

# Getting STUNG for Science



## Entomologist Justin Schmidt has felt hundreds of insect stings

**T**he first time Justin Schmidt got stung by a type of wasp known as a tarantula hawk, he thought he was going to die. He describes the pain as “shockingly electric,” like a “running hair dryer has been dropped into your bubble bath.” His advice if you were to get stung by one of these wasps? “Lie down and scream.”

As an entomologist at the Southwestern Biological Institute in Arizona, Schmidt studies the behavior of stinging insects such as ants, bees, and wasps. He travels the world in search of

live specimens. He will shimmy up a tree to snatch a wasp’s nest or scoop an ant colony from the earth with his bare hands. His curiosity has made him a frequent victim of insect attacks. In his 43-year career, Schmidt says, he has been stung more than 1,000 times by 80 different species of insects.

At first, he figured that pain was just part of his job. But then he realized his experiences could help answer some puzzling questions. For instance: Why do some stings hurt a lot more than others?

To compare different kinds of stings, Schmidt created the Sting Pain Index. It ranks stings on



a scale of 1 to 4, with 4 the most agonizing. “By putting numbers to the pain, I could begin to see patterns,” Schmidt says.

For example, the stings of solitary insects like the tarantula hawk often feel awful, but don’t do any real harm. On the other hand, insects that live in social groups, such as honeybees, tend to have moderately painful stings that are highly toxic. These observations told Schmidt

that toxic stings are important defenses for social insects, which have to protect nests full of tasty larvae and sometimes honey. The

pain of toxic stings is a warning to predators: Stay away or you could die.

“It turns out that pain is a very valuable mechanism for discouraging a predator from attacking you,” says Schmidt. But it’s a lesson that’s lost on him. “Pain to me is just a bluff.”

—Ariel Bleicher



MYNUPPERE ESCOURAS/PIUMINDEN PICTURES (YELLOW JACKET, TARANTULA HAWK); JOHN ABBOTT/INEL/IMMIDEN PICTURES (BALDFACED HORNET); COURTESY DR. JUSTIN SCHMIDT (JUSTIN SCHMIDT); PIOTR NASRZECKI/IMMIDEN PICTURES (VELVET ANT)





Schmidt hunts for bugs and get stung!

## EXPONENTS



2 SKILLS SHEETS

An exponential scale grows by a factor greater than 1. The Sting Pain Index is an exponential scale that grows by a factor of 10. This means that each whole number on the scale is 10 times as painful as the previous whole number. For example, a sting ranked 2 is 10 times as painful as a sting ranked 1. The exponential expression  $\frac{10^x}{10^y}$  can be used to compare the pain of two stings ranked  $x$  and  $y$ .



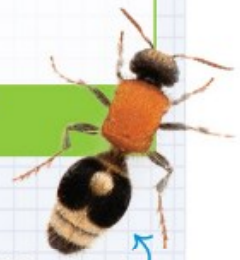
**EXAMPLE:** The sting of a tarantula hawk is ranked 4 on the Sting Pain Index. How much more painful is it than a honeybee's sting, which is ranked a 2?

**Step 1** Write an exponential expression.  $\frac{10^4}{10^2}$

**Step 2** When dividing numbers of the same base with exponents, you subtract the exponents. (When multiplying, you add the exponents.) Rewrite your expression using subtraction.  $10^{4-2} = 10^2$

**Step 3** Evaluate the exponent.  $10^2 = 10 \times 10 = 100$

→ So a tarantula hawk sting is 100 times as painful as a honeybee sting.



YOUR TURN

Use exponential expressions to compare the stings of insects at different levels on the pain scale.

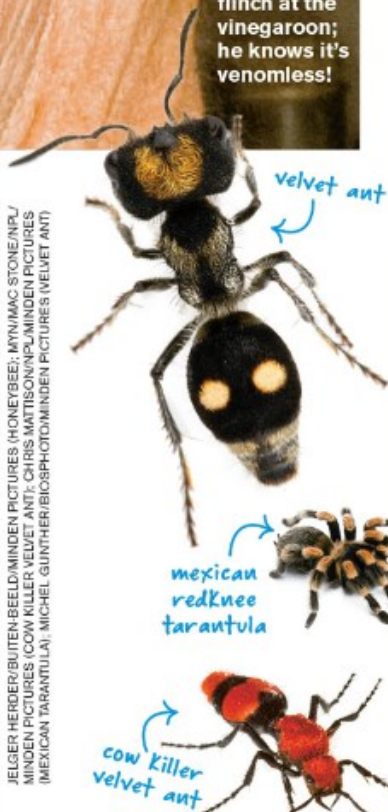
**1** Schmidt says the sting of an iridescent cockroach hunter feels like "a stinging nettle pricked your hand." He ranks it a 1. How much more painful is the sting of a warrior wasp, which Schmidt ranks as a 4 and equates to being "chained in the flow of an active volcano"?

**2** The sting of a baldfaced hornet ranks a 2 on the Sting Pain Index. It feels like "getting your hand smashed in a revolving door." How much more painful is the sting of a red paper wasp, which ranks a 3 and feels like "spilling a beaker of acid on a paper cut"?

**3** The yellow jacket, a common wasp, has a highly toxic sting. It ranks a 2 on the Sting Pain Index. The sting of the largest velvet ant is less toxic, but ranks a 3 in terms of pain. How much less painful is a yellow jacket sting compared with a velvet ant sting? (Hint: When an exponent is negative, as in the expression  $10^{-x}$ , you can rewrite it as  $\frac{1}{10^x}$ .)

**4** No known insect stings hurt more than a 4 on the Sting Pain Index. But if Schmidt were to discover a new insect whose sting is 100,000 times as painful as a honeybee's 2, how would he rank it?

Justin Schmidt doesn't flinch at the vinegaroon; he knows it's venomless!



JELGER HERDER/BUTENBEELD/MINDEN PICTURES (HONEYBEE); MYN/MAC STONE/NPL/MINDEN PICTURES (COW KILLER VELVET ANT); CHRIS MATTISON/NPL/MINDEN PICTURES (MEXICAN TARANTULA); MICHEL GUNTHERR/ICSPHOTO/MINDEN PICTURES (VELVET ANT)

Describe a stinging pattern

Schmidt discovered with the insects: