

by Wendy Carlisle

# HEAD INJURIES



When is it safe to go back on the field? For some players, never. Yet the AFL's chosen experts continue to be sceptical of links between concussion and long-term health risks for players, even as the weight of scientific evidence grows.

**Last month**, it was revealed that head injury-related claims lodged by former gridiron players against the US National Football League (NFL) were shooting way ahead of predictions. It was the latest twist in a story that began in 2011, when 4500 retired players brought a class action against the league, alleging it knew about the dangers of repeated hits to the head but had concealed it.

The players' class action had been fought largely on the claim that repetitive head injury put players at increased risk in relation to a number of neurodegenerative diseases – not just the early dementia disease known as chronic traumatic encephalopathy (CTE), which is a major concern but can still only be diagnosed at post-mortem. The action was settled in 2013 when the NFL agreed to set aside a kitty of US\$675 million in compensation, albeit on the basis of no admission of guilt. In 2016, the NFL admitted to the connection between CTE and gridiron for the first time.

Now, barely a year after US courts had signed off on the final details of the settlement, players' claims relating to neurodegenerative disorders like Parkinson's disease and amyotrophic lateral sclerosis (ALS; known in Australia as motor neurone disease, or MNR) are triple what had been predicted.

If it seems remarkable that the issue that has threatened American football's very existence has barely raised its head in Australian Rules football, consider this: according to Australian Football League concussion expert Professor Paul McCrory, AFL players have higher rates of concussion than NFL gridiron players.

**The Australian Football League** is big business. The broadcast rights deal for 2017–2022 was worth \$2.5 billion. Its 700 listed players earn an average salary of more than \$350,000.

Australian Rules football is the nation's biggest spectator sport, and its broadcast appeal depends on the players' athleticism and the contact nature of the game. While the players are taller, heavier, faster and fitter than they were a few decades ago, the AFL also has an obligation to make the game safer.

In recent years it has introduced more stringent rules designed to protect the head, and heavier penalties for above-the-shoulder contact. Under its concussion protocol, a player must rest for 10 minutes before his club's doctor conducts five minutes of tests. Since 2014, players diagnosed with a concussion are not allowed to return to play that day. Only players whose symptoms have disappeared can return to play.

The AFL's official injury report from 2017 noted:

Concussion rates remain relatively stable with approximately seven injuries per team per year (all diagnosed concussions, not just those that cause missed matches). The incidence and prevalence of concussions causing matches to be missed appears to have levelled off in 2017, although concussions continue to be managed conservatively.

Even so, former Sydney Swans club doctor Nathan Gibbs has called into question the AFL's numbers. "They're not counting all of them," he told me.

Over a 14-year period, Gibbs sat on the sidelines, week in week out, "obsessively" counting concussions. His report, which was published last year, put the Swans' concussion rate at two and a half times higher than the official AFL statistics.

Gibbs thought the numbers might be underreported not just because of the players but also because of the doctors. Fines are imposed on doctors for not bringing concussed players off, especially in the case of delayed concussions.

However, the real story of concussion was buried deep in the numbers of the AFL's injury report. Eighty per cent of concussed players were declared fit to play the following week, thus not missing a game. Among those who did miss a game, one quarter were players who had already been concussed that year, and they spent four times longer on the sidelines than players who had injured their hamstrings, knees, shoulders and calves.

There was another brewing issue: what to do with "the bump"? The bump, the hip'n'shoulder, was one of the most sacred elements of the game. A bump, applied legally, allowed a player to knock his opponent off the ball.

A series of decisions by the AFL's match review officer had decreed that bumps that had caused players serious concussion – from a head knock – could be legal. After West Coast's Mark Le Cras was let off after a bump that concussed Gold Coast's Ben Ainsworth earlier this year, Gibbs was furious.

"This is ridiculous," he told *The Daily Telegraph*. "The whole anti concussion movement is about protecting the brain of contact sports athletes ... And it leaves the AFL open to litigation because they have a rule interpretation which increases the incidence of brain injury."

There is definitely a "disconnect" in the way the bump is being policed, former Hawthorn player Jack Fitzpatrick told me. Fitzpatrick was forced into early retirement last year after his ninth concussion. "It's confusing and probably not a great look if a player ends up in hospital and that bump is declared legal."

Fitzpatrick said he was in favour of keeping the bump in the game, and "the AFL is trying to get it right".

The AFL has agreed that the risks of Alzheimer's, Parkinson's, dementia and ALS/MND are higher for those with brain injuries, and that "players are educated about the risks". As for the threat of chronic traumatic encephalopathy, the AFL would only say it "acknowledges that head trauma in boxing can be associated with neurodegenerative disease".

As another former club doctor tells me, "Concussion is not good for business."

"Any sporting organisation in the world would want concussion to go away. It's a legal nightmare, so they want to make sure they treat it properly when it happens and they want to downplay it big time. And they want all their stats to show it's not happening very often.

“The irony is, concussion rates in contact sport are not going down. It’s okay to go to a lot of trouble to treat them after [the injuries] have happened, but it’s too late. The damage is done.”

So when is it safe to go back on the field?

**Reports of AFL players** retiring early due to “ongoing issues with concussion” and on “doctors’ orders” keep coming.

St Kilda star Koby Stevens is the latest, making his announcement in July this year. The 27-year-old had suffered eight concussions in his career and his doctors told him not to risk another one. Brain scans now showed he had brain damage, and he admitted that his penultimate concussion last year had “felt like a bomb had gone off”.

“I’ve taken hits, come back from them strong,” he told Fox Footy, “but to have someone say there’s been changes to my brain, and they can’t really tell you what they are – they’re just there – it’s tough.”

Brisbane legend Jonathan Brown had a similar story to tell when he quit after serious concussion in 2014.

Brown had played 256 games for the Lions and won three premierships, as well as the Robert Rose Award for most courageous player in 2007, 2008 and 2011.

and cognitive disorders, and then death. In Tizza’s case, the disease took more than 18 years to end his life.

For Tizza, there was no cure or treatment, apart from a cocktail of antipsychotics that calmed his demons enough for him to sit in his favourite chair and ask 40 times a day if the lights had been switched off. His doctors thought he had Alzheimer’s.

The journey to his diagnosis had been as swift as Tizza’s descent into dementia had been slow. The day after he died, family friend and journalist Peter Fitz-Simons rang the family with his condolences. Tizza had coached him in the Australian under-21s and then in the NSW team. Fitz relayed a message from researchers in the United States: would the family agree to donate Tizza’s brain for CTE research? CTE can only be diagnosed when the brain is fixed in formaldehyde, sliced and examined, when the truth is teased out by stains and high-powered microscopes.

The Taylor family agreed, and one of the researchers at the CTE Center at Boston University later told Tizza’s son Steve that his father’s brain had one of the worst cases of CTE she’d ever seen. “I don’t know how your father was functioning on any level at all.”

Steve knew that, in the end, his father was not functioning at all.

## Why were individual players’ concussions getting worse? And why were so many players retiring from concussions?

“It’s become evident after my concussion last week,” he said at his farewell press conference, “I don’t respond or bounce back like I used to from those hits.

“I’ve had pretty strong medical advice this week that it was in my best interest to stop.”

The list of other players who have taken their doctor’s advice in recent years includes Sam Bleasdale, who retired in 2015 after two serious concussions, Matt Maguire, Leigh Adams, Sean Dempster, Heritier Lumumba and Justin Clarke. Liam Picken and Ben Jacobs are also both out indefinitely, and Paddy McCartin was recently sidelined with his seventh concussion in four years.

If the league’s concussion protocols were working, why were so many players returning the following week to play? Why were individual players’ concussions getting worse? And why were so many players retiring from concussions?

**There has been just one confirmed case** of the dreaded CTE in Australia. It was found in the brain of former Manly rugby union breakaway Barry “Tizza” Taylor, who died in 2013, aged 77. He had played 235 games for Manly.

The symptoms can take 20 to 30 years to manifest: first memory problems, and mood disorders, then behavioural

Tizza was in his 50s when he started to get lost driving around the block. Later the CTE spread to his temporal lobes, and then the area of the brain that controls emotion – the amygdala – probably at the time he had to give up his coaching due to “behavioural problems”.

Steve says that one day his father tried to punch the living daylight out of him. “He had me up against the wall and I managed to wrestle him to the ground and just hold him till it passed ... I looked into his eyes and I thought, *This is not my father.*”

And then the CTE would have spread deeper into his hippocampus, which is associated with memory formation and retention. At the end, Steve asked him if he knew his own name. Tizza just looked blankly at him and shrugged.

By the time of Tizza’s death, the CTE Center and other major research bodies were making clinical discoveries that rocked the world of contact sports. They were studying the brains of former footballers, and war veterans who had been exposed to what had previously been considered mild head injury, and in a succession of important research papers found a strong link between repetitive head injury and CTE.

The then deputy director of the US National Institute of Neurodegenerative Disorders and Stroke,

Dr Walter Koroshetz, stated in relation to advanced CTE cases, “I don’t think there’s any wriggle room. It’s pretty clear this is due to head injury. Whether there are other things involved and where it starts, that’s hard to know, but I don’t think there’s any question that it’s related to head injury.”

Most of the research has been led by neuropathologist Dr Ann McKee of the CTE Center, whose work earned her a place in *TIME* magazine’s list of the world’s 100 most influential people in 2018. In a 2017 study published in *The Journal of the American Medical Association*, McKee and fellow researchers examined the brains of 202 former American football players from all levels of the game. Nearly 88 per cent of the donated brains had the degenerative brain disease. It’s important to note that there is an inherent self-selection bias in these results, but, strikingly, by far the highest incidence was in former professional players, those who had played and been hit the most: 110 out of 111 brains of those who played in the NFL had CTE.

**I met Steve Taylor** in March at the launch of the Australian Sports Brain Bank at Sydney University’s Brain and Mind Centre. He’d come with family members to support the establishment of the first brain bank in Australia dedicated to studying CTE in sportspeople.

Forty people have so far pledged their brains – among them former NFL player Colin Scotts, rugby league star

Ian Roberts, and former Wallaby Peter FitzSimons.

Chris Nowinski, one of the pioneers of the Sports Legacy Institute in Boston (now the Concussion Legacy Foundation), had flown in for the opening, and he sketched for me what science knew about CTE, starting with boxers in the early 1900s.

At the time, boxing was at the peak of its popularity. If ever there was to be a live experiment on repetitive head injury it would be in the boxing ring. Victory was declared on the basis of a knockout or a standing count, and it wasn’t unusual for boxers to have hundreds of bouts in their careers.

In the late 1920s, American pathologist Harrison Martland decided to investigate the brains of former boxers, men who in later life suffered psychiatric disturbances, cognitive impairments, and mood and gait disorders. Conducting limited brain autopsies, Martland described the brain injuries he found alongside the clinical symptoms. He called it “punch drunk syndrome”.

By 2007 when Nowinski – a clean-cut, good-looking former Ivy League footballer and world championship wrestler – decided to partner the Concussion Legacy Foundation with Boston University and Dr Ann McKee, they realised this was a truly neglected disease. They could only find 45 cases of CTE in the medical literature. Thirty-nine of them were related to boxers.

A decade on, the idea of a sports brain bank had been exported to Sydney University’s Brain and Mind Centre.

It was partnered with the Royal Prince Alfred Hospital, which was closely involved with an existing brain bank for multiple sclerosis research, and a brain and tissue bank for brain tumours. The RPA's head of neuropathology, Associate Professor Michael Buckland, agreed to lead this new sports brain bank.

"I've probably looked at over a thousand brains in 10 years," he said. "Reading all the papers about CTE I thought to myself, *I haven't seen this*."

"And then I started to think, *I actually have never even been looking*. You only see what you know about, and that's one of the maxims of neuropathology."

Buckland's first aim was to define whether CTE is present in Australia.

Even though it was the hottest issue in contact sports, none of the major codes sent anyone to the launch.

In 2016, the Victorian Brain Bank at the Florey Institute of Neuroscience and Mental Health had announced plans for a "concussion brain bank" for AFL footballers. But as to its progress, neither the Florey nor the AFL would say. How many footballers had pledged their brains? How many brains were in the bank?

The Florey was not "at liberty to disclose how many brains had been pledged or received". The AFL would not confirm whether it had paid for any autopsies, but said it had contributed funds to the project.

Chris Nowinski could only shrug.

"Not exactly an active research program, is it?" he said.

**I have been following** the story of concussion in sport since 2014, when I investigated the AFL's approach to CTE for ABC Radio National's *Background Briefing*.

Former Sydney midfielder Jude Bolton told me then that he was terrified of CTE. He had played 325 games for the Swans, and held the records for most tackles in a career and the most tackles in a game.

Bolton told me he'd been concussed in the 2012 grand final, and his recollection of the finish of one of the most thrilling games in AFL history was patchy at best. He couldn't remember whether he finished on the park or off. He had to check the tape.

It was his grandfather who convinced him to give up the game after that. "He said, 'Well, you don't want to be a dribbling mess when you're an old man.'"

Bolton had seen his grandmother slide into dementia, and it was "horrific".

"I mean, we all saw what happened out of the States," he said, referring to the CTE story.

Former Melbourne player Shaun Smith, famed for his 1995 "Mark of the Century", recently told me a similar story. He said he'd been experiencing not just huge memory problems but also anger issues. He'd put up his hand to join a proposed class action against the AFL alongside stars like Nicky Winmar, John Barnes, John Platten, and, according to the *Herald Sun*, up to 70 other former players.

Barnes, a premiership ruckman with Essendon, was diagnosed with epilepsy six years ago and has

experienced increased memory loss and anger issues. He believes they're all linked to his playing days. Four-time premiership winner and Brownlow medallist John Platten, concussed 36 times in his career, was concerned that he may be experiencing the early stages of Alzheimer's disease. ("John went to hospital 10 times for concussions and always played the next week," lead lawyer Greg Griffin told the media.)

Bolton, who has subsequently become an ambassador for concussion awareness, told me he was confident the AFL was doing the research into concussion that would provide some answers.

However, the AFL's concussion experts have been among the most sceptical and openly derisive of any link between concussion and CTE, and even of the link between repetitive head injuries and neurodegenerative risk generally.

In 2013, when announcing a concussion collaboration with the Florey Institute, the then deputy CEO of the AFL, Gillon McLachlan, said, "There has been a lot of speculation about concussion and its longer-term effects on players, much of it arising from the emergence of post-mortem diagnoses of chronic traumatic encephalopathy [CTE] in former NFL players in the United States who had apparently been subject to repeated hits to the head during their careers."

He acknowledged the concern of past and present AFL players, and said this was the reason why the AFL had signed a "groundbreaking scientific partnership" with the Florey Institute, to study concussion under the Florey umbrella. They were hoping to raise \$3 million from third parties to kickstart it.

The Florey annual report for 2015–16 said Professor Paul McCrory and his team were "starting to feel those flutters that accompany a major development". They hoped to "publish the science of concussion, conclusively in the next couple of years".

"Paul remains sceptical of the simplistic view that the number of concussions suffered in a sporting career results in long-term brain damage," continued the report. "It's really not a scientific statement," he is quoted as saying. "It's more of a belief system." Instead he and the Florey team were putting in place "scientific structures" to investigate concussion, and were, in the words in the report, "looking inside the brain to provide evidence-based proof on the impact of concussion – both at the point of the knock and over a person's lifetime".

But the third party the AFL hoped to attract – the NFL – wasn't interested. Instead it was announced that a more modest project would be funded from the proceeds of player fines.

By 2018 that amounted to \$500,000, which was funding a Traumatic Brain Injury Lab led by Professor McCrory with Hawthorn club doctor Michael Makdisi, also a member of the AFL concussion working group. It was to run an MRI project of AFL players who had been concussed, as well as working on "long-term studies into the impact of concussion on former players",

which been announced in 2012 as a follow-up to a study of concussed players from the late '80s and '90s around which just one small research paper had been published, in 1996.

As of September 2018, the output has hardly been prolific. Despite many promises of research being published soon, nothing has yet emerged.

**Aged in his late 50s**, Professor Paul McCrory is boyish-looking and softly spoken. It's an appearance that belies his authority in the world of sports medicine.

The former Collingwood club doctor is the chair of the global organisation that hosts the biannual International Conference on Concussion in Sport. It's a group that was originally brought together in 2001 by the International Ice Hockey Federation, the Federation Internationale de Football Association Medical Assessment and Research Centre, and the International Olympic Committee Medical Commission to advise on how to manage the issue of safe return to play of concussed athletes, and its protocol document is the bible in the world of contact sports.

McCrory is also the most prominent member of the AFL concussion working group established in 2010 to advise the AFL on these issues, although the AFL was keen to emphasise to *The Monthly* that "Professor McCrory does not represent the AFL".

He's an international concussion consultant and has advised, among others, the NFL, the National Hockey League (NHL), the AFL and Cogstate, the company that developed and sold the computerised sideline concussion tests that every club in the AFL and NRL uses.

It's an impressive CV, with hundreds of academic papers. In January he was awarded a \$600,000 Medical Research Future Fund grant to study mild traumatic brain injury and the risk of long-term neurodegenerative and neurobehavioural disease. However, while McCrory's bio asserts that he is a "global leader in the field of sports concussion and CTE" he has published no original clinical research into the disease. He declined to be interviewed by *The Monthly*.

When McCrory stood to deliver his public lecture on "The Concussion 'Crisis': Media, Myths and Medicine" at the University of Melbourne in April 2016, the audience was in no doubt as to his authority to provide such an important overview. He carried the imprimatur of the Florey Institute – Australia's most respected neuroscience research facility – where he was a research fellow, and he was about to address a topic that had sent the world of sport into a kind of existential crisis. Did concussion expose players to the threat of the dreaded early dementia disease, CTE?

*The Age* reported the lecture under the headline "NFL Concussion Problem Overblown: AFL Expert Paul McCrory", and in it McCrory referred to "all the carry on and hoo-ha you get from the United States" and accused the media of presenting "oversimplified views". He questioned the significance of NFL-related findings from Boston University.

He began the lecture by asserting that concussion wasn't a physical injury to the brain, nor was it bruising or bleeding or the brain bouncing off the skull. Concussion was "chemical changes" occurring in the brain, which took it "temporarily offline". Ninety per cent of people got better in a few weeks, he said.

He then put concussion into context: the CTE "story" had some problems. The group "pushing the CTE story ... proposed a series of stages of this sort of protein on the brain called tau. This is the brown stain you can see here," said McCrory, pointing to an image of a dissected brain, "ranging from a few little spots up to the sort of gingerbread brain ... which is most severe".

"It sounds like a good story if you see something on a post-mortem slice."

By the age of 50 everybody had abnormal tau in the brain, said McCrory. Repetitive brain injury had nothing to do with it. "It is part of the ageing process," he concluded.

Yet in 2015, a panel of neuropathologists convened by the US National Institute of Neurological Disorders and Stroke took the first steps in developing a set of criteria for the diagnosis of CTE at post-mortem. The neuropathologists agreed that the pattern of tau deposition in the brain is distinct and is different to the tau that is seen in other neurodegenerative diseases and as a consequence of ageing. It wasn't the definitive set of diagnostic criteria for this neglected disease, but it was a start.

In his lecture, McCrory pointed out that the NFL had not admitted any liability when it settled the class action brought by former gridiron players, but the NHL, now facing a similar class action, was going to fight because "the CTE story is not all it's cracked up to be".

Eight months after his lecture, McCrory provided an expert opinion to the NHL. In his 55-page affidavit, McCrory said concussion was not a physical brain injury but a transitory problem.

It was an opinion that ran counter to the copious documented clinical research using advanced imaging techniques that had identified the subtle damage caused by concussion – the disruption in white matter and the microscopic breaks in nerve cells that affected the brain's ability to connect to other parts.

In McCrory's opinion, CTE was not a separate disease.

The thesis that CTE was not a distinct disease received another workout less than 12 months later, when American neurosurgeon Professor Allen Sills stepped onto the podium at the AFL Concussion Symposium: Advances in Understanding & Management to deliver the keynote address.

Dr Nathan Gibbs, now chief medical officer of the Wallabies, had been impressed by this talk. "He had a great graph showing the incidence of tau deposition in autopsies where they looked at brains and found that tau deposition was there, progressively in a linear sort of progression, as you get older from your 20s and 30s." In other words, abnormal tau build-up came with age and was a normal part of ageing independent of head trauma.

Three days after this keynote, it was announced that Professor Sills had been appointed chief medical officer of the NFL.

**Neuropathologist** Dr Willie Stewart, based in Glasgow, is one of the leading CTE investigators in the world. Fit and in his 40s, Stewart has his own concussion story.

It was dawn and he was riding into the Queen Elizabeth University Hospital for a meeting when a car turned in front of him. The last thing Stewart remembers is the windscreen exploding in his face. His bike was totalled.

At hospital they were “picking bits of windscreen out of my face and didn’t even check for concussion”, he said. “They didn’t even think about it.”

“I certainly didn’t think I had concussion. I thought I was fine! But a colleague who arrived at the crash scene said I wasn’t. He told me I was behaving massively inappropriately for someone who’d just gone through a windscreen.”

I asked him what “inappropriately” meant.

“Like I was catching up with him at a party,” said Stewart.

But the concussion did catch up with him. His memory, his ability to think straight. For the next three months, he struggled. His wife thought it was closer to six.

and individuals who have been exposed to brain injury [which is CTE] ... If anyone read the literature they would see that.

“[And] it’s not simply the tau pattern which is distinctive in brains with CTE. There’s inflammation, disruption of the blood brain barrier.

“I can go on and on. You know, the brains of these people are considerably different than normal ageing. Not only that – we always reflect our work back to normal ageing.

“The brain injury is important because it’s the grain of sand that goes into the oyster ... This is the thing that causes the damage that triggers the whole event. But with current evidence where it is, to suggest that the causative agent is something other than brain injury is disingenuous and frankly ridiculous.”

Stewart said the view that concussion was not a physical injury to the brain was based on “no good evidence”.

“The suggestion that there is no structural change is based on old imaging studies where you just didn’t have the resolution, you just didn’t have the technology to be able to see the damage in the brain.

“I think that view that is promoted by some people takes a selective insight into the current knowledge and literature by ignoring the other evidence, which shows quite clearly that there is evidence of damage to the brain.”

## **“Even in a concussion which is a mild injury, which most people recover from, at some structural level there’s damage to the brain.”**

It’s a cautionary tale he’s telling. If one of the world’s leading experts on brain trauma couldn’t recognise his own concussion, what hope did a player have? If a hospital ER didn’t check for concussion, what hope for a player taken to hospital with a broken jaw?

Stewart has been at the forefront of the CTE debate between those doctors and clinicians who are closely associated with the big sports and those who are on the opposite side, such as the clinicians at Boston University’s CTE Center and himself.

It was his view that the concussion management protocols devised by the Concussion in Sport Group were not written by a consensus of medical experts. “This is not science, this isn’t experts, this isn’t medicine, this is sport [that] has written the document.”

**“I am unaware** of any original research he has done on this [CTE],” said Stewart of Professor McCrory.

The opinion that CTE was an effect of ageing was one example, said Stewart, of people speaking outside their areas of expertise.

“We’ve known about age-related tau for decades – there’s nothing unusual about it. And we’re perfectly capable of being able to distinguish between that

The risk of brain injury, said Stewart, was dependent on two things: the severity of the injury and the cumulative damage of many repetitive head injuries.

“So if you get hit by a car and get severe head injury you have a lot of damage to the brain, and the chance of long-term damage to the brain is relatively high. If, however, you get tackled in rugby and bang your head on the ground, your risk of damage is low and presumably your risk of long-term damage is relatively low as well.

“But if you get tackled or hit in a scrum a hundred times in a match, [each] one of these can be causing microscopic damage to the brain which may not produce any symptoms at all, may not make you feel dizzy or confused or have any memory problems – but is at the deepest level in the brain causing some injury.

“Even in a concussion which is a mild injury, which most people recover from, at some structural level there’s damage to the brain, and that’s why we need to be cautious. Because the brain may or may not recover. We think in most people it probably does, but for some people it may not.”

The question scientists were now looking at was the critical one: why did most people seem to recover from

repetitive injuries, while a small number didn't – and why did some get CTE?

The epidemiology of the disease was still a mystery.

**Melbourne neurophysiologist** Dr Alan Pearce remembers the mixed feelings he had in 2015 when he signed a \$60,000 research agreement with the AFL to study the effects of concussion on past players.

The project was set to last two years and be based at the University of Melbourne. It was expected Pearce would publish his findings in a journal. The intellectual property would rest with him. The research question was simple. Did a history of repetitive head injury in former players affect their neuro functioning? Research subjects would be drawn from among the 600 former AFL and Victorian Football League players who had responded to a mass online survey sent out by the AFL Players' Association in 2014, probing them for information about any lasting effects of concussion.

For his AFL research, Pearce was to replicate tests he had used successfully in a previous study, at Deakin University, of retired amateur and elite Australian Rules footballers in their 50s, using a technique known as transcranial magnetic stimulation. He had found that there were statistically significant differences in motor control and brain activity of the concussed players. It was research that attracted not just media interest but also the interest of concussion researchers around the

world and the AFL Players' Association.

His ambivalence in 2015 began when he was told the AFL would choose whom he would be testing for brain damage.

"I mean, as a scientist that screams selective recruitment," Pearce told me.

"It amounted to the AFL saying, 'Well, we'll send player A and B to Alan, but not player C.'" As to why player C wouldn't make the cut, Pearce had no clue.

He made his concerns known, but says he was told it was "to ensure they get the right people to be tested in terms of what they had reported on in the survey". Still, he believed the AFL was genuinely committed to "solid science", and a contract like this would keep the rest of his research ticking along.

But Pearce's research never got off the ground. There would be no published findings. The real trouble began in October, after the ABC's 7.30 featured a story on Pearce's "groundbreaking" research. An introduction to the segment described it as the first time the AFL had studied the long-term effects of concussion, and reporter Louise Milligan mentioned how "sceptical" the AFL and its advisers had been about CTE. The fact that the AFL was funding this research at all represented a "significant shift in its attitude to the long-term effects of concussion".

The story aired on a Friday night. At 9.51 am the following Monday, an email landed in Pearce's inbox at the University of Melbourne.

It was from Paul McCrory, from his personal email: “Did you get approval from the Melbourne University to do that story as per our arrangement which was a specific and non-negotiable requirement if you were going to work at the University?”

Pearce’s heart sank. McCrory was not a man to be messed with. Even though McCrory was not formally a party to Pearce’s research contract with the AFL, he seemed to be playing an active role in policing it.

Pearce’s reply was in the affirmative.

“Yes permission was given, as per yours and Linda’s [Professor Linda Denehy, head of the University of Melbourne’s Melbourne School of Health Sciences] directive. I was not going to participate unless sign off was sought from Linda. Both the ABC and [Ian] Pendergast [AFL Players’ Association general manager of player relations] had contacted the University of Melbourne media department and Ian had spoken to Linda to allow this to occur. I respect your position.”

Two days later, Linda Denehy cancelled Alan Pearce’s arrangement with the University of Melbourne.

The following week, Pearce and McCrory had a coffee to discuss how to take Pearce’s project forward. According to Pearce, McCrory was unhappy because Milligan’s story reported that the only research being done by the AFL into long-term effects of concussion

At his lecture, Professor McCrory had dismissed this as “50- and 60-year-old people who have got worries for all sorts of reasons”, before adding, “We haven’t found any that have matched the American experience.”

The “American experience” was presumably referring to that of CTE. But it would not be possible to find CTE among the former players. For one thing, they were living. CTE could only be diagnosed at post-mortem.

In August 2016, Pearce learnt more about what the former AFL and VFL players had reported about the consequences of their concussions. At the AFL’s Concussion Network Meeting, McCrory revealed that these “worried players” had in fact scored highly on clinical depression and anxiety scores. Pearce’s contemporaneous notes of that meeting record McCrory saying he believed this might be because players were having difficulty adapting to life after the game, and that their depression might be more to do with anaesthetics and surgeries they had received during their footy careers. He blamed the media for their anxiety.

A few months later, Pearce was given more unwelcome news. He was told he would not be doing the psychological or motor skills and ocular tests that were part of his study. Other researchers would do those, and he would not be privy to the results.

“I said, ‘Look, if you take those things off me, then

## Pearce knew that a third of the 600 former players who had responded to the 2014 online survey about the effects of concussion had complained of ongoing problems.

was Pearce’s. In Pearce’s account, McCrory said this was “misinformation”, because he and the Florey Institute had been doing that research for years.

McCrory, via the Florey Institute, would not confirm the contents of the conversation with Pearce, and said he had no role in Pearce’s departure from the University of Melbourne. Denehy has told *The Monthly* that Pearce did not have approval to do the ABC interview, and she had decided that her department was unable to supervise his concussion research.

Pearce was puzzled as to what long-term research McCrory and the Florey Institute were doing. “I don’t really know. All I know is what is publicly discussed, and there is some neuro-imaging research going on, but there has been no data presented in a peer-reviewed journal or even a proper conference.”

**Pearce shifted the project** to Swinburne University of Technology, but it all went downhill from there.

It took five months for the AFL to send Pearce his first former AFL player. He found this deeply troubling. Pearce knew that a third of the 600 former players who had responded to the 2014 online survey about the effects of concussion had complained of ongoing problems.

what I am doing is essentially worthless, because the data I get, the waveform activity that I measure using my technique, has no context.”

“They said, ‘Oh, don’t worry, we just want you to do that.’”

Eighteen months into Pearce’s contract, only one former player had made their way to his lab. In his final report to the AFL, delivered at the conclusion of his two-year research deal, Pearce advised that he had tested eight former AFL players and 74 controls.

“So what is the value of your research?” I asked.

“There is no value. It’s unpublishable,” Pearce said.

In a written statement to *The Monthly*, the AFL said Pearce’s funding “was not renewed, as the AFL formed the view that it was not delivering productive outcomes”.

**Soon after settling its class action**, the NFL promised US\$16 million to fund research into individuals deemed at “high risk” of developing CTE. The US National Institutes of Health (NIH), the world’s largest independent research institution, would allocate the funding.

But when the NIH announced that the successful grantee would be Boston University, the NFL management was furious. They complained of bias, and said

they had not agreed to the project. (They had.) Members of the NFL's head, neck and spine committee personally rang NIH officers to complain.

The upshot was that the NFL took its "unrestricted grant" off the table and walked out of the deal.

Later a US Congress report would conclude that the NFL had attempted to influence funding decisions at the NIH, and had acted dishonestly and out of self-interest, as its representatives sought to direct the money towards their own preferred project.

One NFL doctor came in for particular criticism: the chair of the NFL's head, neck and spine committee, Dr Richard Ellenbogen. The report found he was "a primary example of the conflict of interest between his role as a researcher and his role as an NFL advisor".

Barely six weeks later, Ellenbogen was in London, convening a concussion "think tank" with 14 other medics from contact-sport organisations. The NFL was looking for research collaborations, and "new and innovative ideas".

Paul McCrory was there too, but not, according to the AFL, as their representative.

Over the weekend, the NFL agreed to fund a CTE research study that would, according to Ellenbogen, "establish if there is any correlation between recurrent head impact in sport and neurodegenerative disorders later in life".

McCrory took the role of "investigator". The project would not be studying footballers, however. It would be studying jockeys.

It would ask why jockeys weren't getting CTE.

The project was the brainchild of Dr Michael Turner, the British Horseracing Authority's former medical officer. He said that jockeys had the "highest rate of concussion in the recorded literature".

"Therefore if concussion created long-term problems with dementia we would expect to see lots of jockeys who are demented, suicidal and had CTE, and we don't seem to see that."

Turner said this research was about whether the "hype" around CTE could be "substantiated".

Ellenbogen joined McCrory on the jockey study scientific committee, as did Dr Rudy Castellani, a neuropathologist who was also an expert witness for the NHL's defence against the players' class action.

The NFL would kick in US\$1 million for the research. (By 2017, according to McCrory, the "retired jockey project" had £4.5 million in funding.)

At his lecture, McCrory had also stated that jockeys had the highest rates of concussion in the epidemiology of sport. "The sport that is one, two, three on the all-time list of causing concussion is horse racing ... and look what is right down on the bottom: NFL football."

Jockeys had concussion rates 40 times higher than AFL players, he said.

"So that's a clue that the CTE story has a few questions we don't understand yet."

The Florey Institute would be part of the jockey research project too, according to its 2015-16 annual

report. “Jockeys are also demanding the attention of the Florey team,” it said in a two-page spread on the work of Professor McCrory.

However, by this time the situation for jockeys had become dramatically worse. Now McCrory said jockeys had concussion rates 100 times higher than AFL players.

“If any group is going to show long-term problems it’s going to be jockeys, and we’re working with a population of jockeys applying the same imaging protocols [as the Florey’s AFL study],” said McCrory in the annual report.

**“It’s not like jockeys are screaming out** as a great population to be studied here,” Dr Willie Stewart told me. Nor did he know what data was being relied upon to make the claim that jockeys had the highest concussion rates of athletes.

“To say that in some way studying horse races is going to give us some insight into CTE is a false assumption. If that were true, then Harrison Martland back in 1928 would have written a paper about horse racing. Because when we first recognised the problem with head impacts and sport and dementia it was in boxers. Why? Because boxers were exposed to high levels of brain injury and cumulative head impacts. That’s where you saw the punch drunk syndrome, in boxers, not jockeys.”

The evidence for this claim that jockeys had concussion rates higher than any other athletes was difficult to find. Professor McCrory and Dr Turner in London both provided citations that didn’t support their assertions; indeed neither study mentioned jockey concussion rates.

Nor did the papers provide support for McCrory’s claim there were 40 million sports-related concussions each year in the United States. The citation put this figure at 3.8 million.

Clarification was sought. The response was obtuse. “The talk at the Florey Institute was for the lay community, not for a scientific audience,” and “Please note: for public, lay audience scientists don’t usually include formal citations.”

I was further advised: “The slides showing concussion rates in sport were derived from various studies.”

I had another question: What exactly was the jockey research program referred to in the 2015–16 annual report?

“It is a long-term project and a scientific program is yet to be defined.” In other words, in mid 2018 the research project that was discussed as underway in 2016 had in fact not yet begun.

The website of the jockey research project in London claimed that it was “collaborating” with the Florey Institute. Indeed Professor McCrory was listed as the chair of the scientific committee, and the Florey’s deputy director, Professor Graeme Jackson, was listed as the director of Imaging.

What then was the Florey’s relationship with the jockey research project in London?

The reply from the Florey was emphatic: “The

Florey has no relationship with the foundation.”

What was Graeme Jackson’s relationship with the jockey research project in London?

Professor Jackson was doing his work in an “unpaid capacity” and agreeing to oversee their imaging protocols and interpretation of their imaging studies. It is an honorary position, came the response.

The next time I checked the jockey project website, all references to Professor Graeme Jackson had disappeared.

Then in late July, when *The Monthly* asked the Florey Institute if it had misled its stakeholders about its involvement in the jockey research, the institute came back with an entirely different answer.

There was a memorandum of understanding covering research and imaging. So, yes, that meant there was “a collaboration”. The MOU, however, would not be provided to *The Monthly*, as it was commercial-in-confidence.

There were no concussion research projects listed among the Florey’s 146 ongoing projects.

**The 2017 AFL injury survey** is a challenging read. Its 17 pages of dense tables and injury data are illuminated by just five brief dot points of “observations”. Not one of those dot points explains that 80 per cent of concussed players returned to play the following week.

Numbers like that worry Dr Willie Stewart. How, he asks, could sports decide that a player had recovered from a mild traumatic brain injury on the basis that their symptoms had disappeared?

It was a decision that was based on “no scientific evidence whatsoever, other than most people are symptom-free in seven to 10 days”, he said.

“There is no evidence, no investigation, no test, no blood, no scan, to say that the brain has recovered in that time.

“But there is plenty of evidence to say that sport operates on a week-to-week basis – and so seven days seems coincidentally to fall quite happily for playing next Saturday.”

Stewart said there were clinical metabolic studies that suggested the brain hadn’t recovered in that period, and also studies in other sports that clearly showed players who had been concussed had higher injury rates throughout the whole season.

He wanted to know how sport could claim player welfare was the number one priority when “there are still players retiring because of long-term concussion issues”.

**Sitting with Peter Gordon**, Western Bulldogs president and high-profile plaintiff lawyer, I thought of the many players who had announced early retirements citing concussion.

“The obligation as a club is to follow the advice of the best experts,” said Gordon.

He was of the opinion that Australian Rules football was inherently less risky than soccer and gridiron, games which both encouraged head contact.

What did he make of the fact that concussion tests only measured symptoms and that once symptoms had been relieved players were back on the field?

“If science or developments in medicine demonstrate that there are risks we hadn’t previously appreciated, then our obligation as an industry is to change and adapt our practices and our rules to make sure we are taking reasonable care of our players.”

What did Gordon make of the fact that in boxing, for instance, if a boxer was knocked out they could not return to the ring for many weeks, but in AFL they could be back next weekend?

“Boxing doesn’t have a 22-week season, or a seven-day turnaround between bouts. The timing logistics of ‘the sport’ are completely different to AFL,” said Gordon.

However, he was “open” to the idea that the non-playing period extend beyond “the cessation of symptoms” and that “second and subsequent concussions” also have an extended non-playing period, but “I am awaiting guidance from medical science”.

I asked him, “What do you think of Professor Paul McCrory’s statement that the relationship between repetitive head injury and CTE is ‘speculation’? Do you agree with that?”

“No,” he replied. “I don’t.”

He continued: “I don’t agree with Professor McCrory on the basis of the reading that I have done. I think CTE is an established risk for repetitive head trauma, certainly in the NFL.”

“And have you made that view known?” I asked.

“Yes, I have. And I have said they should be seeking a broad spectrum of views, and not just focus on one expert.”

“Do you think he should continue in the role [of AFL concussion expert]?”

“I don’t wish to make any other comment,” said Gordon.

**Willie Stewart** has secured funding from the Football Association to do his study on Scottish footballers. There are 10,000 former professional footballers in his study, and they will be matched with a similar-aged control group.

Stewart and his co-researchers are using dementia as a proxy for CTE. It would help them understand the relative risk of repetitive head injury for a large group of people who played contact sport.

He outlined the possibilities.

“It may well be that what participation in sport does not change is the percentage of people who get dementia, but instead of getting it when you are 70, you get it when you are 50.

“Or maybe it doubles the incidence of dementia, but they get it at normal age, so high-level sport is a risk for dementia.

“Or maybe it means that dementia goes up considerably but actually it’s because the former footballers are living till they are 70 and 80.”

It’s a research project that might answer Jude Bolton’s questions.

**At the 2018** Frontiers in Traumatic Brain Injury conference, hosted by the Imperial College London in early July, some of the world’s best researchers gathered to discuss the latest developments in brain injury research.

Front and centre of the conference was chronic traumatic encephalopathy. Professor Lee Goldstein from Boston University’s CTE Center delivered a presentation on his work, which – to cut a long story very short – has investigated the mechanistic pathway between the physical injury and CTE in the brain.

Goldstein’s research examined the impact of repetitive head injuries on rats and then replicated these injuries in human brain models. According to this research, it was the repetitive head injuries, not concussion, that caused the CTE-like pathologies in the brain.

He’s also over the “CTE debate”.

“The debate on whether CTE exists or not at this point is irrelevant to me,” he told me. “The scientific evidence for me and many others at this point has the same truth value as smoking and cancer ... People can decide whether they read the scientific literature. And they can read it as well as I can.”

He said it is vested interests like Big Sport and the military that want neurodegenerative disease associated with repetitive head injury to just go away.

“I want to know who is at risk, and I want to treat the disease now and help those people who are suffering,” said Goldstein.

Already they had inklings of therapeutic pathways. He was optimistic about the future.

And a therapeutic solution is what the Taylor family want too. They hoped that donating Tizza’s brain to science might lead not just to changes across sporting codes in relation to concussion but also to the ability to treat CTE in the living.

As for the AFL, it’s almost as if they don’t want to know. **M**