BBC

Alan Turing: Turing's final challenge

Video transcript: Clip from *The Secret Life of Chaos*.

JIM AL-KHALILI:

Think of the way a steady wind blowing across sand creates all kinds of shapes. The grains self-organise into ripples, waves and dunes. This happens even though the grains are virtually identical and have no knowledge of the shapes they become part of.

Turing argued that, in a very similar way, chemicals seeping across an embryo might cause its cells to self-organise into different organs.

These are Turing's own very rough scribblings of how this might work. They show how a completely featureless chemical soup can evolve these strange blobs and patches. In his paper, he refined his sketches to show how his equations could spontaneously create markings, similar to those on the skins of animals.

PROF. IAN STEWART:

Turing went around showing people pictures saying: "Doesn't this look a bit like the patterns on a cow?" And everyone sort of went: "What is this man on about?" But actually he knew what he was doing because yes, indeed his pictures, they did look like the patterns on a cow. And that's why cows have this sort of dapple pattern or whatever. So an area where mathematics had never been used before – pattern formation in biology, animal markings – suddenly the door was opened and we could see that mathematics might be useful in that sort of area.

So even though Turing's exact equations are not the full story, they are the first piece of mathematical work that showed there was any possibility of doing this kind of thing.