly intelligent people tend to atheists - you know, David Attenborough, Jonathan Miller, Richard Dawkins, etc. etc. Would you say there is a strong correlation - there must be, surely - between externality and religion and atheism?

Raj Persaud

That is a very, very loaded question! I need to quibble a little bit with some of the assumptions that the most intelligent people, you said, are atheists - you gave a list of names there, which seemed a slightly arbitrary sample, I have to say. What is very interesting about that notion is it depends how people define their religion, and it depends how they live through it. Some people would say that God gives us free will, and then judges us

depending on how we exercise our free will, so that is the view that some people take. It depends on their view of religion. Other people say that God is omnipotent and determines everything that happens, and those people, obviously, would be externals because they are saying they can do little to exercise power over their destiny. So I would be careful. It is a very interesting point you are making.

In psychology and the social sciences, when people talk about variables, like religion - do you believe or don't you believe - that variable often masks a massive amount of detail. You know, one of the questions is how do people believe? You might have two Christians who might be more different from each other, in terms of how they believe, and one of them might be closer to an atheist in terms of the impact of religion on their behaviour. So one of the issues is defining variables more carefully, I would argue.

Audience Member

I think if there were a God, he would be very disappointed in those who believed in him because he obviously has given enough reason to not believe - the evidence is overwhelming. In other words, absence of evidence means you assume it is not there, and when you think about it, people who believe in things that are not there, the word we use is mad.

Raj Persaud

Again, this is a controversial one. Let me suggest this to you: as a psychologist, what I am really interested in is not so much what people believe, but the consequence of those beliefs for them. If religion helps people do difficult things in their lives, then it may be a good thing, and if those difficult things are, for example, making massive personal sacrifice, leaving the world a better place than they found it, if it helps people do difficult things, then, to me, that means religion might be a good thing.

There are many people who do very difficult things without needing religious faith; but on the other hand, it does seem to help some people accomplish very, very difficult things and sacrifice.

Audience Question

I was interested in the emotional control. Seemingly, to me, that indicates the secret of living is to how to learn emotional control by learning how to reason. For example, in the first lecture we had, we were shown a venomous snake. Most of us here would shriek in almighty fear at the possibility that we would have a snake bite, would not get to the hospital and therefore we would die. But if we control our emotions and reason that if that we did this, that or the other, that we would increase our chances of surviving; successful living. What I am getting at is how do we learn how to control the emotions and apply reasoning to a successful outcome?

Raj Persaud

Well, it is a million dollar question: how can we learn more emotional control? There are many different ways we can do it, but let me make one point, and it picks up on a point that the other lecturers made earlier.

We live in a culture that seems very averse to stress, a culture that says stress is, by definition, 'a bad thing' and we must all spend our lives trying to reduce the stress of everyone else. But actually, one of the things we notice about people who can control their emotions, particularly at stressful moments - let us say you are serving in a tennis game, in the final point, you have got championship point at Wimbledon championship, at that moment, an enormous amount hangs on your ability to serve well at that moment. Guess what happens? Some people choke - they cannot actually perform the serve at the moment - whereas others can perform it seamlessly. The ones who can perform it seamlessly have developed massive emotional control at that moment.

It is an area that I am very interested in because I see quite a few elite athletes who have to develop emotional control at a specific moment. Guess how you do it? You do it by finding yourself or putting yourself in that kind of testing situation a lot. You cannot develop emotional control and serving championship point if it is the very first time you have been put in a stressful situation where a lot hangs on every single thing you do. So one of the ways we develop emotional control is by exposing ourselves to increasingly challenging situations, and then gradually learning to control our response to it.

Audience Member

Building up experience?

Raj Persaud

Yes. You mentioned reasoning, and we have heard a bit about CBT. My experience is that rapid change tends to occur when people find themselves in difficult predicaments, and that therapy which involves a lot of talking and reasoning tends to take a lot longer. People sit and talk for a long time and the talking method tends to take a long time to produce change, but you find yourself in a difficult predicament and you survive it and come through it stronger, and a lot of rapid change tends to occur. So I am much more interested in actions and putting yourselves in difficult situations, because I think we learn a lot more from it.

Audience Question

I am struck by the three orders of theory of mind, because I am not sure I can reach the first order. I am not sure I know what I am thinking. That is surely quite a deep problem, because how do you know what you are thinking?

Raj Persaud

You make a good point, because there is a lot of evidence of unconscious reasoning, unconscious processing. People will deny being racist, and yet, you stick them in a brain scanner and their amygdala lights up when they are shown faces of people of other races, so maybe there is unconscious racism. But you are also raising an important point about one of our tasks in life, which is to develop deeper insight into ourselves.

I will close with an anecdote I have told here before, which I think is a good example of that. I was doing a televised phone-in once where a woman rang in and she had this question for me. Her husband did a lot of business travel. He had just come back from a trip abroad and he had gone off to work that morning, and she was rather helpfully unpacking his suitcase for him, which is a very dangerous thing to do, and she found a lot of opened packets of condoms in the suitcase. So, in a state of some alarm, she rang me up, and she was asking me, in front of 10 million viewers, did I think her husband was having sex outside of the marriage? Now, what is fascinating is, all 10 million viewers and myself know he is having sex outside the marriage - and we have never even met the guy! She is married to him, sees him on a daily basis, and she cannot see it. Why can't she see it? Because she is in a state of what we call denial. Denial is not a long river in Egypt! It is a very important emotional state.

What is going on is that she is in denial because she cannot face the consequences for her of what it would mean for her marriage if it was the case he really was having sex because that would be traumatic. So what she has to do, and here is a key tip, before you can see stuff, you have to know what you would do about it if it was true, and only then can you see it.

To go back to your point, she has to develop insight into herself, because actually everyone else can see the guy is having sex. She is the only one who cannot, and yet she is right up close to it. So we need to develop insight into ourselves, we need to do emotional work with ourselves. It can be the case that working with someone else giving you feedback about yourself is a key part of that. The trouble is, we find it very difficult to listen to other people telling us stuff about ourselves that we do not want to hear, and yet often that is the most valuable thing of all. So one key tip is you should tell people close to you, 'Tell me stuff that I need to hear even if it does not look as though I am going to be very keen or happy to hear it.' Liberate people to tell you truths about yourself that you normally would prefer not to hear, because, although it will be stressful, it will be a very educational experience.