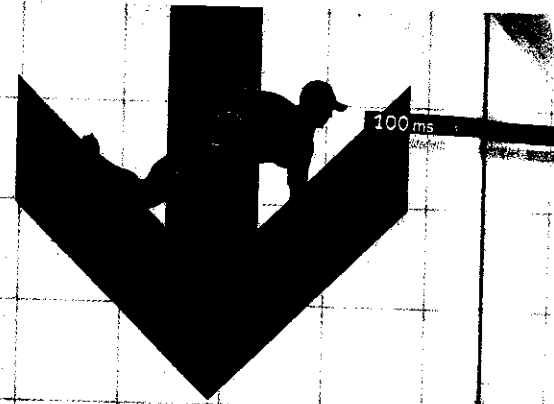


ANATOMY OF A SWING



IN LESS TIME THAN IT TAKES TO BLINK AN EYE, PRO HITTERS ROUTINELY ACHIEVE THE EXTRAORDINARY.

BY DAVIN COBURN /// ILLUSTRATIONS BY INTOAROUTE

When Ryan Zimmerman stands at the plate, there's no time to analyze physics. "I'm thinking about what the pitcher might throw in that situation," says the 22-year-old rising star with the Washington Nationals. "I have to eliminate as many options as I can before he releases the ball." Twenty times last season, Zimmerman pounded a pitch into the seats. Now PM stops the clock to examine ball spin, bat speed and the rest of what Zimmerman instinctively understands about hitting. Here's how those home runs happened.

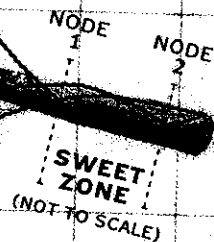
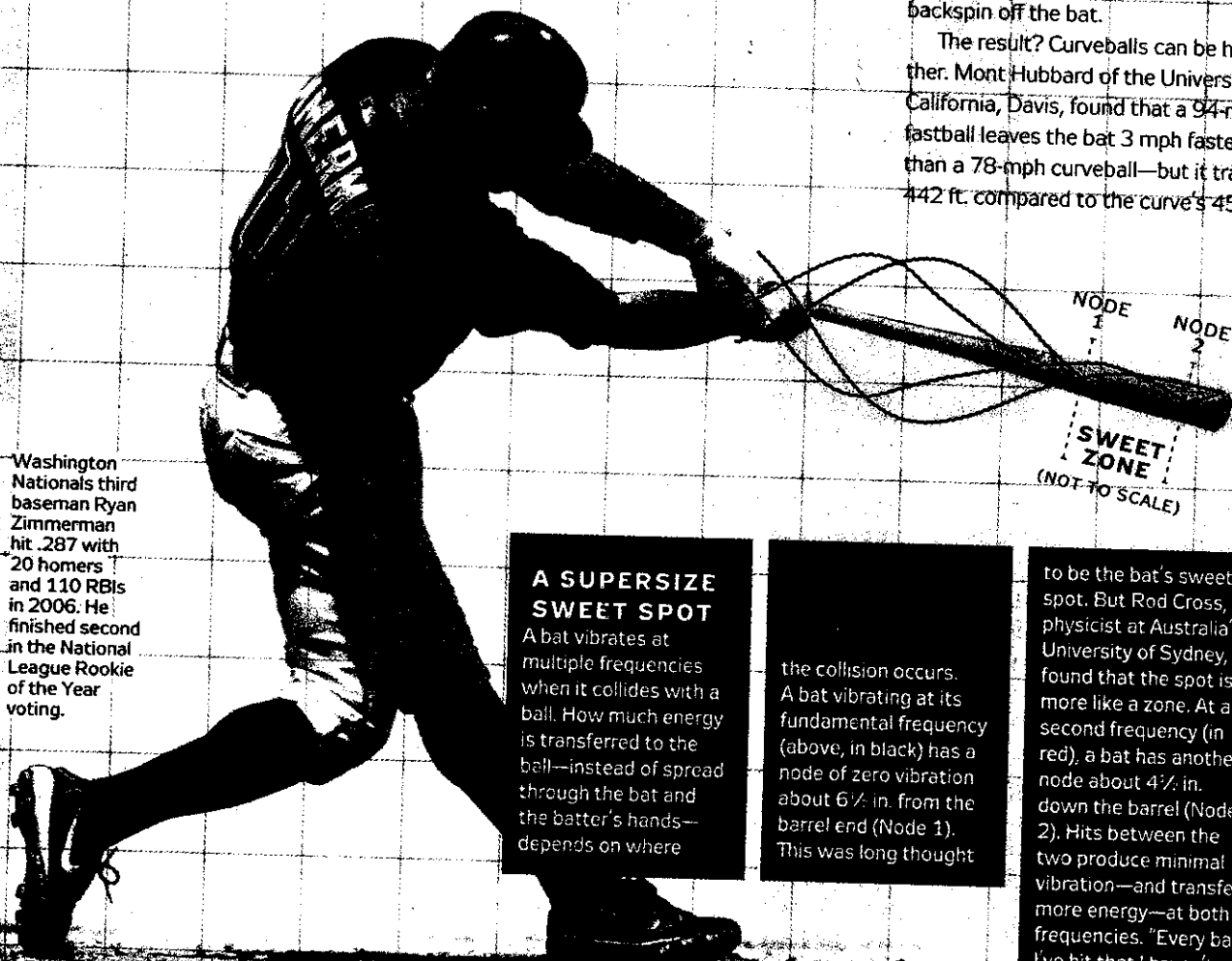
SPIN CONTROL

A fastball comes to the plate with backspin—up to 1800 rpm. To hit the ball out of the park, a batter must reverse the rotation of the ball so that it leaves the bat with backspin. This gives the ball lift.

A curveball can carry topspin of 1900 rpm, making it bite downward as it crosses the plate. By crushing a curve, a batter builds on the pitcher's topspin—producing 45 percent more backspin off the bat.

The result? Curveballs can be hit farther. Mont Hubbard of the University of California, Davis, found that a 94-mph fastball leaves the bat 3 mph faster than a 78-mph curveball—but it travels 442 ft. compared to the curve's 455 ft.

Washington Nationals third baseman Ryan Zimmerman hit .287 with 20 homers and 110 RBIs in 2006. He finished second in the National League Rookie of the Year voting.



A SUPERSIZE SWEET SPOT

A bat vibrates at multiple frequencies when it collides with a ball. How much energy is transferred to the ball—instead of spread through the bat and the batter's hands—depends on where

the collision occurs. A bat vibrating at its fundamental frequency (above, in black) has a node of zero vibration about 6 1/2 in. from the barrel end (Node 1). This was long thought

to be the bat's sweet spot. But Rod Cross, a physicist at Australia's University of Sydney, found that the spot is more like a zone. At a second frequency (in red), a bat has another node about 4 1/2 in. down the barrel (Node 2). Hits between the two produce minimal vibration—and transfer more energy—at both frequencies. "Every ball I've hit that I haven't felt, I knew I hit well," Zimmerman says.

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