

## **Airing Pain Programme 104: How Sleep and Chronic Pain Interact**

***More pain, less sleep. Less sleep, more pain. The relationship is a complex one, but what are the mechanisms behind the link between sleep and pain?***

*This edition of **Airing Pain** is funded by the Constance Travis Charitable Trust and the Isabella Memorial Trust.*

*Sleep can be a sanctuary from life; a way for the brain to decompress and begin restorative processes, but for those living with chronic pain, the pain/sleep cycle can become a vicious one.*

*In this edition of **Airing Pain**, Paul speaks to clinical and health psychologist Dr Nicole Tang about how polysomnography, a method of measuring the biophysiological changes that occur during sleep, can suggest aspects of brain functioning during sleep cycles.*

*Dr Tang explains how the deeper stages of sleep, like Rapid Eye Movement, are linked to pain sensation and emotional processing, and when you are deprived of these particular stages of sleep there is evidence of increased levels of pain sensitivity.*

*Paul also speaks to Dr Sue Peacock, consultant health psychologist and author of *Sleeping with Pain* (2016), about how she found sleep to be one of the major issues among pain clinic patients and her non-pharmacological approaches. Dr Peacock discusses how focusing on restructuring sleep patterns resulted in nearly all patients having improved quality of sleep.*

**Paul Evans:** This is **Airing Pain**, a programme brought to you by Pain Concern, the UK charity providing information and support for those of us living with pain and for healthcare professionals. I'm Paul Evans and this edition has been funded by the Constance Travis Charitable Trust and the Isabella Memorial Trust.

**Sue Peacock:** Because you've had so many sleepless nights, you expect to go to bed and you're not going to be able to sleep. So, you don't sleep because it's another vicious circle which is the whole of pain management isn't it, breaking up vicious cycles?

**Evans:** Getting a good night's sleep should be the most natural thing in the world, shouldn't it? Well, many people with chronic pain might disagree. Here's the conundrum. Poor sleep can make the pain worse, but the more we *worry* about our sleep, those negative thoughts can make getting a good night's sleep difficult. Pain and poor sleep each feeding into the

other in a downward spiral and that's the vicious cycle of pain which needs to be broken. So, what's going on, or what *should* be going on in our brains while we sleep?

The University of Warwick's Sleep and Pain Laboratory is home to some of the leading research into the science and clinical aspects of sleep and pain and Dr Nicole Tang is Associate Professor of Clinical and Health Psychology there.

**Nicole Tang:** When you are sleeping, your brain is still very active to a certain extent. It's just that the functions that you thought would be very active during the day; they would turn down a little bit. But during the night, there are a separate set of functions happening, helping you to process information that you've learned during the day. There has been some scientific evidence showing that during the night, potentially, the biology will work in such a way that it helps you to clear out the toxic substances in the brain that could potentially be linked to the development of dementia, further down the line. So there is stuff that the brain is doing like reorganizing information, helping you to process some difficult emotions; lots of things that we do when we're sleeping.

**Evans:** One of your research interests is the relationship between sleep and chronic pain.

**Tang:** It's my current obsession [laughs]

**Evans:** I have fibromyalgia. People have said, and I tend to agree with them, that if I were to give somebody the gift or the non-gift of fibromyalgia just for a day or two, what they would need to do is be deprived of sleep, for a week.

**Tang:** So it's a fairly complex idea, a gift and a non-gift ...

**Evans:** A curse.

**Tang:** [laughs] ...would be to deprive you of sleep. Actually, it's true, it's almost like double torture. So, when you are already in pain and you can't go to sleep, it's almost like the last resort of peace and restoration is taken away from you. So, lots of people in similar situations as yours would describe it as a double torture, because you know that severe prolonged sleep deprivation is a form of torture. Pain is commonly used as a means of torture, so if you were experiencing *both* at the same time, that could be a real curse.

**Evans:** So, what is going on when somebody hits the pillow to go to sleep and they become drowsy, this, that and the other? What are the processes going on within the brain, the sleep mechanisms, if you like, between going to bed or falling asleep and waking up in the morning?

**Tang:** Well, it's hard to put it into words because the brain certainly doesn't have a manual with the different words to say 'well this is what I'm doing, this is what I'm doing'. But there is a way that we can tap into electrical activities in the brain to suggest what sort of functioning, or what sort of mechanisms the brain is undergoing when you were sleeping. So, one technology that we use is polysomnography. It's almost like a lie detector but it's a technology that gives you an array of physiological information, so it has EEG (Electroencephalography) [where] you have electrodes stuck onto your head to tap into the electrical activity from the scalp and then it has EOG (Electrooculography) to measure your eye muscle movement, so we can check the eye movement while you are sleeping.

We also have EMG (Electromyogram) to measure your muscle activity. So, combining all of that together with your breathing, your heart rate etc., we can actually check what stage of sleep you are in. Using that kind of physiological information, we know that there are different stages of sleep, so by the time you drift off to go to sleep, you probably start from a very light stage of sleep, so it will take a while to fall asleep. Sleep is not like an instantaneous process. Sometimes people refer to it 'as soon as my head hits the pillow', then they'll fall asleep. You will be lucky if that happens! It could be also pathological if that happens during the day, but usually for an ordinary person it will take a while, slowly to get into sleep. We will start with the lighter stages of sleep first, which we call 'Stage 1' and 'Stage 2' sleep and then, only for a small proportion of time during the night, we will have the deeper stages of sleep, which we call 'Stage 3' sleep, so every night we will cycle through these different stages of sleep, maybe 4 or 5 cycles. If there's no disruption to your sleep pattern whatsoever, then we just go in a cyclical manner letting different brain processes happen.

**Evans:** So what are the functions of those different stages?

**Tang:** As far as we understand right now, different stages of sleep have different functions, particularly for the deeper stages of sleep, which we call 'slow-wave' sleep. They are associated with the hypothesis that it is restorative. It helps you to feel the sleep quality, it helps you to feel better. This stage of sleep is also closely linked to your pain sensation. REM (rapid eye movement) sleep, has been associated with emotional processing [and] learning etc. Different stages of sleep could have different functions, but they are all inferred functions, so it's really hard to say for *sure* that this is exactly what it does. But we have learned from different experimental studies knowing that when you deprive someone of this particular stage of sleep, it is particularly linked with an increased level of pain sensitivity or disrupted emotional functioning etc.

**Evans:** Some people with chronic pain will identify with feeling they've had a poor night's sleep, even though their partner might say 'no, you've slept all night'. I'm speaking personally. In the morning, I will say to my wife, if she'd asked me how I've slept, and I'd say 'well I've had a terrible sleep. I've been awake most of the night' she'd say 'no you've been snoring most of the night'.

**Tang:** [laughs]

**Evans:** So how can we have such differing views of my sleep?

**Tang:** Yeah, it's really interesting I mean in fact, my doctoral research is all about this discrepancy between people's *experience* of sleep and also what we can measure from polysomnography (that I've just talked about), actigraphy measurements that check your movement, then estimate your sleep parameters, and also partners' reports. [Laughs] It is well known that there are discrepancies, systematic discrepancies, between what other people report on your sleep and how you experience your sleep. So that suggests that the way we perceive sleep quality is much more complicated than just a few parameters that are being picked up by our existing measurements.

Lots of other things could go how we judge our sleep quality - for example, your mood [and] your physiological sensations at the time when you're thinking about your sleep. But what we found from experiment[s] is that it's the level of cognitive arousal, so your thoughts, your worries, what you were thinking at the time, could affect your judgment quite a bit. The level of anxiety could also affect the way you see your sleep. Your memory and biases that we tend to have in terms of what we pay attention to, would also affect how we report our sleep quality. From a clinical point of view, it is really useful to understand that discrepancy, because let's say if a patient comes along and says 'I've got really terrible sleep quality' and then when you send them to the sleep clinic to have a sleep study, the reports come back completely normal, so what would be the implication? Some people misinterpret that as 'oh the patient is just exaggerating etc' and then that could build into a lack of trust in subsequent consultations. But for us, what we are trying to do, is to understand the intricate psychological factors or physiological factors that would affect the way [in which] people perceive sleep quality by better understanding what caused the complaint, what caused the perception of poor sleep quality - we can treat them accordingly, not necessarily through drugs, but it could be through non pharmacological treatment.

**Evans:** That's Doctor Nicole Tang from the University of Warwick's Sleep and Pain Laboratory. Well, based on a non-pharmacological approach, the book 'Sleeping with Pain' offers strategies for a restful night's sleep. Its author is Dr Sue Peacock. She's a consultant health psychologist with two decades' of pain management experience within the NHS and now works in an independent practice.

**Peacock:** Having worked in the pain clinic for so many years with chronic pain patients, you notice that sleep is one of the big issues that comes along with it. Nobody seemed to be doing anything about it, so possibly about three years ago, I designed a program specifically for chronic pain patients who had sleep problems. Before that, we just did one session on the pain management program that was just about sleep, but that wasn't really enough. So, we developed this sleep program that looked at challenging unhelpful sleeping patterns, challenging unhelpful thoughts about things, dealing with racing minds, relaxation strategies and keeping sleep diaries and all that kind of stuff. Then using that information to reschedule sleep patterns, which isn't easy, but because we had the support of the psychology staff, we could help our patients move that forward and so we could help them change their sleep pattern. As a result of the 6-week program, we found that nearly all of them reduced the length of time it took them to get to sleep and improved their quality of sleep. So the reason I wrote the book was because access to pain clinics is actually quite difficult for so many people. I thought we need to get the word out because this is a huge problem - to get the best night's sleep it's very much about doing the basics of sleep hygiene, which is always such a strange word I think. It's basically looking at your sleeping environment, so is your bed comfortable? Is your room dark enough? Is it warm or cool enough, depending on what you need? Have you got rid of all the mobile technology and TV and all that kind of stuff - are you comfortable basically? So there's those kind of things but then also prior to getting into bed, I think it's important about getting a good routine. So do you do the same things every night? For example, for me, I probably watch the 10 o'clock news, put the dog out and go and clean my teeth, then go to bed. So it's usually the same kind of pattern and I think having that pattern helps because it gets you into that routine that you're *preparing* to go to bed. Then, when you get in bed, you turn the light out and go to sleep and that's the way to start it. I think it's also worth spending some time before you perhaps get to bed, say you get to bed at 10:30 or whatever, say [at] about 8 o'clock, write down what kind of things you need to remember for the next day or what you need to do for the next day, so your brain's not constantly trying to remember stuff while you're lying there awake, tossing and turning.

**Evans:** But aren't you reinforcing that business where 'I have to prepare to go to sleep now'? At 8 o'clock, I have to start writing a list so I can clear my mind later, surely that's reinforcing it?

**Peacock:** Well, I think you're right. I think if writing it down helps you remember what you need to do, because quite often when you're lying there in bed trying to remember, it's the fact that you're trying to *remember* everything that's racing around. So if you know that it's written down, you don't have to worry about thinking about it because it's already done for you. It's also about thinking about what's happened in the day, do I need to reflect on the day, what's gone right, what's not gone so right, what would I need to do that'll change it - all those kinds of things to try and clear your mind. Not saying you can clear your mind completely, but if you can clear your mind a little bit then that reduces the brain's need to keep saying 'you need to remember this, you need to remember this, you need to remember this' kind of thing as you're trying to sleep.

It's also useful [laughs] to turn your clock away from you because sometimes [laughs] when you lie there, it feels like you've been asleep for absolutely ages and you look at your clock again, it's five minutes [later] and then you just get stressed, cross, anxious and irritated with yourself and that's not going to be conducive to a good night's sleep.

I also think, whilst you're trying to reschedule your sleep pattern, that if you can't sleep and you're lying there for 15-20 minutes, you might as well get up because you're just going to lie there and get crosser and crosser and more uptight, so less likely to sleep. So I think it's important to prepare things that you can do in the middle of the night, or two o'clock in the morning, whenever you get up, so you've got soothing activities that you can do. Nothing too stimulating - if I said 'go and watch a film', I don't mean some kind of action-packed thriller, [laughs] just a nice film kind of thing [laughs] that's quite gentle. Or if I said 'listen to some music' it's not some kind of hip-hop, dance kind of stuff ...

**Evans:** It wouldn't be!

**Peacock:** [laughs] It's more gentle music that can help you get back into that relaxation set of mind. Then, when you feel sleepy tired again, sleepy tired is when your eyes feel as if they're really heavy and dropping off, you kind of feel yourself nodding. Rather than thinking 'right, it's time to go to bed now' whether you're tired or not - it's got to be sleepy tired when you head to bed.

**Evans:** The middle of the night sometimes can be when one has one's most creative thoughts.

**Peacock:** Yes.

**Evans:** I have a friend who combats this by having a writing pad by the bed and rather than festering over it for goodness knows how long, writes down the thought and it's gone.

**Peacock:** I think it's a really good idea, I used to do that when I was writing my PhD.

**Both:** [laugh]

**Peacock:** Yes, I always say to my patients, if you can, have a notebook or a bit of paper by your bed because if you think of something, if you've written it down, you know it's written down. Whether you can read your writing or not in the morning's another issue [laughs], but you better make it enough [that] you'll be able to make sense of it enough to know what you what you were thinking about in the middle of the night.

**Evans:** There are apps for smart phones and things like that, I think Sleepio is one, based on cognitive behavioural therapy techniques. What do you make of those?

**Peacock:** Some of my patients like them and some of them don't. The course that I ran and subsequently my book, is very much based on CBT approaches with a little bit of hypnotherapy [laughs] in there as well and a little bit of mindfulness. I think probably for younger people, and I don't mean to sound ageist about this, but a lot of younger people like and embrace more technology than older people. We are getting younger and younger people into pain clinics, so I think there's a place for both, I think it's about preference. The most important thing about it is that you do it, record it and stick to the program because if you stick to the program, then you're more like to get success - be it the book, be it apps.

**Evans:** I found the explanations and worksheet approach in Dr Sue Peacock's book 'Sleeping with Pain' very readable, practical and it's attractively priced. You can buy it online, just put the title into a search engine or you can get details from Sue's own website which is [apaininthemind.co.uk](http://apaininthemind.co.uk). You'll also find on the website some useful information and resources about living with chronic pain.

Now, as I always do in these **Airing Pain** programmes I'll just remind you of the small print and that is that whilst we in *Pain Concern* believe the information and opinions on **Airing**

**Pain** are accurate and sound based on the best judgments available, you should always consult *your* health professional on any matter relating to your health and well-being. He or she's the only person who knows you and your circumstances and therefore the appropriate action to take on your behalf.

We've been talking about sleep hygiene as a component of cognitive behavioural therapy, or CBT, for insomnia, but as Dr Nicole Tang of the University of Warwick Sleep and Pain Lab explains, it's not the only component.

**Tang:** From research, we know that actually, poor sleepers and good sleepers do not differ that much in terms of their sleep practices. In fact, lots of people with problems sleeping couldn't have better sleep hygiene or [a] much more regimented routine that they would follow and they have meticulous bedroom settings that *should* be very facilitative of sleep. So in CBT for insomnia, mainly what we're trying to tackle is, first of all, some of the behaviour that we know would contribute to a persistent disrupted sleep pattern. For example, one of the common responses to pain would be to lie down, to not do too much during the day, trying to make sure that the pain doesn't get aggravated and also at the same time, they get enough rest. Probably, it's just the vicious circle that you and I would be very familiar with because when you are in pain, you don't want to move and then you lie down, sometimes you have a nap and to see if you can catch up on the sleep that you lost [laughs] the night before.

**Evans:** You've been spying on me!

**Tang:** [laughs] I haven't been! But it's just a very common experience and it's totally understandable why people make certain decisions because of what's happened before. So, this vicious circle, you can understand why people got into it. It's not particularly helpful in terms of protecting sleep in the long term, particularly for sleep quality that you were talking about earlier - because the longer you lie in bed to get the amount of sleep that you need, means that you are essentially lowering sleep quality. For all of us, we've only got a certain quota of sleep that we could obtain - if you spend more hours in bed, you are still sleeping the same amount so that means that you're not that efficient in terms of your sleeping. For the rest of time when you're not sleeping, but were still in bed, probably you'll be either experiencing it in the form of awakening or the long beginning process of falling asleep or you've woken up in bed and then you don't want to get out of bed. Those would be the times potentially be filled with worries and frustration, anxiety and depression, because of the lack of ability of going to sleep.

**Evans:** I didn't sleep last night. I will go to bed at half-past nine and the anxiety involved in 'will I get to sleep, will I get to sleep, will I get to sleep' and, of course, you don't get to sleep.

**Tang:** Yeah, exactly because you get so worked up, you're anticipating sleep to come and you're forcing it to come along. It actually just makes it *harder* to happen.

**Evans:** I can remember thinking as a teenager 'I don't know how to go to sleep; I don't know how to do it'.

**Tang:** Well, sleep is *easy* when it comes naturally, but when you're *forcing* it to happen, it doesn't come. I remember one sleep researcher put it as an analogy, it's almost like a butterfly or a dove in your hand, so as long as you allow it to happen, it happens naturally. When your body wants to claim the sleep, it will, but when you try to grab it, control it, it will just fly away.

**Evans:** Another sleep issue that some people have is that they go to sleep okay, but they will wake up at two o'clock in the morning and have trouble getting back to sleep then. What's going on there?

**Tang:** There could be many, many reasons why people wake up at a certain time, certainly, sleep is a *habit*. What's happening, potentially, is because they don't have enough sleep pressure to drive them through the whole night of sleep. So that's one possibility that is linked to what I talked about before. When you have been spending your sleep pressure during the day in the form of an afternoon nap, in the night, you won't have the same amount of sleep pressure to drive you into deeper stages of sleep and for the long period of time that you hope you would be sleeping for.

**Evans:** So, by sleep pressure, you mean you only need a certain amount of sleep? If you're using that up in the day before you really should be going to sleep in the night, then the pressure's gone and you didn't need that sleep in the first place?

**Tang:** Yes, it will make it harder for you to plunge into deeper stages of sleep and to maintain your sleep for a long period of time in the evening, so that's one possibility.

**Evans:** We sort of glossed over pharmacological help for sleep. A lot of people with chronic pain take tablets for it.

**Tang:** Mm-hmm

**Evans:** One of the benefits of some of those tablets is that they get good sleep after it, which in itself is a benefit, as far as I'm concerned anyway.

**Tang:** Mm-hmm

**Evans:** Is there a role for CBT psychological approaches alongside those pharmacological approaches?

**Tang:** Well, definitely I mean, if the tablets are working for the patient, that's really good news but I think the sad reality is that it doesn't work for everybody. [With] quite a lot of the patients that I've seen in clinic and also from different research reports, although they do get longer periods of sleep, the sleep quality, after taking a sleep[ing] tablet is not so good because the tablets change the sleep's architecture. That affects the kind of sleep that they get and they're not necessarily benefiting from it from that particular point of view. Also, taking tablets would have side effects and you know about that, so it's about choosing what you want - the side effects of the tablets and also the drug interactions that they [patients] have to worry about. So that's why, in current guidelines, it is not recommended for people with sleep problems to take sleeping tablets for the long term - the type of sleep problems that chronic pain patients do experience is the long-term type of sleep problem. So in a way, tablets, while they work, they may work beautifully for the short-term for some people, but for quite a lot of people, they do have difficulties taking all these tablets with side effects and also not necessarily the effects they are looking for in terms of sleep outcome. So, we have to be very careful with the use of medication.

**Evans:** You mention exercise and sleep - I mean, is there a correlation between exercise and sleep and chronic pain?

**Tang:** If you think of sleep as an activity, you can see a continuation of sleep and physical activity during the day. The more you do during the day, that would help you to build up sleep pressure and that sleep pressure eventually would help you to plunge into deeper stages of sleep, to have faster sleep onset and a deeper quality of sleep. So, if you look at it that way, physical activity *should* be linked with sleep quality. *However*, as with everything, [it] is not as simple as that and to try to detect that relationship is quite complicated. There have been some studies suggesting that, by offering people exercise intervention, it may help with sleep. The kind of activity that has been introduced for people with arthritis would

be some sort of mild aerobic exercise, like Tai Chi and Tai Chi Chung. In the States, there has been a group of researchers looking into that for older patients with osteoarthritis - it seems to show quite a lot of benefits, in terms of both sleep and all the quality of life outcomes, also inflammatory markers - they have demonstrated some positive changes in those two, so that is quite encouraging. But for some people, if they don't manage the physical activity carefully, they could have overdone it and in the short term exercise could induce more pain and that could affect their sleep in a negative way. So, it depends on how you manage your physical activity level in such a way that you are getting the best from both worlds.

One of our studies is actually showing the very interesting association between sleep and next day pain. What happens is that when you measure people's sleep and physical activity over a period of time, we found that on days when people are sleeping better, I mean chronic pain individuals, on days when they're sleeping better, they tend to have a very different physical activity pattern the following day, compared to days when they have had a poor night's sleep the night before. So, that means that without any intervention, if you manage to sleep better, you will have a slightly higher level of physical activity in general, following a good night of sleep. So that seems to suggest the therapeutic power of sleep in itself as an overnight therapy - it can boost your physical activity the next day. But the interesting thing is that when we also looked at the people's pain rating, while having a good night's sleep could **reduce** your level of pain in the morning up till sometime in the afternoon, but by the time in the evening when you measure the pain again, it could go **up** in the opposite direction. Combining the data between pain rating and physical activity level, it seems to suggest that if people don't manage their physical activity carefully after they think 'I've got a good night's sleep and I have to do this, I have to do that, I have to make up for lost time' [laughs].

**Evans:** I was going to say, can I hazard a guess at that and that is, if you have a good night's sleep and you're feeling good in the morning, then you really go for it...

**Tang:** Yeah

**Evans:** ...and you suffer later.

**Tang:** Yea, you put it eloquently. Yeah if you don't manage it well and if you suddenly are tempted to do a lot, take on a lot more than what you can physically do, it could be not a blessing.

**Evans:** That's Dr. Nicole Tang, Associate Professor of Clinical and Health Psychology at the University of Warwick's Sleep and Pain Laboratory. Don't forget that you can download all editions of **Airing Pain** from *Pain Concern's* website which is [painconcern.org.uk](http://painconcern.org.uk), from *Pain Concern's* YouTube channel, just put *Pain Concern* and *YouTube* into your search engine, and from Able Radio which is at [ableradio.com](http://ableradio.com). The book 'Sleeping with Pain' is by Dr Sue Peacock and her information and resources website is [apaininthemind.co.uk](http://apaininthemind.co.uk). She can have the last words on this edition of **Airing Pain**.

**Peacock:** You've had so many sleepless nights, you expect to go to bed and you're not going to be able to sleep. So, you don't sleep because it's another vicious circle, which is the whole of pain management isn't it, breaking up vicious cycles? So I think it's about trying to break that vicious circle and trying to reframe the way you think about your bed and that association with bed and sleep. It's about the basic sleep hygiene things of not doing anything, using bed for sleep and sex and that's it, so don't have your TV in, don't have your iPods out or your mobile phones, all that kind of stuff - it's just very much for those two things. Then you can start to change your thought patterns and change that negative way of thinking, 'what's the point of going to bed because I'm not actually going to sleep'. Once you start changing your sleep pattern and you start noticing change, you notice that you *are* getting to sleep and it's a little bit longer than you thought it was going to be when you're recording in your diary and think 'oh that's okay', so it gives you more confidence that you will be able to sleep. Eventually your sleep pattern improves and the time that it takes you to get to sleep in the first place or if you wake up in the night, it gets less.

## Contributors:

- Dr Nicole Tang – Clinical and Health Psychologist, University of Warwick, Chartered Psychologist with the British Psychological Society.
- Dr Sue Peacock - Consultant Health Psychologist, Associate Fellow of The British Psychological Society and author of “Sleeping with Pain: Strategies for a restful night from a pain management expert”.

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