NO-BRAINER

HEAD TRAUMA IS AMONG THE MOST FEARED AND CATASTROPHIC INJURIES IN CLIMBING. SO WHY AREN'T MORE ROCK CLIMBERS WEARING HELMETS?

By **Dougald MacDonald**
Photography by **Ben Fullerton**

BETH RODDEN DIDN'T EXPECT TROUBLE ON THE *CENTRAL PILLAR OF FRENZY* ON YOSEMITE'S MIDDLE CATHEDRAL ROCK. AFTER ALL, THE 33-YEAR-OLD SUPERSTAR HAD FREE CLIMBED THE *NOSE* OF EL CAP AND PUT UP THE VALLEY'S HARDEST CRACK CLIMB, THE UNREPEATED 5.14C *MELTDOWN*. ONE OF THE BEST FEMALE ROCK CLIMBERS ON THE PLANET, SHE HAD NEVER BEEN INJURED IN A CLIMBING FALL. RODDEN DEVOURED ROUTES LIKE THE *CENTRAL PILLAR* WITHOUT BREAKING A SWEAT.

But this mega-popular 5.9 would serve as a reminder of one of climbing's greatest risks—and also a leading appeal of the sport: that anything can happen, anywhere, anytime, without warning, even on the most familiar terrain. Partway through the first pitch on the *Central Pillar*, Rodden's foot slipped on polished granite, flipping her upside-down and into a freefall. Twenty feet down, going approximately 23 mph, the back of her head slammed into rock.

At first, Rodden says, "I didn't think I was hurt. We actually climbed the rest of the day. But the next night at dinner, I was having a really hard time concentrating. I could see [people talking], but I couldn't process what they were saying." Another red flag: Rodden's forehead was sore, even though she'd hit the opposite side of her head. The next day she went to her doctor, who explained that her brain had slammed forward against her skull upon impact with the rock face. Diagnosis: concussion.

Concussion is only one of many serious head injuries a climber might suffer—others include skull fractures and severe lacerations—but new awareness of concussions' frequency and their potential long-term effects has caused consumers, manufacturers, and regulators to re-examine many sports and their protective equipment. High-tech anti-concussion helmets are making their way into the cycling and skiing markets, and President Obama recently declared that if he'd had a son, he might not allow him to play football because of the latest research on traumatic brain injuries. No data exists on the number of concussions in climbing, but there is little doubt that Rodden's experience could happen to anyone.

Rodden says her recovery was slow, and she wonders if the concussion is to blame when she has trouble concentrating even today. The symptoms of traumatic brain injury can last for weeks or months—and multiple concussions can cause years of problems. The accident caused Rodden to rethink her stance on climbing helmets. "I hardly ever wore a helmet while climbing in Yosemite, but now I always try to wear one, even if the route is easy," she says.

But sometimes, especially when the climbing is hard, Rodden chooses to leave her helmet behind. When we spoke, she was in Spain for sport climbing on overhanging limestone, and she hadn't even packed a helmet for the trip.

When it comes to helmets and climbers, inconsistency is everywhere. Most ice climbers and mountaineers wear helmets, as do many traditional rock climbers. But far fewer rock climbers don lids for short climbs, especially sport routes. (Though you can't rule it out, you're much less likely to smack your head or suffer rockfall on an overhanging 5.12 sport climb, at the Red River Gorge, Kentucky, for example, than you are on a ledge-filled 5.8 in Eldorado Canyon, Colorado.) Many ice climbers forego their helmets while rock climbing. Some climbers wear a helmet to one crag but not to another. Or they'll wear it while leading but not while belaying. And given the track record in cycling—around half of all cyclists still don't always wear helmets, despite a great toll of head injuries—this is not likely to change. Most climbers will continue to make day-by-day decisions about their helmets.

On the surface, this seems nuts. If helmets prevent or mitigate head injuries, shouldn't a climber always wear one, from the second he arrives at the crag to the moment he starts hiking back to the car? Or is helmet use, like so many aspects of our sport, an issue that resists pat answers?

HEAD INJURIES, THOUGH RARE IN CLIMBING, ARE POTENTIALLY CATASTROPHIC.

On a spring day in 2008, Evie Barnes, a 21-year-old boulderer, started up her first trad route, the long, easy east face of the Second Flatiron in Boulder, Colorado. Near the top, her partner asked if she'd like to lead a short step. Barnes fell partway up the pitch, popping out her naively placed pro, and tumbled down the slab. She sprained both ankles, strained a knee and thumb, and chomped a big chunk out of her tongue. Before she came to a stop, she smacked the side of her head just above her left ear against a big flake of conglomerate sandstone.

Barnes was in shock, but other climbers helped her get to the trail and walk down the mountain to her car. She didn't go to the doctor right away, but then, a couple of days after the fall, a friend told her she was acting "weird." Barnes says, "I've never been much of a crier, but I started randomly crying on my way to work." A round of visits to neurologists and other specialists soon began. Though no evidence of injury showed up on MRI or CT scans, Barnes began suffering migraines. Her speech slowed, and her motor skills deteriorated.

"If I was eating, my fork would just sit there; I couldn't bring it to my mouth," she says. "And my legs would crumple beneath me while I was walking."

Barnes was diagnosed with post-concussive syndrome, a series of symptoms associated with brain injuries, and five years later she's still trying to find her way back to a full recovery. "My neurologist put me on a seizure medication that helped my migraines but made me act like I was drunk. It was embarrassing," Barnes says. She tried craniosacral therapy and massage. "Life was doable, and I could work a part-time job, but I never got the energy back that I used to have."

Last fall, she banged her head against a low ceiling, and some symptoms returned. (Victims of repeated concussions are particularly vulnerable to long-term problems.) Now she's undergoing hyperbaric treatments, breathing 100 percent oxygen in a chamber for 70 minutes a day. Unable to work full-time, she helps clean the hyperbaric business to pay for treatments she can't afford. But she's begun climbing again. "It took a lot of adjustment, because just like with the fork not being able to get to my mouth, my hands didn't want to move to the next hold," she says. "I'm definitely not as strong as I was before, and I'm way more cautious. But I'm starting to feel like I can actually train again."

Luckily for climbers, injuries like Barnes' are unusual. High-altitude mountaineering is more dangerous: If you venture above base camp on Annapurna, you've got about a 1 in 25 chance of dying. By contrast, fatalities in rock climbing and bouldering are very uncommon. Statistically, rock climbing is nowhere near as dangerous as the mainstream media (or your mom) would believe.

An average of about 30 climbers of all disciplines die each year in the United States, from falling, rockfall, or any other cause—about the same number of skiers and snowmobilers, combined, killed by avalanches annually in the U.S. Compare this with cycling, which kills 600 to 800 riders a year and injures more than 40,000 in the United States—a greater rate of deaths per participant than in climbing. A parent or nurse might argue that 30 deaths is still an unacceptably large number, but compared to other sports perceived as less dangerous, rock climbing is statistically quite safe.

In fact, the huge majority of climbing injuries are non-traumatic—finger and elbow tendonitis, shoulder pain, and similar overuse injuries—or cuts, sprains, broken bones, and other non-life-threatening injuries, mostly in the lower extremities. In 2009, the *American Journal of Preventive Medicine* published a study by Nicolas Nelson and Lara McKenzie of U.S. Consumer Product Safety Commission data on climbers admitted to emergency rooms. Injuries to the lower extremities accounted for nearly half of the climber ER visits between 1990 and 2007, with ankles bearing the brunt of the damage. In the same study, head injuries (including neck, face, eyes, ears, and mouth) accounted for 12 percent of the total—an average of about 275 a year. (There was no data on who wore a helmet.) Other studies and surveys have shown a 4 to 8 percent rate of head trauma among all climber injuries.

The actual total of head injuries is likely considerably higher than these studies suggest. Some surveys included tendonitis and other non-emergency injuries, and the Nelson-McKenzie study did not account for injured climbers who saw a non-emergency physician (as Rodden and Barnes did), nor did it track fatalities. We also do not know the numbers of unreported head injuries—climbers who took a blow to the head but never saw a doctor.

Meanwhile, there's no doubt that head injuries, though relatively uncommon, often are radically different from other climbing maladies. Inflamed tendons are frustrating and painful, but they rarely require significant medical intervention; broken bones seldom demand hospital stays. By contrast, a quarter of the head injuries in the 2009 survey—more than twice the rate for all climber ER visits—resulted in hospitalization. And as Evie Barnes' experience shows, the consequences of head impacts can stretch over years.

"Every single doctor said, 'You should have worn a helmet,'" Barnes says now. "They said I probably still would have gotten a light concussion because I hit so hard, but they had no doubt that if I had a helmet, I would have been way better off."

HEADS UP!

How to handle a head injury

LACERATION

> **Signs and Symptoms (S/Sx)** Cuts to the scalp are the most common head injury. Bleeding can be profuse. > **Treatment (Tx)** Check for more serious injury (like fracture). Firmly apply a bulky dressing. Consider tying the hair across the wound to act as a makeshift stitch. Apply ice to control swelling, if possible. > **Evac?** No

SKULL FRACTURE

> **S/Sx** You find a depression or obvious crack, discharge from the ears or nose, or black and blue around eyes or ears. > **Tx** Apply diffuse rather than direct pressure to stop bleeding (flow can relieve build-up and pressure in the skull). Stabilize spine and monitor airway, breathing, and circulation. > **Evac?** Yes

CLOSED HEAD INJURY

> **S/Sx** If trauma causes brain swelling inside the skull, the brain becomes compressed. Did your partner lose consciousness? Watch for headaches, personality changes, altered vision, and dizziness. > **Tx** Manage airway, breathing, and circulation. Wake up every few hours to assess level of consciousness. > **Evac?** Yes

**In the days and weeks following head trauma, watch for symptoms indicating concussion: concentration and memory trouble, irritability, personality changes, light or noise sensitivity, problems sleeping, and depression.*

ROCK CLIMBERS WEAR HELMETS IN SOME SETTINGS BUT NOT OTHERS.

Not long ago, very few climbers wore helmets, even in the most dangerous situations. Pioneering alpinist and gear maker

SUPERCORN

Yvon Chouinard climbed perilous ice and alpine routes with his head clad only in a yellow-and-purple knit hat. "When I started climbing 25 years ago, it wasn't cool to wear a helmet," says Dan Middleton, chief technical officer at the 65,000-member British Mountaineering Council (BMC), which has done extensive helmet research and education. "You'd very rarely see people [using them while] crag climbing. Now that's changed."

The same story has played out in the U.S., where helmet sales are growing fast. According to Leisure Trends' Outdoor RetailTRAK surveys, helmet sales have nearly doubled since 2004, reaching 64,239 units in 2012. That's only a small percentage of climbers, however. The Outdoor Industry Association estimates that 5.7 million people participated in rock climbing, gym climbing, bouldering, or mountaineering in 2011. If this total is accurate, only about 1 percent of all types of climbers are buying a new helmet each year.

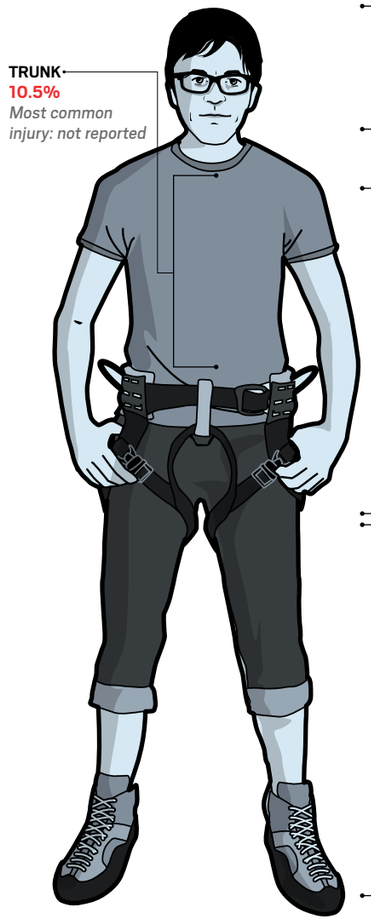
The vast majority of ice climbers and alpinists wear helmets. But among rock climbers, helmet use varies widely depending on where and how you climb. In a survey of 1,887 rock climbers published in *Journal of Trauma* in 2006, 36 percent reported wearing helmets most or all of the time, while 19 percent never wore helmets; the rest sometimes or seldom wore them. Another survey of 1,400 rock climbers, completed last year by Kevin Soleil, then a master's student at the University of Tennessee, Knoxville, found similar patterns. The percentage of respondents who said they usually or always wore a helmet was 49 percent among sport leaders, 53 percent for topropers, and 86 percent for leaders on traditional climbs.

Look around a typical American crag, and Soleil's numbers will likely seem high. (He cautions his results may be skewed because he did not survey climbers under 18—the mean age in his survey was 36, and younger climbers tend to wear helmets less often than older ones.) Based on multiple observations of sport and traditional crags in Colorado last spring, helmet usage was lower across the board. In Boulder and Clear Creek canyons, at five mid-difficulty sport climbing crags, about 35 percent of leaders were wearing helmets. Less than 20 percent of belayers wore helmets, and only 10 percent of people standing or sitting under climbs wore them. Down the road in Eldorado Canyon, a traditional area known for loose rock and tricky protection, 66 percent of leaders wore helmets, and 45 percent of belayers were helmeted.

Unsurprisingly, Soleil's survey suggests that as climbs get steeper and the difficulty higher, especially on sport routes, fewer people wear helmets. Generally, overhanging climbs are less vulnerable to rockfall and impacts with the rock. Chris Weidner, who says a helmet saved his life after a 30-foot fall on El Capitan a decade ago, usually doesn't wear one anymore for sport climbing. "I can't think of anybody

AFTER THE FALL

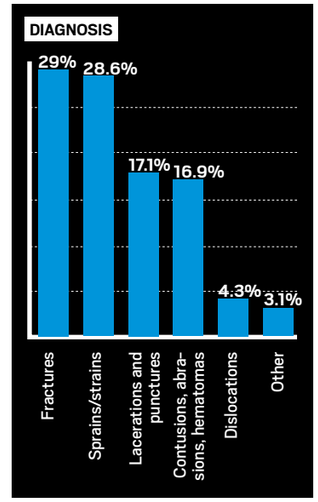
The numbers behind climbing's most common accident



TRUNK
10.5%
Most common injury: not reported

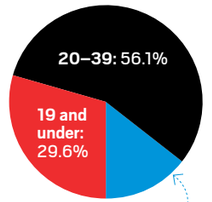
HEAD
12.2%
Most common injury: laceration

UPPER EXTREMITIES
29.2%
Most common injury: dislocation

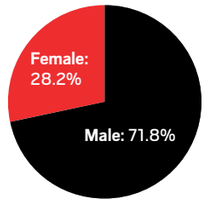


LOWER EXTREMITIES
46.3%
Most common injury:
> *FEET broken bone*
> *ANKLES sprain or strain*
> *LEGS laceration*

AGE

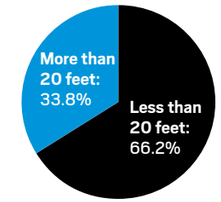


SEX



Men suffer more lacerations and fractures. Women, more sprains and strains. Men were more than twice as likely to be hospitalized.

FALL DISTANCE



Falls account for more than three-quarters of climber emergency room visits.

Source: "Rock Climbing Injuries Treated in Emergency Departments in the U.S., 1990–2007," Nicolas G. Nelson, MPH, Lara B. McKenzie, M.A., Ph.D
NOTE: This study only looked at ER visits. Other studies show that overuse injuries to the arms, fingers, and shoulders are climbers' most common injuries.

that sport climbs hard and wears a helmet," he says. Rodden said during her trip to Spain, "I haven't seen a single person here wearing a helmet."

Virtually no one boulders with a helmet, despite the frequent bruising falls many boulderers take. One who does is the father of the bouldering V-grade and author of the Hueco Tanks guidebook, John "Verm" Sherman, who has had multiple concussions and now sports a helmet on highballs and even some butt-draggers. In a column at *dpmclimbing.com*, Sherman wrote, "These days, if I can't find a legitimate reason not to wear a helmet, I wear one. Which is 98 percent of the time."

You can also find rare instances of people climbing indoors with a helmet. Mark Dixon, 55, is an emergency room doctor in Loveland, Colorado, and a 5.12 leader, and every time he ties in to lead a route at the Boulder Rock Club, he also straps on his helmet. "I started wearing a helmet in the gym about a year ago," he says. "I was taking a lot of falls, and twice in a week flipped upside down and whacked my head. It was nothing serious, but I thought, 'This is stupid—I wear a helmet biking, climbing outdoors, and caving; why not wear one here, too?'"

For many climbers, the decision whether to wear helmets is not based on safety at all, but more around comfort and fashion. Soleil's survey found that trad climbers were much more likely to say helmets were comfortable and "acceptable fashion." Sport climbers were more likely to say a helmet was "unaesthetic" or uncool. (Typical negative comment: "I feel like I stand out at the crag.") Soleil also found a significant correlation between climbers who don't wear helmets and those who believe brain buckets "take away from the aesthetic look and feel of a climbing scene," or that they "reduce performance."

Though it's rare, there are cases where a helmet negatively affects climbing performance. Most trad climbers can recount stories of removing a helmet to squeeze through a tight chimney. Helmets also can push your face away from the wall if you're pulling in close for a delicate move. And for climbers who count the ounces of their quickdraws and choose sub-9mm ropes for redpoints, even a 1/2-pound helmet may be too much to bear.

"A risk-based approach to helmets is what we're pushing," says Dan Middleton of the BMC. "We don't want to just say, 'Oh, you must wear a helmet.' Climbing isn't about rules. We want people to think about the risks and make their own decisions."

Soleil's study concluded that rock climbers make some logical risk-based decisions: They tend to wear helmets more often when they perceive greater threat from rockfall or climbs are less steep (thus a climber is more likely to impact something if he falls), and where routes are longer, poorly protected, or farther from medical care. However, the survey also reveals that some climbers make poorly reasoned decisions, including basing their choice on what's "cool." And across all types of rock climbing, fewer survey respondents wore helmets while belaying than while leading or following—despite the fact that falling rocks and dropped gear are at least as likely to hit you below a pitch as when you're actually climbing it.

If you count ice climbers and mountaineers, climbers as a group still don't wear helmets as often as participants in other head injury–prone sports. After rapid growth in the 1980s, the number of cyclists wearing helmets leveled out at around 50 percent, with the percentage rising as cyclists get older. The National Ski Areas Association reported that 61 percent of skiers and boarders wore a helmet in the 2010/2011 season, up from 25 percent in 2002/03. But among rock climbers, especially if you count belayers, boulderers, and people hanging out at the base of a cliff, fewer than half at any given crag are likely to be wearing helmets.

CLIMBING HELMETS ARE GOOD AT PROTECTING AGAINST SOME TYPES OF IMPACTS, BUT NOT OTHERS.

If every climber wore a helmet all the time, some would avoid life-altering brain injuries. But others would still be killed or disabled by head trauma. In early 2002, Rod Willard, an accomplished ice climber, was belaying behind the *Fang* in Vail, Colorado, when a block of ice estimated at 400 pounds broke off and hit him in the head. He was wearing a helmet, but he died instantly.

Rick Vance, technical information manager at Petzl America, explains that climbing helmets are considered Category 2 personal protective equipment, because they can't guarantee protection against all risks they're designed for. "A helmet can protect you against a golf ball–sized falling rock easily, but it cannot protect you from a microwave-sized block traveling at terminal velocity," Vance says. "They're called death blocks for a reason."

Smart climbers are aware of helmets' limits, and they focus more on avoiding blows to the head than fending them off with a thin skin of plastic and foam (See "Climb Smarter," p.49). Simple steps like avoiding climbing under other parties and placing protection frequently to avoid long falls will do much more to prevent head injuries than any helmet can.

There are even a few rare instances where helmets will increase your chance of injury: For example, it's possible you could choke on the chinstrap if wedged into a chimney or crevasse after a fall. Straps on construction hard hats are designed to break for this reason, but climbing helmets are different—they have to stay on during a tumbling fall, and the straps are tested under load not to slip or break.

A less obvious hazard is what's called risk homeostasis, the theory that says humans take more chances when they feel more protected. If donning a helmet entices you to attempt a 5.11 X face climb, are you really any safer?

In fact, it's very difficult to prove that climbing helmets save lives at all, despite many anecdotes suggesting they do. On its website, Petzl has collected stories from climbers who swear helmets saved their lives. Reading these accounts, and looking at the photos of the busted helmets, you could easily conclude these climbers would be "dead for sure" if it weren't for that trusty lid. But would they? Would a helmet have prevented Rodden or Barnes' concussions?

"The answer is nobody knows," says Christopher Van Tilburg, a mountain rescue and wilderness medicine expert who has worked for 14 years as a doctor at an emergency clinic on Mt. Hood in Oregon. "And the reason nobody knows is we can't do a randomized, double-blind study on people wearing helmets."

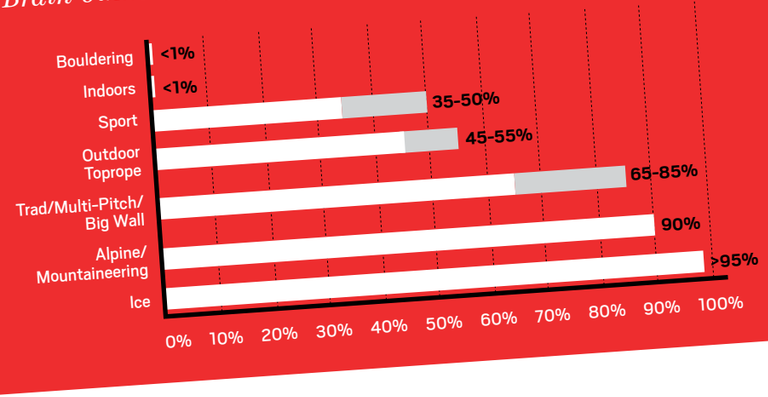
Numerous studies have shown that ski and bike helmets reduce the severity of injury in certain types of crashes. And though the data cannot prove that helmets save cyclists' lives—because it's impossible to say with certainty that a person would not have lived if he *didn't* have a helmet—the fact that a very high percentage of fatal cycling accidents involve head injuries, and that most of the cyclists killed are not wearing a helmet—well, that's a compelling set of statistics.

In 2007, the British Mountaineering Council surveyed nearly 500 climbers who had suffered head injuries, from minimal to severe. It concluded, "Wearing a helmet significantly reduces the chances of suffering a severe or major head injury: Non-helmet-wearers [were] more than twice as likely to suffer a severe head injury than helmet wearers."

"Helmets probably don't prevent death [among climbers]," says Dr. Van Tilburg. "Rock climbers die when they take huge falls and they have massive trauma. So the question is, are helmets useful for preventing head injuries? I would say absolutely yes, they are. The bigger the fall, the less the helmet is probably effective at preventing a concussion, and it doesn't prevent what we call contrecoup injuries, where your brain moves inside your skull

WHO WEARS HELMETS*

Brain-bucket use by climbing discipline



*Sources: "Helmet Use Among Outdoor Recreational Rock Climbers Across Disciplines: Factors of Use and Non-use," by Kevin Henri Hogan Soleil, 2012; author field observation.

WHAT CLIMBERS SAY, PART 1

HITS AND NEAR MISSES

Five climbers learn from their closest calls.

DANIKA GILBERT

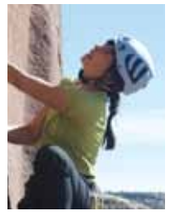
Overlook Cliff, Ouray, CO

THE INCIDENT I always wear a helmet, but one day I took it off between climbs and forgot to put it back on when my boyfriend started leading. Thirty seconds later, a grapefruit-sized rock careened down. I pressed against the cliff, and the rock grazed my skull, opening a gash. A direct hit might have killed me.
THE TAKEAWAY Friends saw me covered in blood that day, but many still don't wear helmets at that crag, even though stuff comes down regularly there. I'm not sure what the disconnect is. Rockfall is unpredictable.

CHRIS WEIDNER

El Capitan, Yosemite, CA

THE INCIDENT I was climbing the *Salathé Wall* and was leading the pitch off Sous le Toit Ledge. It starts with a 5.6 ramp, then goes up a slightly overhanging crack. I clipped into an old fixed piton, then back-cleaned the piece below me. Just as I was reaching up to place the next cam, the piton ripped out. I fell 30 feet, and landed headfirst on the ramp.
THE TAKEAWAY I had a helmet on; it broke in three places, and I really believe that it saved my life. Other than pure sport climbing, I pretty much always wear a helmet.



CAROL KOTCHEK

Bubble City, New River Gorge, WV

THE INCIDENT I had just started up a four-star, 5.10 sport route when my foot slipped and I flew straight back into a tree, spun around, and slammed the ground on my side. Most of the impact was absorbed by my leg, but I had a contusion on my head too. The foam inside my helmet detached from the outside plastic, so I know the helmet absorbed some impact.
THE TAKEAWAY When things go bad in climbing, it happens fast. I learned not to take sport climbing too casually—I was heading up the route with a gym mentality—and always to wear a helmet.

REID PLETCHER

Practice Rock, Boulder Canyon, CO

THE INCIDENT I always wear a helmet trad climbing, but I left the helmet in the car for a day of sport. After five routes, I made an impulse decision to try a trad route to end the day. I fell, two pieces pulled out, and I landed on a ledge. I got two skull fractures, brain contusions, and a subdural hematoma.
THE TAKEAWAY The doctors told me I might have survived because I *wasn't* wearing a helmet, as this allowed more swelling and relieved pressure that otherwise could have resulted in termination. I always wonder what would have happened with a helmet. Maybe I wouldn't be here at all. Maybe it would have helped. I will never know.

KELLY CORDES

Wizard's Gate, Estes Park, CO

THE INCIDENT I hopped on a wildly overhanging 5.13a sport climb, and I had a heel hook when my forearms flamed out. My hands came off, my heel stayed on, and somehow I flipped upside down, spun, and swung back into the rock headfirst. Leave it to me to take the safest form of climbing and make it as dangerous as possible. I got 13 staples in my skull—I could have put a TCU in the gash—and 14 stitches in my face.
THE TAKEAWAY I tend to wear a helmet. Though, as time wears on, I've gotten more lax about it. If you say, "Always, always, always wear a helmet," well, what about in the gym? You've got to be smart and look at the probabilities.

and bounces against the opposite side. But certainly, for a non-fatal fall, with a medium degree of impact, the helmet absorbs some impact."

Climbing helmets might absorb even more impact, and might do a better job of preventing injuries and saving lives, except for two powerful and inter-related forces: The standards that guide helmet testing and manufacturing aren't pushing helmet design in that direction, and consumers—the climbing community—aren't demanding it.

HELMET TESTING DOESN'T ADDRESS THE NEEDS OF MODERN ROCK CLIMBERS.

Though they vary in design and construction, all climbing helmets are compromises. They are good at preventing scalp wounds and skull fractures, especially from falling objects, but are not nearly as effective at preventing concussions and other brain injuries from front, rear, or side impacts. The ideal climbing helmet would protect equally on all sides, and would be just as effective at preventing or mitigating concussions as it is for deflecting falling rocks. This helmet does not exist.

Why not? Despite increasing awareness of the consequences of traumatic brain injury, the standards by which helmets are designed and tested have not changed significantly in more than 30 years. The original standards were designed to protect climbers against falling rocks and chunks of ice in the Alps, and this is essentially the same today.

Most manufacturers design their helmets to pass tests developed about 35 years ago by the International Mountaineering and Climbing Federation (UIAA). These were later adopted and slightly modified by the European Committee for Standardization (CEN); the CE label you see on climbing equipment is required for many types of gear to be sold in the European Union. In one helmet test, a 5-kilogram (ca. 11-pound) weight is dropped 2 meters, or about 6.5 feet, onto the crown of a helmet mounted on a head form, which in turn is connected to a device that measures the amount of force absorbed by the head and neck. The UIAA standard requires no more than 8kN of force transmitted; the CE maximum is 10kN. (In other words, a UIAA label means the helmet meets a stricter standard.) A second test for penetration drops a 3-kilogram pointed cone 1 meter onto the helmet—to pass the test, the cone can't punch through the helmet and reach the head form.

Tests for front, side, and rear impacts were added later. The head form is tilted at a 60-degree angle so the 5-kilogram weight drops onto the sides of the helmet. But the drop is only 0.5 meters (a little more than 1.5 feet), a standard 75 percent less strict, in part because your body can absorb more impact from an angle than head-on.

It's impossible to translate these numbers to real-world situations and say that, for example, a locking carabiner dropped from 20 feet will bounce harmlessly off your helmet, but one that falls 1,000 feet on El Cap may break your skull. There are too many variables. Companies also don't disclose whether their helmets barely meet the standards or if they significantly exceed them. But the bottom line is that a helmet with a UIAA or CE label is designed to standards that offer considerably more overhead protection than side, front, or rear.

Moreover, these standards don't cover blows far down the sides of your head—like the knock on the temple you might well experience in a fall, or the blow to the back of your head when you duck to avoid a falling rock. A standard of 60 degrees off-vertical "isn't what other helmet standards (rescue, for example) would consider true side impact," says Petzl's Vance. "I'm envisioning an impact perpendicular to your ear, forehead, or back of the skull. There is no [such] standard for climbing helmets. I realize this may sound a little silly, but without a performance standard to design to, we as manufacturers are left to decide for ourselves what the acceptable minimum level of protection might be."

Of the thousands of incidents reported in *Accidents in North American Mountaineering* between 1952 and 2012, about 800 resulted from falling rock, ice, or other objects. And such victims are much more likely to have serious head injuries than victims of falls. The Nelson-McKenzie study concluded that being hit by an object (compared to being injured by other mechanisms) was four times more likely to injure a climber's head than another part of the body, and three times more likely to result in hospitalization.

The good news is that we already have climbing helmets that are quite good at preventing injuries from falling objects, at least if they come at you from straight overhead. The UIAA and CE standards are strictest for exactly this kind of protection. The bad news is that accidents involving falls—versus falling objects—are far more common.

During the same 60-year period (1952-2012), *Accidents in North American Mountaineering* reported more than 5,400 incidents of falls on rock, snow, or ice—nearly seven times as many as accidents involving falling objects. ("No hard hat" was listed as a contributing cause in 434 cases.) Falls also accounted for more than three-quarters of rock climber injuries in the Nelson-McKenzie study of emergency room visits, where a cause was known, while getting hit by an object caused only six percent of the ER visits.

The problem is that helmets' protective benefits are much less certain for climbing falls than they are for falling objects, because the official standards for front, rear, and side impacts are lower, and the amount of side-impact protection built into helmets varies widely. Meanwhile, helmet makers still have to make sure they meet the UIAA and CE crown-impact and penetration standards, even though many rock climbers might care far more about protection in falls. In this way, the standards lock manufacturers into a set of design compromises that do not serve all climbers equally well. But the manufacturers accept this situation—and participate in the standards' development—in part to gain valuable protection in another realm: the courtroom.

THE IDEAL HELMET WOULD PROTECT EQUALLY ON ALL SIDES. THIS HELMET DOES NOT EXIST.

"The standards are the backbone of [product-liability] defense," says Doug Phillips, founder and president of Metolius Climbing. "The

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*See our own [mostly unscientific, fairly messy] helmet tests and more at climbing.com/helmetfail or on the iPad.

BUY IT RIGHT, USE IT RIGHT

How to find the best helmet for you—and make it last

SHOP FOR COMFORT AND STYLE

GUIDING PRINCIPLE: Only buy a helmet that's comfortable to wear—and that you're comfortable wearing. If you hate your helmet because it has too much or too little ventilation, pinches your sunglass stems, or you feel like a dork with it on, you'll never use it.

GET THE RIGHT FIT: Make sure it sits horizontally across your forehead, just above your eyebrows. Those cute kids with their helmets tilted back over gap-toothed grins might as well have targets painted on their foreheads. Try on multiple sizes for the best fit (keep in mind you may wear a hat underneath—always choose a low-volume hat without any "button" on top). Adjust the chinstrap and headband so the helmet is centered on your head and won't shift backward (exposing your forehead) or side to side (exposing the temples). Test the fit by snugging up the headband and shaking your head with the chinstrap unbuckled. The helmet should stay put. Before buying, wear it with your pack on—make sure you can still look up comfortably. See p. 52 for a visual guide to how to wear your helmet.

CHOOSE THE HELMET THAT'S BEST FOR THE CLIMBING YOU DO MOST

All brain buckets "manage," or slow and weaken, the energy created when an object strikes your head—whether a rock falls from above or your noggin hits a ledge. But the helmet's unique design can make it better suited for some applications than others. Here are the three main types of helmets.

● **FOAM.** Like bicycle helmets, these have one or more layers of foam—usually expanded polystyrene (EPS)—that crush or break to absorb energy upon impact. Usually covered with a thin plastic shell. Must be retired after any significant impact or if cracked and damaged.
Pros: Very lightweight, more protection on the sides
Cons: Easily damaged, "one and done"
Best for: Shorter rock climbs

● **HARD SHELL.** Rigid outer shell and a webbing suspension, similar to a construction hard hat. Hard shells are heavier than foam, but they're workhorses. They'll survive minor impacts (such as falling ice) and continue to protect.
Pros: Most durable, can handle multiple minor impacts
Cons: Heavy, less off-center protection
Best for: Ice climbing, multi-day mountaineering, schools, and outdoor groups

● **HYBRID HELMET.** Combines a hard outer shell with a foam lining, both of varying dimensions. More durable than all-foam helmets, but lighter than the classic hard shell.
Pros: Lightweight, low-profile, fashion forward, more durable than pure foam
Cons: Many have less side protection than foam helmets
Best for: All-around use, multi-pitch rock, mountaineering, and ice climbing

CHECK YOUR HEAD

Many things can weaken your helmet—do you know them all?

1. Helmets don't work when it's too ____.
A. Hot B. Rainy C. Cold D. Overcast

2. True or false: Stickers make your helmet weaker.

3. Sitting on a helmet is fine as long as...
A. You weigh less than 175 pounds.
B. It's on soft ground.
C. You pad it with a jacket.
D. All of the above
E. None of the above

4. Which of the following are signs you need to retire your helmet?
A. It's a different color than when you bought it.
B. The foam lining is cracked.
C. It's dented.
D. It's 10 years old.
E. All of the above

5. Attaching a POV camera to your helmet will make you...
A. A YouTube sensation
B. Off-balance
C. A gaper
D. More likely to get injured than you are using a helmet with no camera

6. True or false: A helmet is the perfect place to store an emergency space blanket while climbing.

1) A and C. Some become brittle below –40°F. 2) Could be true. Rick Vance, technical information manager of Petzl America, says, "Some adhesives degrade the most commonly used helmet shell materials. Some don't. But it would suck if that PBR or I ♥ Boobies sticker was what put you in a wheelchair." 3) E. Sitting on helmets—or sitting on a pack with a helmet stowed inside—is the No. 1 destroyer of foam and hybrid helmets. 4) E. Any helmet must be retired if it has cracks, dents, or gouges deeper than 1mm or 2mm in the foam or shell. Ultraviolet light also can weaken helmet plastics—store them out of sunlight, and watch for color changes indicating UV damage. Never use a helmet older than 10 years. 5) D. (and perhaps A or C.) Helmet makers say the adhesives attachment for helmet cams could weaken the plastic. Attach it to a headlamp clip or other non-structural component if you must. Never drill a hole. Also, unscientific observation suggests only bad things happen with a POV cam on board. 6) False. Though many sources (including this magazine) have recommended stowing emergency gear between the harness and shell of a hard-shell helmet, filling this gap transmits more force to your skull.

TEXT BY LAURA SNIDER (BUY RIGHT)

UIAA Safety Commission is a collection of equipment makers, climbers (each country has a representative), and test houses, and we all agree on what a helmet should be and do, and that makes it hard to sue for a head injury when the helmet meets the standard."

Phillips adds: "We [at Metolius] would like to get a bouldering helmet going, but without a solid standard in place, it is all but suicidal from the manufacturing perspective. The standard builds a box, and as long as you stay in the box, you are relatively safe. Moving outside the box—building a helmet that is not covered by standards—is very risky."

According to several members of the UIAA Safety Commission, no changes to the helmet standards are currently in the works or were discussed at the commission's spring meeting in Chamonix, France, in late May. Nor has the CEN implemented any significant changes recently. Once proposed, any new standard would take years to develop and implement. And even if climbing manufacturers and the other players could agree on new standards for climbing helmets that would serve rock climbers better, there's reason to believe the climbing public—that's you and me—might not buy it.

THE MARKET DEMANDS HELMETS THAT ARE LIGHTER, NOT SAFER.

Metolius is a company that has built its reputation in part on products that maximize climbing safety, like its beefy Safe Tech harnesses with double belay loops, strength-rated gear loops, and other redundant and extra-strong components. About a decade ago, Metolius started developing a Safe Tech helmet specifically designed for maximum protection, but after less than four years of selling the new helmet, the company pulled it from shelves last year. It was heavier than most modern helmets, and neither the company nor climbers loved the design.

"We were never able to make the helmet that we wanted to make," Phillips says. "The rock climber of today needs side-impact protection, and the standards are set up for rockfall protection. What you have to do is protect against both, and that tends to make the helmet heavier and bigger than a rock climber wants to wear."

Indeed, the general trend in helmet design is in the opposite direction from the Safe Tech or the Wild Country 360, a helmet introduced in 2009 that has generous foam lining and other features giving "more or less the same levels of protection all around the head, rather than just at one specified, super-strong test point at the top of the head," explains Wild Country spokesman Richie Patterson. Radically lightweight new models like the Black Diamond Vapor and Petzl Sirocco (both reviewed in *Climbing's* 2013 Gear Guide) show innovation is alive and well in helmet design, yet it's mostly aimed at ever-lighter helmets, which will meet UIAA standards but aren't designed for maximum protection.

As a result, many companies figure they can protect more climbers, and sell more helmets, if they produce a model that might get non-traditional helmet users to wear one more often—or to start wearing one at all.

"Now that there are more choices, pretty much all the mountaineers and ice climbers wear helmets, but that single-pitch cragging market has eluded all of us," says Bill Belcourt, the director of climbing products at Black Diamond Equipment. "We have yet to come up with a helmet of any design that people will wear [in large numbers] at the crag."

Black Diamond's latest attempt, the Vapor, uses large ventilation gaps and layers of Kevlar and carbon rods over a foam lining to reduce the helmet's profile and cut the weight to under seven ounces. Getting the Vapor certified was a challenge. The testing organization in Europe "took issue with the number of ventilation holes," Belcourt says. "In their opinion, a helmet should have fewer holes and be more protective. And my retort was, 'Right now, the whole industry makes the helmets you describe, and there's a whole user group that's refusing to use them.'"

If the industry and the UIAA adopted tougher helmet standards, Belcourt argues, it would be possible to build a helmet "that's more robust than probably anything we have right now. [But] what you would get is something like a ski helmet, and that's not going to fly with the cragger."

Moreover, even a climbing helmet designed to maximize side protection might not do much to prevent concussions—at least using current climbing helmet technology. Though the exact causes of concussions aren't fully understood, researchers believe they result from the brain rotating or shaking inside the skull, straining nerves. And as recent headlines have shown, even the $400 helmets worn by professional football players are no guarantee against the concussive impact of repeated blows to the head.

But research into helmets for cyclists—who are at least as ventilation-, weight-, and fashion-conscious as climbers—shows promising developments that might someday help prevent or mitigate injuries like

WHAT CLIMBERS SAY, PART 2

HELMET OR NO HELMET?*

The top factors influencing climbers' decisions

YOU'RE MORE LIKELY TO WEAR A HELMET IF... (MOST INFLUENTIAL)
- Peers wear helmets and encourage their use.
- You believe helmets are comfortable.
- Your favorite crags have loose rock.
- You believe helmets are acceptable fashion.
- You stick to grades you can onsight without falling.
- You are older and have more climbing experience.
- You believe helmets are effective at reducing head injuries.
- You have witnessed a major injury at a climbing area.

YOU'RE LESS LIKELY TO WEAR A HELMET IF... (MOST INFLUENTIAL)
- You believe that helmet use reduces performance.
- You climb 5.12 or harder.
- You believe helmets "take away from the aesthetic look and feel of a climbing scene."
- You frequently climb overhanging routes.
- You believe helmets are too expensive.
- You learned to climb indoors.
- You believe the rock is solid at your favorite crags.

**Source: "Helmet Use Among Outdoor Recreational Rock Climbers Across Disciplines: Factors of Use and Non-use," by Kevin Henri Hogan Soleil, 2012*
Note: Differences and ranking among some factors not statistically significant

A VISUAL GUIDE TO PROPER HELMET USE

A helmet is designed to protect your head from falling objects—which it can't do if you fall prey to these common brain-bucket misapplications.

those suffered by Beth Rodden and Evie Barnes. Though their effectiveness isn't proven, these helmets use new materials and suspension systems to delay the transmission of force to the skull—by slowing and weakening the energy impacting your head, the theory goes, you get less rotation and rattling of your brain. The Swedish-developed the Multidirectional Impact Protection System (MIPS), a modular "helmet inside a helmet" that moves independently to absorb some of the rotational force of an impact. Another new system, dubbed Angular Impact Mitigation (AIM), from an Oregon company, uses a lightweight honeycomb of aluminum, like a car's "crumple zone," to absorb more energy than the expanded polystyrene (EPS) foam in most modern climbing helmets.

The latest models using MIPS technology are comparable in weight and profile to traditional cycling helmets. And though the retail price of such helmets is bound to be steep, if there's a market for the $140 minimalist Vapor helmet, isn't there likely to be another segment of the climbing market that would pay just as much or more for maximum protection?

Some companies have already improved their helmets' level of protection by using dual-density foams, as in bouldering crashpads—the softer foam absorbs impact, and the harder foam helps spread it out. Dave Furman, hardgoods category manager for Mammut Sports Group, said the company's internal tests show significant benefits in the dual-density foam versus the single-layer foam linings in earlier generations of Mammut helmets. At present, though, no companies we contacted said they were developing helmets specifically designed to be more concussion-resistant. (Some helmet-makers did not respond, and others may have held back information for competitive reasons.)

Ultimately, whether consumers demand more protective helmets will be influenced not just by safety and cost considerations, but even more by the decisions of other climbers. According to Soleil's research, the single biggest thing influencing whether climbers wear helmets is their friends and other climbers. "Peer helmet use had the largest correlation to helmet use of any factor in the study," Soleil wrote. In other words, if the people you climb with wear helmets, you're more likely to. If they don't, you won't, either.

Magazines and other media also have a huge influence. *Climbing* occasionally gets letters from readers, like this one from New Jersey: "I like your magazine, but it is very troubling that so many of the photos depict climbers without helmets on. Does your organization recommend climbing without proper head gear?" The easy and obvious answer is that, no, *Climbing* doesn't promote helmet-free climbing. Instead, the magazine's photos reflect the current state of helmet use by climbers—*Climbing* shows the sport as it's practiced today. (See the editor's note on p.6 for more about *Climbing's* positions on helmets, testing standards, and the media.) In advertisements and videos, the vast majority of sponsored sport climbers and boulderers rarely wear a helmet. But imagine if Chris Sharma showed up in the next Reel Rock film slaying 5.15 routes in Catalunya with dirty-blond locks poking out from under the plastic brim of his helmet. Helmet use among sport climbers would skyrocket. No one says badass freestyle skier Kaya Turski isn't cool because she wears a helmet. No one calls downhill mountain biking champ Aaron Gwin dorky because he protects his head. Why should climbing be different?

Of all the helmet-makers we contacted, Edelrid was the only one that said it "instructs…photographers to show rock climbers wearing a helmet." The majority responded something like Black Diamond's Belcourt, who said, "Climbing has a long history of being non-conformist and anti-establishment, so we don't want to tell people what they should or shouldn't do when it comes to a choice like this. Our job is to make a helmet that climbers will want to take, not try to make them take one."

IT'S A NO-BRAINER.

When I began researching this article, I expected to reach a simple conclusion: Helmets can prevent or mitigate life-changing or life-ending head injuries, so more climbers should wear them. But what I discovered was a complex landscape of product technology, regulations, and climber psychology. Helmets, I found, don't protect particularly well against certain head injuries, including concussions. The certification tests do not specifically target the kinds of climbing that most people do today. And the design trend—propelled by consumer demand—is toward lighter and smaller helmets that are arguably less protective, not more. In such a landscape, I realized, the safest climber is not the one who reflexively dons any old helmet for protection, but the one who uses his

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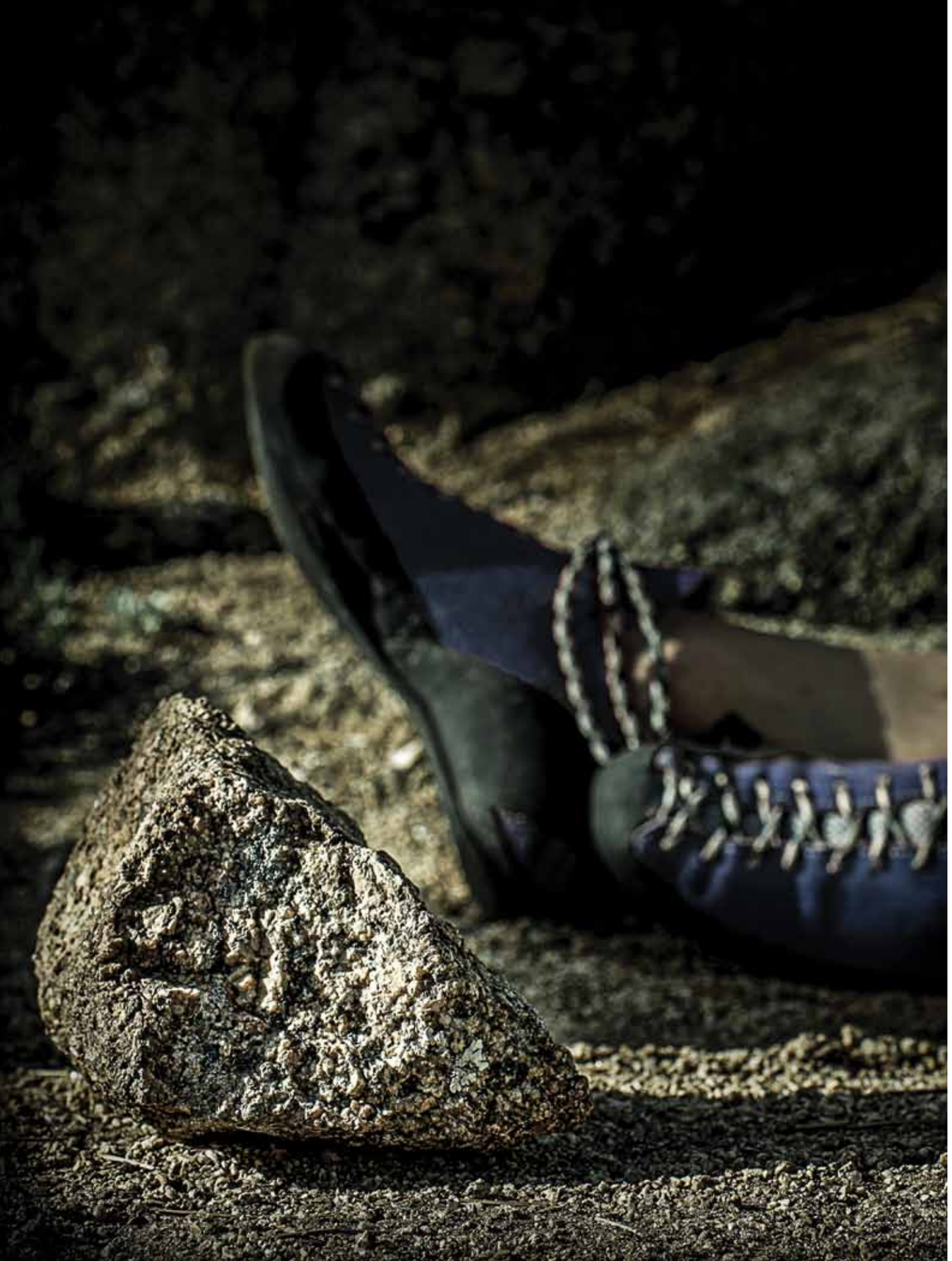

WHAT CLIMBERS SAY, PART 3

THE STATE OF HELMET USE

We asked a range of climbers why they do or don't wear a helmet.

The consequences of a single accident without a helmet outweigh any annoyance. The least we can do for those who love us and for those we love is to try to make it as safe as possible.

—Michael Feldman (New Jersey climber)

Can't think of a single reason not to wear one 100 percent of the time outdoors. They are so light and well ventilated now that there's really no downside.

—Kevin Craig (Colorado climber)

Several winters ago we were in the Eklutna Valley of Alaska, 15 miles from the nearest road. Rapping off at the end of a big-wall ice day, I was halfway down when it felt like a baseball bat collided top-center of my head. I had dislodged a bowling ball of ice with the ropes, and it shattered my helmet into a dozen pieces. I always wear a helmet.

—Ben Erdmann (Alaska alpinist and big-wall climber)

I used to be lazy about helmet wearing. I thought they were only for leading. Then one day, out of the blue, while belaying my husband on a sport route, a chunk of the climb exploded. I caught him while many large rocks whizzed past my head. Had one of them hit me, I would be dead. Helmets forever.

—Betsy Gelvin (Washington climber)

When Larry Dalke and I attempted *The Diagonal* on Longs Peak, we left our helmets in a meadow below. A couple of pitches up, a rock the size of a bus broke from the wall and crashed into the snowfield. The funny part is that we rappelled and then returned with our hard hats, but of course no helmet would have helped us had we been under such a falling rock. But those bullets and marble-sized missiles that often whiz by are good reason to have a helmet on this part of the east face.

—Pat Ament (Colorado legend)

My rules: Always in the mountains on rock and ice, almost always at the crags, but not on steep, closely bolted sport routes with no rockfall danger. That is managed risk, but still risk.

—Mark Kroese (American Alpine Club president)

I wear one on ice, in the alpine, or anytime someone is above me. Other than that, no.

—Jess Roskelley (Washington alpinist)

A friend of mine died sport climbing a few years back after falling and smacking the back of his head on rock. It made me think about how most people don't wear helmets while sport climbing or bouldering, but the potential obviously exists in both disciplines for head injuries resulting in death. Personally, I have never considered wearing a helmet bouldering. It would definitely get in the way. Also, the peer aspect of helmet use is huge—when I began bouldering, no one wore helmets, and I just followed suit. I'm sure if helmets were par for the course, I would wear one.

—Angie Payne (Colorado boulderer)

I rarely wear helmets—only in the alpine and for extreme single-pitch trad. Head injuries during sport climbing are low compared with ankle, leg, and other injuries. I don't know anyone who wears a helmet regularly while sport climbing. I also don't like the feeling of wearing a helmet. It doesn't necessarily inhibit performance, but it's one more thing to carry, and it's quite dorky. Dorky because the risk is so low, while showing up at the base of the Diamond with a helmet is not dorky—it's smart.

—Jonathan Siegrist (Colorado climber)

I do not climb with helmets because I do not need them in the style of climbing that I practice. If I were doing adventure multi-pitch climbing, where the potential of rockfall was hazardous, I would wear one. In bouldering, you want to be as light as possible, so a helmet would interfere with performance. This is just my personal choice. If a helmet gives you extra confidence, though, all the power to you.

—Daniel Woods (Colorado climber)

Helmets make me feel more encumbered and inhibit the free feeling of rock climbing. They suck to wear. But at least they look stupid.

—Nik Berry (Utah climber)

head to assess the risks and climb smarter.

Every time we tie in, we make dozens of choices that could have serious consequences: Should I try this route? Do I trust this belayer or spotter? Can we finish the climb before it rains? Decision-making is integral to climbing's appeal, and helmet-wearing is just one fraught choice in a long chain.

I believe if they thought seriously about the risks and benefits, more climbers would wear helmets. Someday, I believe, helmets will be a lot more effective than they are today. Meanwhile, like so many choices in climbing, helmet use comes down to very personal calculations. Here's how I've made mine.

In more than 30 years of climbing, I've been hit in the head multiple times, usually while belaying ice climbs. Once I was dropped from the ceiling of my local gym, falling about 30 feet to the mat, where I rolled backward and smashed my head into a milk crate full of holds. I ended up with nine stitches in my scalp. If I'd hit the rigid corner of the crate, I might be dead. I can still feel the scar in the back of my head eight years later.

ULTIMATELY, IT COMES DOWN TO THIS: THERE ARE RARELY GOOD ARGUMENTS FOR NOT WEARING ONE.

After that accident, I didn't go full Mark Dixon and start sporting a helmet in the gym. But today, even though I know that helmets could be made stronger and safer, and although I understand it might not save my life, I always wear a helmet while leading, whether sport or trad. I am certain that I climb better with a helmet, with more confidence. And though I frequently don't wear one for toproping or belaying, that's changing, too. Some accidents in climbing are completely out of our control, but wearing a helmet is one easy thing I can do to gain a little power over my fate, without any special skills or effort. And I couldn't face my wife if I chose to climb without a helmet, and then a falling rock or a tumble made me unable to earn a living, or talk to her, or feed myself.

Ultimately, it comes down to this: There are many climbs for which it's perfectly reasonable to argue a helmet is not really necessary, but there are rarely good enough arguments for *not* wearing one. And so, more and more, I do. XX