Ski design inspired by turtle scales

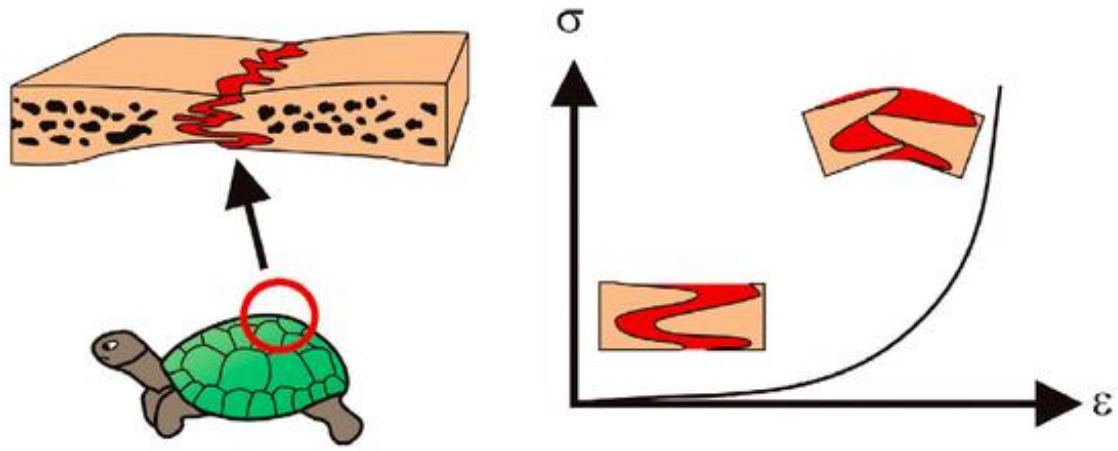
April 4 2016

Credit: Thinkstock

These alpine skis change stiffness in response to the skier's position. EPFL researchers helped develop the new skis thanks to a mechanism that mimics turtle scales.

Looking for skis to maximize the fun as you hurtle down the slopes? The ideal ski can withstand high levels of pressure in turns yet also be easy to maneuver. These two features usually require two different types of skis:

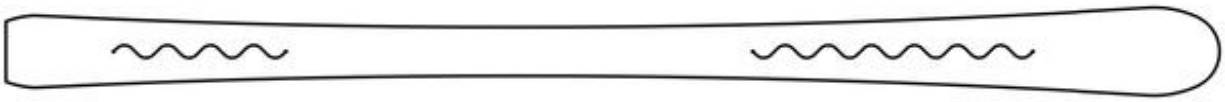
the rigid skis preferred by expert skiers or the flexible ones that intermediate skiers opt for. But a new type of ski offers a two-in-one solution thanks to a design based on turtle scales. These skis are easy to maneuver while entering and exiting turns but stiffen up in the middle of turns to improve the skis' grip on the snow. This 'turtle shell' design is the result of a joint effort of EPFL, the Institute for Snow and Avalanche Research (SLF) in Davos and Stöckli, the Swiss ski manufacturer.



Credit: "Artful interfaces within biological materials"

The idea of mimicking the morphology of turtles occurred to Véronique Michaud, a researcher at EPFL's Laboratory of Polymer and Composite Technology, while she was attending a seminar on bioinspired materials. "The scales of a turtle interlock, like a jigsaw puzzle, and are connected by a polymer," said Michaud. "When turtles breathe, the scales separate slightly and the shell becomes flexible. But when an external shock occurs, the shell tightens and stiffens. It struck me immediately that we could build these features into skis." Michaud's idea took form during a

yearlong Commission for Technology and Innovation (CTI) project in partnership with Stöckli.



The project team ran many studies in their effort to replicate the natural phenomenon in skis. The best results were achieved by embedding aluminum plates with a snake-shaped fissure into the skis at precise locations at both ends. When the skis bend in a turn, the plates on each side of the gap come together and the ski stiffens, allowing the skier to execute stable and precise turns. As the skier comes out of the turn, the gap reopens making the ski flexible again and easy to handle. "The aluminum plates work like the scales," said Michaud, "and a special type of rubber between the plates is like the polymer in the turtle shell."

Michl Leitner, a former professional speed skier, tested the skis for a day together with Tina Maze, the double Olympic ski champion. "We were pleasantly surprised," said Leitner. "It was easier to start the turn. And as the pressure on the skis' edges rose gradually during the turn, the skis really gripped the snow and were very stable. I was impressed by the ease with which the plates come together and separate."

These skis, which went on sale in early March, were designed both for

average skiers, who will find it easier to start their turns, and for experts skiers seeking to get the most out of their skis.

Provided by Ecole Polytechnique Federale de Lausanne