

The Fragile Mind

As we learn more about the link between head trauma and brain damage, contact sports have returned to the spotlight. Those crash tackles, headers and right hooks could be putting people in more danger than previously acknowledged. And while competitors' physiques are growing more powerful, our brains remain as vulnerable as ever. **Are we playing games with our lives?**

Words by Ian Taylor - Photography by Peter Crowther and Julian Benjamin →



CRASH TEST: KNOCKS TO THE HEAD CAN CAUSE PERMANENT BRAIN DAMAGE

A

round the world, a network of laboratories is stockpiling and studying the brains of dead athletes. There are thousands of them: some were donated in wills, a small number in suicide notes and many more by bereaved families searching for answers. In life, these brains belonged to footballers, boxers and NFL stars; cyclists, martial artists and rugby players. In death, they are pieces in a puzzle.

The neurologists who scan and dissect these brains are looking for damage and abnormalities that may have been caused by head impacts in sport. They want to know how prevalent these injuries are, and how a collision on the field of play can lead to life-changing symptoms in the short term, or a neurodegenerative disease over time.

On one level, it's a question of simple physics. The battle of brain and brawn isn't a fair contest, at least not on the sports field. You can make your muscles bigger and stronger, so they can better withstand the artillery of modern contact sports. You can't do that with your grey matter. The more physical athletes become, the greater the forces they're able to exert on themselves and their opponents. The punches are harder, the tackles are heavier – but the brain is as fragile as it ever was.

What causes problems isn't necessarily the blunt force in itself, but how it causes your brain to move inside your head. Each impact has the potential to rattle your skull and cause a physical injury that's as visceral as a torn hamstring. Rotational forces can warp your white matter. Your neurons twist and stretch and shear. At a microscopic level, your brain tissue can come apart at the seams, and damaged blood vessels spill proteins that can be toxic when they gather



The Team Captain

After suffering two concussions in quick succession, former Leeds Rhinos captain Stevie Ward retired from rugby league at the age of 27, with wide-ranging symptoms that still affect him today

I was always prepared to sacrifice my bodily health to win – to play for my team mates, to do something special on the pitch, to be a part of something. In 2017, I played the week after I dislocated my shoulder in a semi-final. In the final, I played the full game and made the most tackles.

It's a game that has allowed me to build my resilience and character and improve communication. You go through the mill in terms of the physicality; you're conditioned to work hard and to play through pain. But the brutality of the game should never be mixed with the fragility of the brain.

I get migraines daily. I'm sensitive to light, screens and laptops. There have been times when I've slurred my speech. I've not been great in terms of processing information. My short-term memory has been hampered. There's the psychological side of it, too: mood swings, depression, anxiety. And my brain isn't processing my inner ear properly, so I have balance issues, which are actually the most daunting. Sometimes, I'm lucky enough to do a gentle static bike. The thing I do most regularly is walking – very different from the life I used to lead.

A lot of players say that they knew what they signed up for. I don't think they knew what could happen in terms of dementia, CTE and post-concussion syndrome. I don't think people were aware of that when we signed up. And you've got to question the autonomy of the 16- or 17-year-old lad whose view of the world is simply to make a name for himself.

I'm clear in my purpose now: it's to help men with their mental health. Mantality (mantality.co.uk) is the organisation I built. We have a mental-health training regimen, which is probably what has got me through this period. We're trying to help people implement habits that are good for your mind.

in the wrong places. Most of us know the catch-all term "concussion", but neurologists prefer TBI, or "traumatic brain injury".

Growing Concerns

"I have a bit of a problem with [the word] 'concussion'," says Dr Willie Stewart, a neuropathologist who runs the Glasgow Brain Injury Research Group, one of the labs that examine the brains

FORMER RUGBY STAR
WARD NOW ADVOCATES FOR
MEN'S MENTAL HEALTH

of ex-athletes. "It's used by some quarters as a kind of soft and cosy word that belies the seriousness of the issue. We're talking about people whose brains have been injured."

A decade after the NFL squared up to a head-injury crisis in American football, British sport is having its own reckoning with concussion. Football and both codes of rugby are under pressure to bring in reforms that better protect players from long-term brain disorders, as well as catastrophic short-term injuries. Though the chorus of concerned voices is getting louder, some think that the governing bodies are still in denial.

The numbers should be a wake-up call. Stewart's research into Scottish ex-footballers found that they are three and a half times more likely to die from dementia than the general population. It's arguably worse in rugby. More than one in five professionals in England will be concussed this season, the legacy of a sport that has become significantly more physical since rugby union went pro in the 1990s. In the past 30 years, the number of tackles made per game has more than doubled. A group of former players is currently taking legal action against the game's governing bodies for the post-concussive symptoms they now live with, including early-onset dementia. One of them, former England international Steve Thompson, can't remember winning the World Cup in 2003.

"More and more players in different sports are coming forward," says Luke Griggs, deputy chief executive of Headway, the brain injury charity. "We are potentially seeing the tip of the iceberg here. Everyone involved in sport needs to fully understand the short- and long-term risks associated with head injuries, particularly at grass-roots level."

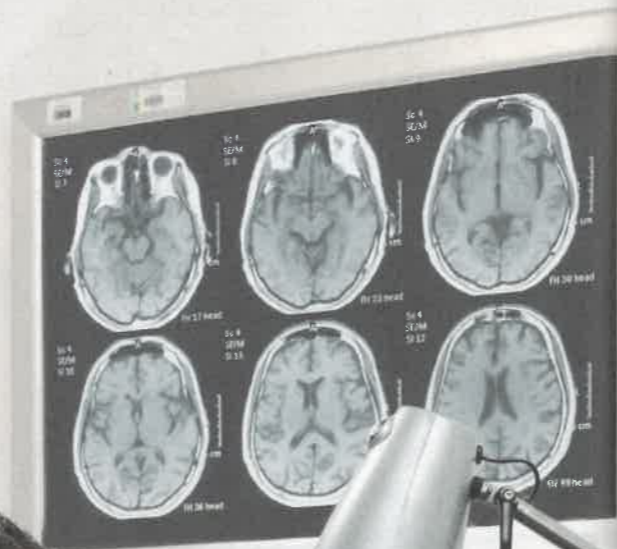
It's not just World Cup competitors who are in danger. Every weekend



STEVIE WARD

THE ONE-TIME CAPTAIN OF LEEDS RHINOS RETIRED AT 27 WITH POST-CONCUSSION INJURIES

DR RICHARD SYLVESTER
 CONSULTANT NEUROLOGIST,
 ADVISOR TO WORLD RUGBY AND
 THE FOOTBALL ASSOCIATION



The Brain Scientist

A consultant neurologist based at Homerton University Hospital, Dr Richard Sylvester provides the neurology assessment for concussion clinics at the Institute of Sport, Exercise and Health. He has also advised the FA and World Rugby

With the vast majority of brain injuries, you don't lose consciousness: probably less than 10%. Usually, what happens is that people are confused, their behaviour is altered and they feel slowed-down and drowsy. One of the important things with the management of head injuries on the pitch is that it can't be up to the player as to whether they should carry on playing.

It doesn't have to be an impact to the head – it could

be an impact to the chest that causes your head to move suddenly. Anyone who has symptoms should come off the pitch and assume it's concussion, just to be safe. If you can be assessed by someone, all the better.

The traditional form of management following a concussion is rest, mental and physical. When I started doing this, I found this quite odd, because when people have had a stroke or a brain injury, we don't prescribe rest: we do rehabilitation as soon as possible. There is emerging evidence that after the first 24 hours – when rest is a good idea – the longer you rest for, the longer it takes to recover.

What I tend to suggest is trying to get back to normal levels of activity, but if there are things that make you feel worse, then avoid them. The crucial thing is avoiding further head injury or contact until you're completely better.

Following a concussion, people are at a far greater risk of getting more of them acutely. That's the rationale for having a period where people don't go back to contact sport, because that risk of having a further injury is really high.

(pre-COVID, at least), millions of amateur sportspeople pull on their boots. They trade punches, compete for headers and wrestle each other to the ground. Neurologists warn that you can't extrapolate what happens in the elite game and apply it to amateur sport, but it's also true that there are perils on a soggy community sports field that don't trouble athletes at the country's biggest stadiums.

Refereeing standards, for example, are generally lower at the amateur level. There may be no professional linesmen. And contact sports can be more brutal

AFTER ONE CONCUSSION, YOU'RE MORE SUSCEPTIBLE TO OTHERS, WARNS SYLVESTER

when there aren't TV cameras or a TMO (television match official) to keep players honest. Tackling or heading technique may not be as good, either.

Head injury protocols do exist at the amateur level – indeed, they're far more stringent than those for professionals – but whether they're properly applied is disputed. Small squad sizes can lead to players returning from injury sooner than they should, or playing through pain

because there isn't a substitute to take their place. Then there's the lack of pitch-side medical support: maybe a St John's ambulance, if you're lucky.

Collision Course

Another problem – at all levels – is an athletes' bloody-minded will to compete. Their enthusiasm to place their bodies on the line in the pursuit of sporting glory and peak performance puts their brains at risk of becoming collateral damage.

"Sometimes, what we see is that players go through all of the return-to-play protocols [without issue]. Then they get to the next match and, after the first contact, they come to the sidelines and say they feel terrible," says Dr Richard Sylvester, a consultant neurologist at the Institute of Sport Exercise and Health, in partnership with HCA Healthcare UK. "It turns out that they haven't been feeling great all week but haven't been reporting their symptoms."

Sylvester sees the fallout in specialised concussion clinics that he runs for athletes. He has scanned the brains of more than 500 rugby players and has noticed the same symptoms in both professional and amateur athletes. "The difference is that, at the professional level, they have access to medical care with expertise from day one. At the grass-roots level, I probably see people a bit later," he says.

Symptoms vary depending on the severity of the injury. The majority of people who have small, one-off concussions recover pretty quickly. "People get very confused, their behaviour is altered, they feel slowed down and drowsy," Sylvester says. "Usually, those symptoms settle down within days to a week or two."

Players with more severe injuries may suffer a collection of additional symptoms, which are loosely grouped together as

post-concussion syndrome. There is more confusion, dizziness and migraines. Speech may become slurred and short-term memory affected. Patients often suffer

"People get very confused, they feel drowsy, and their behaviour is altered"

migraines, anxiety and sensitivity to bright lights. Their families might notice mood and behavioural changes.

There are more than 50 symptoms of concussion to look out for, but it's notoriously difficult to diagnose. A mild brain injury and a severe one can look indistinguishable, and players may not exhibit any symptoms until hours after an injury. Some estimates even suggest that sports concussions are chronically under-reported, with five brain injuries sustained for every one that is reported and treated.

Lasting Impact

It's not just the trauma of a single lights-out impact, or several. Researchers such as Stewart believe that sub-concussive hits can also cause lasting damage to the brain. The effects of every header, every jab that evades your guard, or every crash of hitting a ruck – all the little knocks that sportsmen take on the chin – can accumulate in the brain and increase your risk of neurodegenerative disorders such as Parkinson's, dementia and CTE.

The last of these – chronic traumatic encephalopathy – is a disease that is

specifically associated with repeated head impacts. It's found in war veterans who have sustained multiple blast injuries and psychiatric patients who bang their heads against the wall. Once, it was found in the brain of a clown who had repeatedly been fired out of a cannon.

And neuropathologists keep finding it in athletes who played contact sports for a prolonged period. Long observed in the brains of boxers, it was recognised in NFL veterans around the turn of this century. More recently, it has been discovered in the brains of hockey players, mixed martial artists, rugby players and footballers – always post-mortem, in labs such as Willie Stewart's in Glasgow.

Before death, CTE causes many of the same issues as other progressive brain diseases – for example, memory loss, confusion, impaired learning ability and poor judgement. It increases your risk of dementia by two to four times, and there are also reports of significant changes to behaviour. As with other disorders, it can also alter your sense of who you are.

Research by the charity Headway found that 70% of brain injury survivors consider themselves a completely different person afterwards. In CTE specifically, erratic behaviour and aggression are not uncommon. Depression and suicidal thoughts can stalk victims. Contentious but



The Rugby Pro

A Welsh-capped ex-rugby union player, Alix Popham was diagnosed with probable CTE and early-onset dementia at the age of 40. With a group of other ex-professionals, he is filing legal claims against the sport's governing bodies

When I had the diagnosis, it was terrible news. But, in a funny way, it came as a relief. It gave me answers to why things were happening: losing my temper, not being able to concentrate, forgetting conversations with my wife 20 minutes later.

The scans showed that there were five areas of my

brain that were significantly damaged. My neurologist described it as a leaking tap: a tap dripping on mud once or twice would cause no damage. But if it drips for 14 years, as it did in my case, there would be a big hole.

There's no cure. I'm trying every little thing to try to slow down the symptoms. I gave up alcohol. I'm on a 95% Mediterranean diet. I've decided to do an Ironman.

In rugby, it's all the little contacts. It used to be a game of evasion with contact. Now, it's a game of contact with some evasion. I love the sport, but it can't carry on the way it is. There are simple things that World Rugby and the governing bodies can do to make it 85% safer overnight – 85% of my damage was done in contact training.

Ten years ago, the NFL reduced the amount of contact training they do to 16 sessions per season, predominantly pre-season. During the season, there's not a lot of contact during the week. Now, an NFL player with games has 30 days of contact per year. A rugby union player could be involved in 150.

POPHAM WANTS RUGBY'S GOVERNING BODIES TO LIMIT CONTACT TRAINING

widely publicised cases have even linked CTE to tragedy and violence.

Dr Chris Nowinski is a former WWE wrestler who retired with post-concussion syndrome in 2003. Today, he is the CEO of the Concussion Legacy Foundation and co-founder of the Boston University CTE Center. "The third brain I ever procured for research was my colleague Chris Benoit from the WWE, whom I'd known for five years before he killed his wife and son and then himself. He'd confided in me that he'd had more concussions than he could count," Nowinski says. "He had severe CTE."

The brain of former NFL star Aaron Hernandez was studied at the same laboratory in Boston. Like Benoit's, it had severe CTE. And, like Benoit, Hernandez killed himself and others. He was found dead in his prison cell in 2017 while serving a life sentence for the murder of a semi-professional American footballer.

The idea that CTE can drive somebody to homicide or suicide is speculative and extremely controversial. However, Nowinski says, cases keep appearing. "I spoke yesterday to a man whose father had – at my age, 42 – killed his wife and himself. We were discussing whether or not he had CTE, because he was a long-time contact sport athlete."

Risk Assessment

So, it seems a lot to risk – not just the personality changes but all of it. The headaches and memory loss, the mental health issues, the spectre of dementia. Every sportsman accepts that when they hang up their boots, there will be aching muscles and niggling injuries – but most of us assume that these will take the form of dodgy knees and sore shoulders, not malfunctioning brains.

But risk is a difficult thing to judge. It's important to remember that, for all the noise around concussion, researchers believe that it will just be a significant minority who suffer the worst consequences. They also believe that professionals are at a greater risk



JOHN STILES

CAMPAIGNER SON OF NOBBY STILES, WHO DIED WITH CTE LAST OCTOBER

STILES ESTIMATES THAT HIS FATHER HEADED A FOOTBALL 70,000 TIMES

The Campaigner

John Stiles, a former pro footballer, is the son of 1966 World Cup-winner Nobby, who died in October 2020 with advanced dementia and prostate cancer. His brain was donated to science and discovered to have CTE

I know that my dad was killed by heading the ball. His brain was sent to Dr Willie Stewart, who found CTE right the way through. I estimated that in my dad's career, he headed the ball at least 70,000 times.

I'm an ex-pro. I played for Leeds in the 1980s, and we would use old match balls in training. Sometimes, the cover had come off; they were like concrete. Centre-forwards and centre-halves, they'd head the ball 30 or 40 times a day. You do that four days a week and multiply that for 38 weeks of the year, and it's obvious what's happening. It's an industrial disease.

But even now, I don't think players are aware of the risks. It's outrageous that it's been 19 years since Jeff Astle's diagnosis [one of the first footballers whose



disease and death was linked to heading the ball]. That's nearly two generations of players who have been allowed to play uninformed and unprotected. It's a scandal. There needs to be immediate action to reduce heading in training.

There has to be an agreement, similar to the one with the NFL, where a big fund is set up by the Premier League, the FA, the clubs. It needs to happen immediately, because the families are desperate.

Footballing bodies are fully aware of this. It seems to me that they have chosen not to deal with it because football is one of the biggest businesses in the world, and they're terrified of the compensation and other repercussions.



ALIX POPHAM

EX-RUGBY UNION PLAYER, DIAGNOSED WITH PROBABLE CTE AND DEMENTIA

than amateurs, who generally don't train as often or play for as many years.

Think of it in terms of dosage. Perhaps concussions are like cigarettes, and the more you have, the worse the outcome. "The hope is that because amateurs are likely to have other jobs and so on, they won't be exposing themselves to as much risk, or as many impacts during the week," Stewart says. "It's just the weekend game-day exposures. We hope that's what we're dealing with."

The dose effect is also the rationale behind calls for reform in football

and other sports. If you ban heading in children's football, you remove a significant portion of the head impacts that each player will take in a lifetime. If you limit the amount of contact training in rugby, you cut out a large number of concussive and sub-concussive hits, just like they did in the NFL a decade ago.

Some argue that it's not just the rules of contact sports that have to change, but also the culture around them that glorifies brutal tackles and savage knockouts. This is what cheers players on as they crash head-first through one

collision after another. It's what wills a boxer to stagger to his feet, beat a 10 count and battle on when he lacks the basic motor skills to raise his gloves.

There's a line somewhere between celebrating toughness and unwittingly fetishising brain injuries. Are we sure where that line is? Or are we going too far the other way, attempting to sanitise sports that nobody wants to be genteel?

Professor Mike Loosemore is a consultant in sport and exercise

GARY LOCKETT

FORMER PRO BOXER,
NOW A BOXING COACH



LOCKETT IS PROTECTIVE OF ANY BOXER WHO HAS RECEIVED A BRAIN INJURY

The Boxing Coach

A former professional boxer, Gary Lockett is now a trainer. He was in the corner of British fighter Nick Blackwell, who suffered a bleed on the brain and was placed in a medically induced coma in 2016 after a fight with Chris Eubank Jr

I don't think young boxers and amateurs are aware of the risks. I wasn't: I started boxing when I was eight. I had close to 100 amateur fights and 32 pro fights. I was involved as a coach and manager – before the incident with Nick – in probably about 300 fights. I'd never realised the extent of the devastation it can cause.

Now that Nick is some way towards well, we can look back on it with some perspective. It was a very scary prospect. I told him that not only should he never fight again, he should never head a football again. Unfortunately, he got involved with some people and sparred with some big cruiserweight and ended up back in the situation where he was with another injury. In my opinion, anyone who puts a boxer in a ring when they've had a brain injury doesn't deserve banning, they deserve prison time.



If a kid gets knocked down in the gym, wobbles or is on rubbery legs, that is some kind of concussion. I take the boxer out of the ring and don't let them spar again for about three weeks. I take it very seriously.

But how do you make the sport safer than it already is? The British Board of Boxing Control is, I believe, the most safety-conscious board in the world. You have annual brain scans, annual medicals. If there's a single thing wrong, you have to see specialists. If you're knocked out and concussed, your licence is taken away from you. I don't think there's anything else you can do.

In my mind, I'm never trying to damage someone – I'm trying to defeat them. I never want the other person to be permanently hurt. If the referee judges that person to be OK to carry on, that's just the rules of the sport; the nature of the sport.

medicine at ISEH and the chief medical officer for GB Boxing. He believes that, on balance, boxing is good for you. "There are obviously inherent dangers with taking blows to the head," he says. (The objective in boxing is, after all, to inflict a traumatic brain injury on your opponent.) "However, those dangers have been known about for approaching 100 years, and the sport has been

regulated very heavily. In boxing, you need to be fit. It gets people to control their weight. Boxers tend not to smoke, or take drugs."

It's not a safe sport, but then neither is scuba diving, or horse riding, or rock climbing, or off-piste skiing. We all take risks, and the benefits of contact sports should be weighed with the dangers. Willie Stewart's research into Scottish footballers may have found an increased risk of dementia, but it also found a decreased risk of cancer and heart disease. And which is riskier: playing football with your mates every weekend or sitting at home watching it with a four-pack?

Making Headway

Ultimately, once you understand the dangers, whether you decide to play or not comes down to a personal risk-benefit

assessment. A young professional player with a potentially lucrative career ahead of them may be willing to risk a lot more than a father of two in his late thirties who works full-time and whose kids watch him play rugby for the seniors every Saturday.

Either way, all experts agree that you should read and understand the concussion protocols tailored to your sport, because following them is the best way to offset your risk of long-term brain damage. Unfortunately, it's not possible to concussion-proof your body, though there is some evidence that stronger neck muscles can protect players against concussions, possibly because their head doesn't jolt so much upon impact.

If you find yourself on your backside in the mud, your head ringing and vision blurred, get yourself off the field. Only 10% of concussions involve a loss of consciousness, so don't be tempted to stay on just because the lights didn't go out. If your coach asks if you can play on, tell them you can't. Likewise, don't

argue if they tell you they're taking you off as a precautionary measure.

Stewart recommends referring yourself to a dedicated concussion clinic if you've had more than three concussions. "There are studies that suggest if you've had more than three, your chance of long-term problems is much higher," he says. "It's muddled by things like people remembering how many times they have been concussed in the past, so I think it's something that needs specialist, one-to-one attention."

Consider stepping back if the frequency of your concussions seems to be rising. If you used to get one every couple of seasons but now

you're getting one or two in each campaign, that should ring alarm bells. The same is true if the severity of the blow needed to knock you down is getting lighter.

"If it used to be that

"The longer that football goes on as it is, the more players will be exposed to it"

only a big blow from a prop at speed would drop you, but now the passing scrum-half is causing problems, then that should be a red flag," Stewart says.

Stewart does not expect a shortage of brains to study any time soon. He warns that sports that have been too slow to react to the evidence face an unstoppable wave of brain damage. "The longer that football goes on as it is and doesn't change, and the longer that rugby goes on and doesn't reduce the number of injuries, the more players will be exposed," he says. "And once exposure has taken place, there is nothing you can do to get it back to how it was. Players are accumulating brain damage that they won't be able to undo. We're going to see that in 40 years' time."

"My hope is that we will see a change, and that 2021 will be a momentous year for head injuries in sport globally – when sports will finally start to get serious about this." ■