What happened:

Eggs contain something called "calcium carbonate".  This is what makes them hard.

Vinegar is an acid known as acetic acid.

When calcium carbonate (the egg) and acetic acid (the vinegar) combine, a chemical reaction takes place and carbon dioxide (a gas) is released.  This is what the bubbles are made of.

The chemical reaction keeps happening until all the carbon in the egg is used up -- it takes about a day.

When you take the egg out of the vinegar it's soft because all the carbon floated out of the egg in those little bubbles.

NOW TRY THIS:

Leave the same egg sitting out on the table for another day.

Now feel it again.

It's hard!

The calcium left in the eggshell stole the carbon back from the carbon dioxide that's in the air we breathe.

- OR -

If you were using a raw egg, once the shell has softened, you can place the egg in water, and it'll absorb and expand via osmosis until the shell finally bursts. 

What makes our bones hard?  That's right!  Calcium carbonate -- the same thing that made the eggshells hard.

Optional: Try the same experiment with chicken bones.