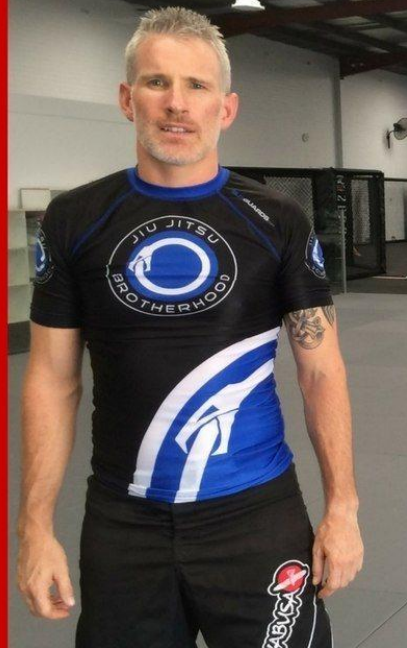


Ian Dunican, PhD

Sleep, Training Timing & Performance in Elite Athletes

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Episode 145



Danny Lennon:

Hello and welcome to Sigma Nutrition Radio, the podcast that brings you evidence-based discussions with the world's leading researchers and practitioners in fields related to nutrition and performance. I am your host, Danny Lennon, and you are listening to Episode 145. And on today's show, we are going to again dive into the topic of sleep and look at some of the research that's emerging on how sleep can affect elite-level athletes, and this has implications for any of you that do any type of training or compete in any type of sport of just how not only sleep but then things that are going to likely influence your circadian rhythm and your sleep cycles like travel, training timing and scheduling, even your nutrient timing and supplementation, how those can feed into impacting your sleep that therefore is going to impact your performance directly as well as your recovery.

And so I'm joined by Ian Dunican who is a PhD researcher at the University of Western Australia and does research out of the Australian Institute of Sport as well with elite-level athletes there investigating the impact of sleep on performance in those elite-level athletes, and this includes among other things the impact of evening use of electronic devices on sleep and on next-day athletic performance, the effects of jet lag and transmeridian travel on athletic performance particularly in teams who spend a lot of time traveling and going from different time zones or traveling long distances via plane to play different teams, and then the

prevalence of sleeping disorders amongst professional rugby players, for example, which is something that's not really touched on. So he gets to work with, like I say, pro rugby players, pro basketball teams as well as combat sport athletes like Olympic judokas, wrestlers, Brazilian jiu-jitsu players, professional MMA fighters all the way up to UFC level, so extensive range of high-level athletes looking at directly their sleep and how it's impacting their performance, and then also the things we can do to modify that to improve it.

So the show notes to this episode are going to be at SigmaNutrition.com/episode145, and if you go there I will link up to any of the research papers that Ian has published in this area as well as some things where you can find him online, and you can also get a transcript of this episode as well as all the previous ones delivered to your inbox as a PDF for free, and you can check that out at the show notes page as well, so SigmaNutrition.com/episode145. Now, let's get into this week's show.

Hey, Ian. Welcome to the show. Absolute pleasure to have you here.

Ian Dunican: Thanks very much, Danny.

Danny Lennon: I'm really looking forward to this chat because, as I mentioned to you previously, a lot of your work I've found really, really fascinating both in terms of the research that you've been doing just because of how novel a lot of it is and that there's not a whole pile of evidence base in some of those areas, and also really the practical application just because of how much of it is done in elite athletes who are working as professional athletes. Before we get into some of that, maybe just to give listeners a bit of context, can you bring us through an introduction into your own neighborhood and how that has led to you doing the work that you do today?

Ian Dunican: Yeah, no problem. Well, as you can tell by my accent, I'm Irish originally, grew up here in Athlone in the Midlands and paused sort of school, spent a little bit of time in the military, five years, and then after that then moved to Australia where I went back to university and sort of developed a career in the health and safety area. Worked in mining for a long time in oil and gas where I suppose I really honed my skills around fatigue and sleep and performance and all kinds of relationship between these things, and then as I moved on through my career obviously had a keen amateur athletic background. I do a lot of ultramarathons, 100km races and up to hundred-milers as well, I was always interested in that side. Ended up then a couple

of years ago bringing that to another level, moving on from mining and setting up my own small consultancy and also undertaking my PhD at the University of Western Australia where we do research with the Australian Institute of Sport, which is the Olympic training center, and also with Super Rugby Western Force in the west and the Wildcats championship basketball team, and then to Perth Lynx, who also is a high-level female athlete basketball team.

Danny Lennon: Awesome. I think that gives a really good context. And just with the work that you're doing both with the university in conjunction with the AIS, what are really the main goals that you and the rest of the research team have set out of examining sleep and what are the main things that you're trying to elucidate?

Ian Dunican: Yeah, I think in the context of the AIS it's a few different things. There are a number of PhD scholars or students there looking at things like nutrition, psychology of sport, skill acquisition, and obviously myself doing some part of the sleep as well. So it's more of a holistic approach. At the AIS we have what we call the Combat Centre, which is obviously taekwondo, boxing, judo, and so on, and wrestling. But I think really the overall goal of the Combat Centre is to try to use these different domains or areas of research to support the athletes and give them a holistic picture with nutrition, sleep and all of these things kind of interacting and then supporting the athlete.

And so really I think the primary goal in Australia is about really increasing the level of those combat sports in terms of personal skill and development of those athletes, and also then ultimately to move up the rankings and more into medal contention or do better on the world circuit. So it's really about supporting those combat athletes and all these different domains. And originally it was a guy called David Martin, who's now in the States with basketball, who started that, and now Clare Humberstone is leading the charge, sort of bringing all those skills together. So it's definitely a multi-disciplined approach to try and support those athletes.

Danny Lennon: Sure. And one of the big ones we obviously want to discuss today is in and around sleep, but before we talk about the things that maybe can impact sleep particularly with relation to athletes and their schedules, for example, perhaps just again to put some context on just how important sleep is for athletes, just as a general overview, what does the evidence base tell us about poor sleep and the impact for athletes? What types of

things is it going to affect that should be of concern for high-level athletes?

Ian Dunican:

Yeah, I think when we talk about poor sleep it's important to understand that we should talk about quantity of sleep, so the hours of sleep, and also the quality of sleep, which we'll probably discuss further in this talk, but it's not just the quantity but it's also the quality of sleep. And the important thing about those aspects, whether it be quantity or quality, is its effect on performance. So in the long-term, if athletes aren't sleeping well, getting enough hours or they have a sleep disorder, it's going to affect their performance in terms of things like reaction time, maybe delay their ability to make quick decisions. So when it comes to strategy, cognitive thinking and any of these aspects, it's going to be affected. And in the short-term, the acute phase, again this may have an effect as well but also may affect more things like strength and power in the short-term from poor sleep. When we talk about sleep, it's really important to talk about not just quantity but also the quality of sleep.

There have been a few studies around like a classic one looking at the opposite of sleep restriction but looking at sleep extension my study out of Stanford a few years ago, which has been kind of thrown out a lot and shown that people who sleep up to 10 hours have better performance in the swimming pool in terms of like the length of time it took you to swim a lap. They also had better shooting accuracy for basketball. Their PVT, which is psychomotor vigilance testing, the reaction time, and the lapses that they had was less, their reaction time was quicker. So all of these type of things seem to be affected by sleep. So if you extend your sleep it gets better, and then we know also from the studies, particularly on the military, if we reduce that sleep, then that's going to be affected as well.

Danny Lennon:

Sure. So obviously there's a huge benefit to making sure that this is as optimized, and I know that's a loaded term, but as optimized as possible before an event or before training to try and get the best performance in those metrics. Can we then say the same thing after a certain training session or event? Does the same thing still hold that it's going to impact recovery? Because I know you just mentioned things like, say, cognition as well as the physical attributes to performance. Does the same thing go with recovery that affects both the cognitive or mental recovery as well as physical recovery as well?

Ian Dunican:

Definitely. We're seeing this, Danny, at the moment in rugby and basketball, particularly in Super Rugby, or in the WNBL in Australia

where we have back-to-back games and particularly when travel is put on top of it. A lot of people will look at the pre-game phase and the nights leading up about the sleep and the travel, and then we have the game night which may have lower sleep quantity and poor sleep quality, but then in the days afterwards we start looking at this in terms of recovery exactly what you said. And the challenge with that is if we don't manage them recovery days, it's going to affect the next week's performance. So when we think about a season, we may have a cumulative sleep that over weeks and weeks if we're playing back-to-back games of basketball on a Friday and Saturday night, if we have a week of Super Rugby, one week at home, one week away, and we have travel on top of that as well, it's really going to affect the next week's performance by disrupting this and putting people out of sync. And then particularly in rugby, we find that every night of the week has a different sleep quantity and different sleep quality based upon this pattern that people kind of follow across the season due to exactly what you're saying, pre-game, game and post game.

Danny Lennon:

Okay, and is that purely down to just in the own athlete's mind that they get that sleep has some value so they'll obviously be very cognizant of that, say, the night before a game, but then the night of that game when it's finished maybe they're just not as mindful of it because they don't have something coming up maybe for another week? Or, does it actually come down to the impact of, say, that match or that training session that's having some sort of physical effect that's causing them not to be able to sleep or the fact that they're just not paying attention to it?

Ian Dunican:

I think it's all of those things. I think in the days leading up, definitely they do try to increase sleep. We see this in rugby. So sleep duration increases in the night before, but then after the game or during the game we see this heightened sense of alertness. They're playing again maybe between 6 p.m. to 9 p.m. They're under floodlights, high amount of light, high adrenaline, crowd interaction. It's very hard for an athlete to achieve what we call sleep onset or the ability to fall asleep within a couple of hours after that game. So with all of this stimulation, the lights and the crowd, that's going to delay what we call time of sleep onset, so that's going to be pushed out. So if an athlete goes to sleep normally at 11 p.m., we're not going to see the athlete going to sleep maybe 1, 2 p.m. or further on.

Now, the other thing we've been looking at as well is other contributing factors to that, and one thing we have been finding not only anecdotally but also from taking saliva samples is that many athletes consume a high amount of caffeine before the game for performance but whilst a lot of

people will have a strategy around using caffeine for performance, nobody has a strategy around the effects of caffeine on sleep. So on the front end we're loading people with caffeine at pre-workout to get performance and on the back end then we're actually delaying that sleep because, when we look at the pharmacokinetics of caffeine, on average it takes about 90 minutes to 100 minutes for caffeine to peak and it could be four to six hours for a half-life. So if you're playing a game between seven and nine at night, it could be 2 to 4 a.m. in the morning before you might be able to achieve sleep. Now, obviously that's going to vary by individuals, but when you look at it on the average across a team this is what we see happening.

Danny Lennon: Yeah, that's a really interesting point because I think, like you mentioned, a lot of athletes are kind of aware that as a stimulant caffeine has pretty decent research behind it having a performance benefit potentially. But then, like if we're trying to imagine if it's going to impact sleep, potentially some of that benefit is going to be counteracted and so then maybe for later training sessions in particular, so like 7 p.m., 7 p.m., if someone's using a caffeine supplement, it could be contraindicated, right? So when we're coming to practical recommendations on this, do you think that for maybe a game, for example, that's going to be at night, there's probably worth still trying to use it because of the importance of the game but maybe they need to limit it at other times, for example, people who typically train in the evenings? Do you think it's contraindicated to actually use caffeine at all pre-workout?

Ian Dunican: Yeah, I would say for the amateur athlete who's taking pre-workout after work in the evening and then going to the gym or going to jiu-jitsu or MMA or rugby training, it's probably not going to be great for you because you're trying to achieve sleep and you've got a job the next day and you may have kids. Particularly in the amateur bracket, I think it's detrimental, you know?

For the elite athletes, I think the timing of the caffeine needs to be looked at. So if your game is at seven o'clock, you want to be taking that caffeine probably somewhere around between half five and six to try and play the game within that peak period of the caffeine coming into the system. What I would definitely advise against is taking caffeine at halftime, and we see people doing this, taking NoDoz tablets, Red Bull and so on. That caffeine you take at halftime is actually not going to kick in till after the game, so you're getting no performance benefits from it at all. So if you're going to take caffeine strategically for a game, you want to be taking it an hour to

an hour and a half before that game for the elite athletes. But then on the counter side, we should be looking at some relaxation strategies post game to try and calm that nervous system down and promote sleep onset, and after a game that can be quite difficult. Particularly if guys win, they'll want to go out and have a drink maybe and have a laugh. And if they lose, they might want to go and drown their sorrow. So it can be a little bit difficult to try to do it, but what you can do is the next day...is provide an extended sleep opportunity so we don't get the guys in for recovery let's say on a Sunday morning and even on the Monday morning. We may delay the time of training till nine or 10 to allow people adequate time to catch up on that sleep.

Danny Lennon: Yeah, I think that's a really interesting concept and the whole idea of looking at training timing is something that maybe a lot of athletes are missing or don't pay much attention to. I mean, some schedules that I can think of, for example, I used to work in a school where there were a few elite youth swimmers who just because of their schedule, would obviously have to be in the local university Olympic pool every morning at like 6 a.m. just so they could train for a few hours before school, and then therefore really those training limitations were replaced without thinking about sleep. But then similarly where people have a bit more control, I know we've mentioned off the air things like the culture around combat sports and the type of training they may do or in the morning, or even just when we hear typical messages in mainstream fitness things like, "Oh, whilst you're in bed sleeping your opponent is out training," and other kind of silly little sound bites like this.

Ian Dunican: Yeah.

Danny Lennon: Do you think that training, say, timing and schedule is not only...we can see obviously it's going to impact performance and recovery, but that a lot of it then becomes dependent on these other messages within the culture that people are picking up and that we need to make people a bit more cognizant of the actual benefit of sleep to that as opposed to just working harder.

Ian Dunican: Yeah, and you know what, Danny? I kind of laugh at this, and this is a great question from you, but I laugh at this because I think most of this is driven from the Rocky movie, you know? Lots of people look at that or look at these YouTube clips of "rise and grind", you know? And I was kind of coining the phrase at the AIS; "rise and grind? I would say 'sleep in and win.'" I think it's important when we talk about training times to

understand what's called a chronotype. So everybody would have a chronotype, and basically what a chronotype is is, you know, are you more likely to get up early in the morning or sleep in? So we have what's called owls and larks. So an owl will typically go to bed late and get up late, a lark will go to bed early and get up early, and then there are some people in the middle that can kind of switch – depends on their family environment or at home, and they can kind of swing between them.

So we've got those three chronotypes – a lark, an owl, or either (in the middle) and it's important to know which one you are. Because if you are an owl and you're training at night and then you're going to sleep and you can't sleep till maybe two or three in the morning, what's the point of getting up at five or six, the crack of dawn, to go for a run when you've had three or four hours' sleep? Because during that sleep period, there's a lot of things happening in terms of recovery, with REM and non-REM, that needs to happen, and if you're constantly impacting those you're not repairing and regrowing your body, and therefore you can't perform. So you get yourself in this downward spiral. But I find a lot of times with amateur athletes or semi-pro fighters who are trying to work or study, they want to get two a day and train in the morning and train in the evening where they'd be probably better off maybe going for a lunchtime run at their job, if they could get even 20 minutes in of high intensity, or doing an extended session in the evening, and I think that would be better. So I think a lot of people mis-time the timing for, you know, to try to explain that, and I think that's one of the biggest things that people could actually change for their own performance.

Danny Lennon: Yeah. Yeah, for sure. I think it's such an important thing where once people have an awareness of that this stuff happens they can start making steps to do that. We've just kind of talked about kind of training timing and training schedules. Something related to kind of scheduling like that is something you brought up a bit earlier around travel schedules particularly to do with teams who will have to travel for a lot of events. And I know you work with Western Force, for example, who are the most traveled sports team there is, and you mentioned basketball earlier which is, again, a notorious sport particularly, say, in the US for traveling.

Ian Dunican: Yeah.

Danny Lennon: Can you maybe just discuss some of your work examining the effects of travel schedules on sleep and performance and some of the things that you've done to look through that?

Ian Dunican:

Yeah. So what we've really done here, Danny, and for people who don't know, the Western Force are based in Perth in Western Australia. They play games in places like Johannesburg and Bloemfontein and Durban in South Africa, then they may have to travel to Queensland, then they may have to travel to Japan, and then they may have to travel to New Zealand, and now most recently as of this year, this season, we've had Argentina join in that competition as well, and Japan. So the guys are traveling across five different countries, so it's a lot of travel. And they might necessarily go and do one trip, but they might go to South Africa, come home, play a game, go to Queensland, come home, and then go to Japan, so lots of time zone changes on top of their training, which makes it quite hard.

So what we did on this, Danny, we employed a tool, what's called biomathematical modeling, which comes out of a discipline of sleep research called chronobiology. And most of the biomathematical tools have been used in things like aviation, US Air Force, Navy, railroads for rolling stock maintenance, and so on and haven't really been applied to sports that much, but we've used a tool called the Fatigue Avoidance Scheduling Tool from a company called Fatigue Science in Vancouver, in Canada, and from that we've been able to use that to create and measure of cognitive human performance for the team when they're at home and when they travel. So that modeling tool allows us to input training times, travel, allows us to calculate the circadian disruption when they travel west or east. So it's got this, what's called a circadian oscillator in there and we put in waypoints or travel points, so we can actually calculate then when they arrive at a country what the cognitive performance would be, and this varies on a scale of 0 to 100, 100 being the top and 0 being the bottom. And to give listeners an idea, if you're at 77%, it's like having a reaction time of being intoxicated to 0.05, and if you're at 70%, it's like having a reaction time of 0.08% in terms of reaction time.

We try to push our athletes up above 90%, 95 for games, and so we use this tool to schedule the training times, look for areas of peak performance when they arrive in an area, and then we augment the training schedules further to try and give them, number one, the individuals or the team members enough opportunity to sleep, but also then for when they are training that they're at peak performance so they can actually remember the play, get the strategy into their head and operate in that sort of optimal zone. So we use that tool and that may take a number of different iterations or a number of different plans to run scenarios from that, and

then we present that back to the coaches and the team and then they make changes from that. So yeah, we use that tool to try and do that. So we're not kind of just making stuff up or thinking this'll work or that'll work. We're trying to place some scientific rigor behind it to use this to give us a number around performance that we can make evidence-based decisions on it or somewhat evidence-based decision-making on it.

Danny Lennon: Yeah, because I think that's interesting, the fact that there's an evidence-based paradigm you're using, and obviously there's data and there's metrics that are driving these decisions because one of the areas that there are maybe a lot of recommendations that don't necessarily have a lot of basis is that specific thing of people traveling to different time zones and have heard of certain strategies to mitigate jet lag or how best to adjust to a new time zone. So how does what you end up doing with the players actually compare to maybe a lot of the mainstream things you see being touted as ways to "adjust" to a new time zone?

Ian Dunican: Yeah, so what we do is we try to, and it's kind of when you read stuff you hear all this different advice, exactly what you said, so we try to, one, obviously, get rid of any sort of stimulants or depressants like alcohol and caffeine. We try to avoid those when we travel. The second thing we look at as well is the timing of the flights as well, so depending on which way they're traveling, if we travel west or whether we travel east. Now, as a general rule of thumb, if you travel in a westwardly direction, it's easier to adjust to the time zone, whereas if you travel in a eastwardly direction it's more difficult to adjust. If you travel north to south, so for example if you fly from Perth to Singapore, it's within the same time zone, you're not going to have any jet lag or circadian disruption within the time zone. You may be tired from the travel but you'll have no circadian disruption. So we take all those factors into account.

We also use light as well. So we don't use any artificial light but we give the guys advice on blocking out light, as in pulling down the shutters on the plane, wearing sunglasses when they come off the plane, whatever it may be. But also as well, a lot of advice out there is when you get to a new time zone you should go out and exercise and get yourself exposed to light. Now, that's not always the case. That may make things worse for people. So we look at all of those factors as well to come up with a plan on arrival.

So sometimes when guys come into a new time zone, it may be 12 a.m. or like 12 noon, we might say, "Right, everybody's going to the hotel

shower, have a sleep, go into a dark room, try to get some sleep or relax, and then we'll come out and do some exercise,” and then a different time zone it might be we arrive at 10 o'clock at night but we'll go and exercise straight away. It just depends what we're trying to do and it also depends on the timing of the game that we're trying to get ready for. So our strategies around getting ready for a game at 12 noon or 3 p.m. in the afternoon are quite different than if we're going to play a nighttime game. So everything is kind of reverse-engineered back from the area of performance that we're trying to get ready for. There is no kind of “one size fits all” for this and it has to be tailor-made.

Danny Lennon: Yeah, I think it just again highlights the importance of taking in the specific context of what is going on and then making decisions based on that as opposed to, oftentimes it's easy for people to try and look for the one solution to one problem. You did mention there the importance obviously of light and then the darkness on the reverse end and getting players zoned in on that. I know you did a study looking at the use of electronic devices by all the athletes, which is something that's obviously being talked about in more of a mainstream context as well of how people looking at their iPhones or their iPad at night can potentially have detrimental impact on sleep onset and then quality of sleep.

Ian Dunican: Yeah.

Danny Lennon: Can you maybe just bring us through the aim of that study looking specifically at those elite athletes, and then a bit of around the methodology and then what those results actually indicated to you?

Ian Dunican: Yeah. This study was done at the Australian Institute of Sport and we had judo camp in town Japan, Australia and New Zealand. So we took I think it was 23 athletes from the judo. We ended up with 18 at the end. We had some just obviously be removed from the process of non-adherence and to the protocol of the experiment. But basically what we did was we had two groups, nine and nine, and we took electronic devices away from one of the groups for two days and then the other group was allowed to use them sort of ad lib across those two days—they served as the control group—and we looked at the difference in cognitive performance and physical performance. So we did an online test with Cogstate looking at decision-making, reaction time and a number of other tests in that test battery there, and then we had a performance test as well. And it's quite hard in judo to have a specific test, so we just had what we call a single-leg triple-hop test, which we normalize for height. We looked at those.

Unfortunately, in that study, Danny, we didn't actually find too much difference between the groups, and the reason we think we didn't find any difference was because, coming back to your last point, was actually the training schedules. Most people were awoken between six and half-six to go training, and the average age of these athletes was 18 and most of them had an owl chronotype where they went to bed late and got up late. So we think if we actually allowed them the chance to sleep in we would have seen a difference in performance. And the reason we make that statement and interpretation is because on the very last day they had to sleep in till nine o'clock, or they had a sleep opportunity, and every one of them actually availed of that sleep opportunity and increased their sleep. So it kind of comes back onto that training schedule. So once we didn't find a massive impact from the removal of electronic devices, we do think that the biggest area we could look at is in terms of the training schedule for younger athletes and allowing them a later start in the morning, again coming back to our previous point on combat sport culture.

Danny Lennon: And I think it just probably highlights the fact that when someone is trying to make positive change within this area of dialing in their sleep before a performance that it's a matter of taking into all these different considerations and trying to modify that into a better overall plan as opposed to thinking one thing is suddenly going to be the magic bullet to fix their sleep, so to speak.

I did want to come back to, we mentioned earlier, circadian rhythm disruption...

Ian Dunican: Yeah.

Danny Lennon: ...in relation to travel, and one thing that comes up typically on discussions around disrupted circadian rhythms and then sleep is particularly when I've had discussions with amateur athletes who obviously don't have the luxury of working in a professional capacity where they can get more sleep or that they don't have to get up and go to work in the morning, and many of those that have shift work is the specific issue that tends to come up a lot. And I think many people listening are probably in this boat that they love training/competing in their chosen sport, they already maybe know the value of sleep and understand it can help, but because of work they may work with shift work and they're going to have more issues or at least it becomes more difficult to try and really dial in sleep and keep their circadian rhythms undisrupted. So to what degree do you think it's possible for such a person

to try and mitigate some of those detrimental effects of shift work? And are there any practical strategies that people can consider that you have found to work?

Ian Dunican:

Yeah, it's very difficult, Danny, if people are working shift work and being an amateur athlete as well. The first thing I'd say is in your shift work, if you are working shift work, try to be on what we call a forward-operating roster, so you do like a number of day shifts, then you move to afternoon shifts, and then you go to night shifts. So, first of all, that's the kind of the advisable rotation of how the roster shift should go over a specified period of time. If you are an athlete who is training on those types of rosters, the first bit of advice I would give you is that when you finish a night shift do not go training in the morning. This is probably the worst thing that amateur athletes could do. This would be my first bit of advice. If you're going to train, train before you start the night shift in the evening. Do not train in the morning.

And the reason being is that with the circadian rhythm over a 24-day, we see the biggest dip in sort of body temperature, cognition and performance between 3 and 6 a.m. in the morning or four and seven, depending on the person, and then when they come out at around six or seven in the morning we have a surge in cortisol. We take our timing from the light exposure from natural light. We have a little thing in our brain called the SCN, the suprachiasmatic nuclei, which is basically about the size of your small fingernail or even smaller, which is like an internal timing chip, and this takes its cue from natural light. So if we're exposing ourselves to natural light, we have this cortisol elevation in our body. If we go out and start lifting weights or going for a run, we're just going to hike it up and drive it up to new levels and it's going to be really hard for us to have sleep, to promote sleep after that exercise. So definitely, number one would be to train in the evening before you start the night shift.

The second thing I would say is leads us to avoid caffeine after 2 a.m. in the morning, again, coming back to our caffeine timing with pharmacokinetics, 90 minutes to 100 minutes roughly to peak, and then four to six hours is the half-life we may feel very tired doing a night shift between two and six or three and six in the morning, avoidance of caffeine during that time will be preferable. Have the caffeine beforehand because the caffeine you consume in that time is actually going to just keep you awake the next morning. They'd be my main bits of advice for amateur athletes working shift work like that.

Danny Lennon: Perfect. Yeah, I think that gives people a lot of stuff to consider. Ian, before we start wrapping up here, when it comes down to the areas of research you're involved with, what future questions in this area would you like to see examined and researched or what areas do you and your colleagues hope to explore further over the next coming years?

Ian Dunican: Well, some of the stuff that we're kind of going into towards the end of this current research is looking at the effects of the entire season on sleep and performance, so the cumulative effect of fatigue. I think that's an area that needs to be looked at.

The other one as well which I think is really unexplored is the effect of sleep disorders on athletes. So we tend to think about sleep disorders generally affecting middle-aged men or women who are overweight, may have some other sort of ailments as well such as diabetes and things like this. We never think about sleep disorders in the athletes where there are 95, roughly, clinical sleep disorders out there. We just don't think about them in athletes when in actual fact a number of athletes may have them and they may not be sleep disorders that are respiratory-related in terms of sleep apnea. They may have things like periodic leg movement disorder, which may be from low magnesium levels or low iron levels, and supplementation can alleviate those. Some athletes may have central sleep apnea where the brain is actually not telling the person to breathe, and then other people, bigger guys maybe of rugby, judo, wrestling, and jiu-jitsu, may have sleep apnea just because of the sheer size of their neck or it could be related to the sleep position. And we've seen some stuff come out of the NFL in the States in the last couple of years using like a level-4 device to measure sleep-related breathing disorders and they've found that one in five roughly had a sleep-related breathing disorder in the NFL, and so that's really going to affect next-day performance and then just travel on top of that as well, basically the person isn't getting enough oxygen and they keep awakening during the night.

So I think these areas around sleep disorders need to be further explored in athletes and not just respiratory ones but periodic leg movement disorder like I said, REM behavior disorder – people sleepwalking and so on. Because when you give all the opportunity you want for athletes to sleep, we'd give them a 10-hour break, 12-hour, 14, but if they fundamentally have something wrong with that sort of basic sleep physiology while they're trying to achieve sleep and what's going on in the body, if they can't solve that then it's going to be just...it's not going to happen.

Danny Lennon: Yeah, yeah, for sure. Ian, before we go, if we were to leave people with a couple of key take-home messages on the role of sleep in athletic performance and recovery just for them to bear in mind and to keep at the forefront of their mind going into the future, what are the kind of key few things that they should take away from this conversation?

Ian Dunican: So I would say number one is make time for sleep. We make time for work, we make time for family, we make time for socializing, we make time for training, schedule a time for sleep and try to be consistent. We probably see a number of sleep hygiene tips on the Internet, but schedule in periods for sleep. The second thing I would say is that early morning training is not always best, so maybe think about not rise and grind but sleep in and win, like I said before. And the last thing I would say is look at the timing of caffeine pre-workout for a performance. They're the three big things I would say at the moment for anybody listening.

Danny Lennon: Perfect. Ian, where can people follow you on social media or get more access to your published work?

Ian Dunican: Yeah, so I am on Facebook – it's "sleep," the number "4," "performance," or on Twitter, @sleep4perform, and you can follow me there, and we have a page on LinkedIn as well, Sleep4Performance. So, pretty active on those and every day on Facebook posting something new and you can find out about there. And also, we try to communicate the work from the AIS through those mediums as well.

Danny Lennon: Perfect, and I will link up to that in the show notes for everyone listening. Ian, we'll end the show on the final question that I ask people and this can be to do with any topic even outside of what we've discussed today, and it's simply if you could advise people to do one thing each day that would have a positive impact on any area of their life, what would that one thing be?

Ian Dunican: Make a plan. Make a plan every day. Make a to-do list. Make a plan and follow it. [Laughs]

Danny Lennon: Perfect. Love that. I think that's one of the things that always will have a benefit for people. So with that, Ian, I just want to say thank you so much for giving up your time today to come on and share some of this information. It's always great to get it direct from the people conducting this type of research and working with the types of folks that you work with, so thank you for giving up your time and for the amazing information and the continued great work that you're doing.

Ian Dunican: Excellent. Danny, can I just say one more thing?

Danny Lennon: You can indeed.

Ian Dunican: If people like the page Sleep4Performance and send me a message on that page, I will give them a free copy of a small ebook that myself and Dr. John Caldwell coauthored last year. It's around managing sleep and performance for jet lag. So for athletes who want to travel, it's a short ebook, roughly about 40 pages, that I will email back to you for free. It is on Kindle as well for about three or four euros I think here in Ireland, but if you like the page and send me a message I'll send you a copy of that book free.

Danny Lennon: Perfect. That's a very kind offer, so I'm sure many people will take up on that.

Ian Dunican: I might get 70,000 messages. [Chuckles]

Danny Lennon: Ian, like I say, thank you so much again for your time. It's been a pleasure.

Ian Dunican: Thanks, Danny.

Danny Lennon: So that was Ian Dunican of the Australian Institute of Sport. If you're interested in diving into even more sleep science discussions, then I'd revert you to two previous episodes of the podcast, #38 with Dan Pardi and #61 with Kirk Parsley. Both of those are still two of the most downloaded and popular shows we've ever had, so if you are interested in looking at some of the stuff around sleep and the evidence base behind it, check both of those episodes out.

The show notes to this particular episode are again going to be at SigmaNutrition.com/episode145 where I will link up on where you can find Ian, where you can contact him online, and some of his research papers that you can find and read through if you are interested.

For any of you interested in comprehensive personalized online coaching for performance nutrition and/or strength and conditioning or powerlifting coaching, then check out details of the Sigma Nutrition and Performance Online Coaching program where you can work on a weekly basis with one of the Sigma Nutrition and Performance coaching team at a level of access that I think is probably unprecedented in the vast majority of online coaching services you'll probably come across. So if you just go to SigmaNutrition.com and click on the Online Coaching tab in the menu, you can find details there of how to apply, the types of people we work

with, and learn a bit more if you are going to be a good fit for us, and I'll also pop a link to that in the show notes as well.

And that brings this week's episode to a close. I really hope you got something valuable from it and you learned something. Yeah, and if you did, if you share this around, I'll be extremely grateful. And of course, if you want to personally say thanks and support the show in an official capacity, then you can go over to Patreon.com/sigmanutrition.

And that is it. I will talk to you in the next episode. Thank you so much for listening.