How he got his stripes

Big Data biology unravels living creatures

BY BART BRAUN Looking at things from a mathematical angle is helping biologists to see the wood from the trees, says Professor of Mathematical Biology, Roeland Merks. "What I cannot create, I do not understand."

Maths is crucial to biology. "Traditionally, the emphasis in biology has always been on measurements", remarks Roeland Merks, who recently held his inaugural speech as Professor of Multiscale Mathematical Biology. "Physicists and mathematicians are often very successful in biology because they have a different way of working. They realise that you can sometimes to start with an assumption and take it from there. You may need to re-adjust the assumption, but it could set you well on your way."
Nowadays, biologists are better measuring than ever: they have entire DNA sequences of organisms (genomics), collections of all the substances in a cell (which, depending the substances, are called proteomics, transcriptomics or metabolomics), overviews of all the connections between cells (connectomics) and truck loads of more information: Big Data. They are swimming in -omics – and therefore data – which makes 2015 a great time to be a biologist.
However, the danger of not being able to the wood for trees looms larger than ever.
"With Big Data you can unravel a living creature and study the individual parts. Then you can make connections between its parts to see what happens if you remove one part, for instance. The famous physicist Richard Feynman once said 'what I cannot create, I do not understand' and biology very rarely has that sort of understanding."
"Create" is relative in this context: Feynman never really built a quantum particle and so far biochemists are still trying to build living cells from nothing. But he did have a better mathematical understanding of the quantum world than anyone before him.
Merks adds: "In the same vein: you can learn things about building cars by copying them with Lego Technic that you can't by just driving them."
The classic example in biology is stripes. Every zebra and every tiger has a different pattern, which is quite remarkable. After all, how does a zebra "know" that a certain skin cell in the upper left-hand corner of his right buttock should be white and the one next to it black? Alan Turing, the British

Voorpagina

Van het Leidse front geen nieuws
Actiegroep De Nieuwe Universiteit Leiden hield dinsdagavond haar eerste bijeenkomst. De ...

Achtergrond

De bezeten ontdekkingsreiziger
De Indische ontdekkingsreiziger Gerret Pieter Roffaer was een verwoede verzamelaar die ...

Bommen raken iedereen
Antropoloog Annika Schmeding trok op met de Kuchis, een Afghaanse nomadenstam die daar ...

Wetenschap

Swartsuikerbekkie - XXX & XXY - Heel Grote Telescoop

Mens door vis
Het eten van vis heeft een grote rol gespeeld in de evolutie van de mens. Archeologe ...

Studentenleven

Inburgeren: Bezetterslessen

Kamervragen: 'De vloerbedekking zoog het bier op'

Frutti di Mare: Fietsen met één been

De tiendejaars bestaat niet meer
Minister Bussemaker bezocht vrijdag Augustinus om met studenten te debatteren over de ...

Nieuws

Bursaal bungelt

Nieuwe website gaat drie miljoen kosten

Verplicht eerste tentamen blijft

Minister wijst rendementsdenken af
De Universiteit van Amsterdam ruimt extra geld in voor de bedreigde geesteswetenschappen ...

'Er moet een discussie komen'

mathematician – featured in *The Imitation Game* currently showing in cinemas – suggested a system of two chemicals. Chemical X stimulates the production of more chemical X and the production of chemical Y. Chemical Y suppresses the production of chemical X so if chemical Y spreads more rapidly than chemical X, very soon "islands" of X will appear in a "sea" of Y. Merks continues: "If the pigment in a zebra stripe is produced under the influence of X, this mechanism could explain how the zebra got his stripes."
Further study of stripes – in zebrafish, being a more practical size than zebras – revealed that the pattern is not caused by chemicals but by coloured cells. "They flick each other: the yellow cells keep the black ones out of 'their' territory. Turing's model crops up when you see that behaviour in differential comparisons. So his idea set biologists onto a new way of looking at the system. It's not about whether chemicals or cells produce stripes, it's about the abstract thought that starts you off."
Merks builds models showing how arteries are formed for his own research. "Imagine you are a cell and you secrete a chemical that attracts other cells. If you smell that chemical, you stretch out towards the source. If you touch another cell, you don't react to that chemical any more on the side that's touching. That's enough rules to build a network of arteries." He has had a picture of the network printed in on the lining of his academic gown.
"For the past few years, I've been teaching Multiscale Mathematical Biology in Leiden, which attracts maths students but only one or two brave biology students. It's a pity, because the answers to many biological questions will be hard to find without maths. I hope that one day school kids will decide to read biology because they enjoy the maths."

De Leidse statisticus Richard Gill wil dankzij crowdfunding het verslag van de ...

Leids verkiezingsdebat Provinciale Staten
'Wij betalen wel voor die fontein'
Plaquette onthuld bij Academiegebouw
KNAW-president
Oud-rector wordt baas van Clingendael
Rapper Typhoon komt naar Werfpop
Raad: Te weinig invloed

Rubrieken

Geen Commentaar: Laat je tanden zien

Super mooi, super vo!

527....: Boeddhisme light
Hebben de boeddha's in het tuincentrum nog iets te maken met religie? ...

Opinie: Liever je mond houden
Engelstalig onderwijs is niet alleen slecht voor de actieve deelname van Nederlandse ...

English page

Dutch students stage a protest
The students occupying Het Maagdenhuis hope that their rebellion will go national and ...

How he got his stripes
Looking at things from a mathematical angle is helping biologists to see the wood from ...