

Gaps in existing knowledge

How bees respond to environmental changes

prof. dr. Dirk de Graaf

EU Parliament, June 14 2016



multiple (environmental) stressors



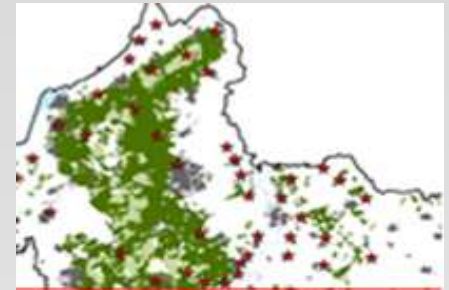
food shortage



pesticides



nest location



habitat fragmentation



diseases



management



climate



genetic diversity

monitoring (environmental) stressors



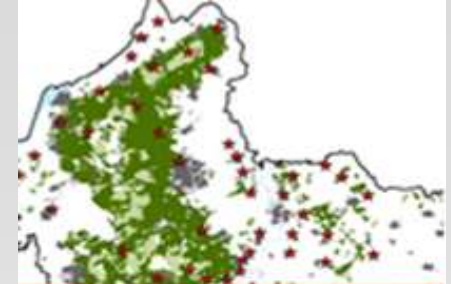
microscopy 1



chromatography



nest location



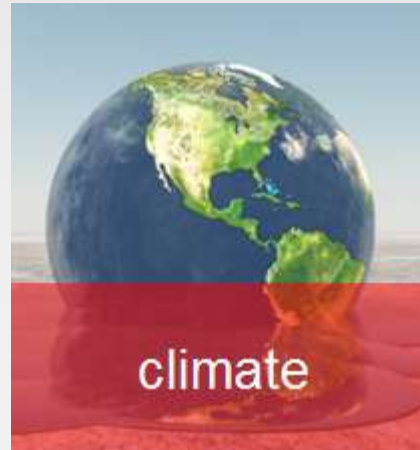
habitat fragmentation



molecular test 1



questionnaire



climate



molecular test 2

can we simplify the monitoring?



one test?



body temperature (fever)

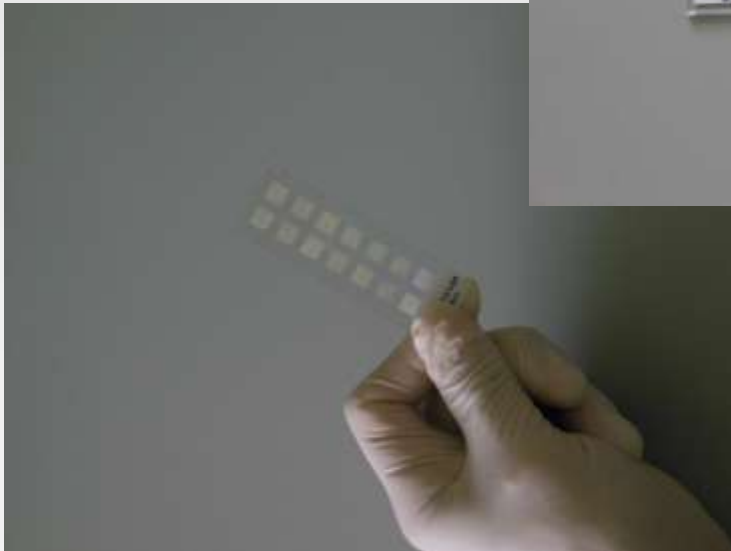
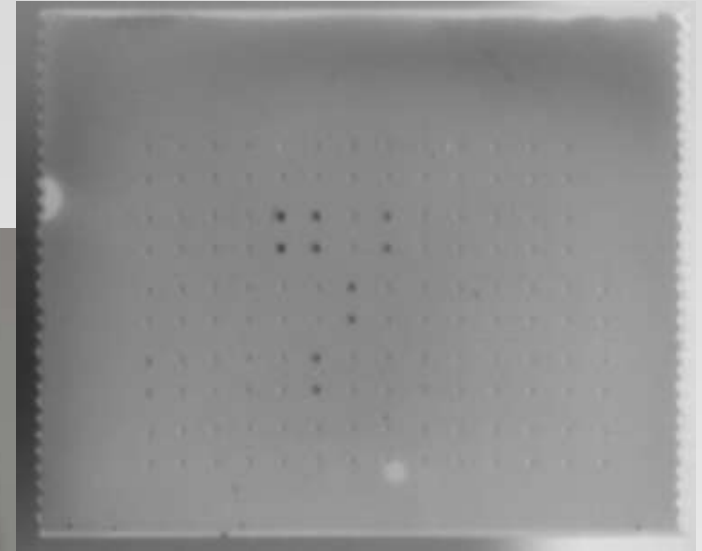


blood analysis

first attempts: BeeClinic



EU 7th FW programme project: BeeDoc
DNA chip technology
> changing response of a stress marker



pathological stress > immune genes
pesticide stress > detoxifying genes
nutritional stress > set of genes
+ broad set of pathogens

what about new stressors?



important limitation: you only find what you are seeking for



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Journal of Invertebrate Pathology 92 (2006) 93–95

Journal of
INVERTEBRATE
PATHOLOGY

www.elsevier.com/locate/yjipa

Short communication

Nosema ceranae, a new microsporidian parasite in honeybees in Europe

OPEN ACCESS Freely available online

PLOS ONE

Comprehensive Bee Pathogen Screening in Belgium Reveals *Crithidia mellifica* as a New Contributory Factor to Winter Mortality

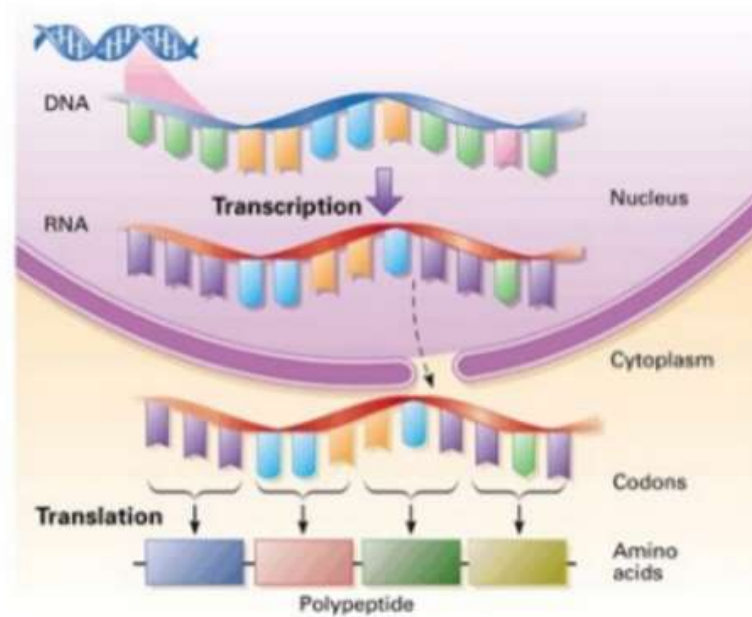
Jorgen Ravoet^{1*}, Jafar Maharramov², Ivan Meeus², Lina De Smet¹, Tom Wenseleers³, Guy Smagghe², Dirk C. de Graaf¹

¹ Laboratory of Zoophysiology, Faculty of Sciences, Ghent University, Ghent, Belgium, ² Department of Crop Protection, Faculty of Bioscience Engineering, Ghent University, Ghent, Belgium, ³ Laboratory of Socioecology and Social Evolution, K.U.Leuven, Leuven, Belgium

can we monitor in an unbiased way?



The Central Dogma of

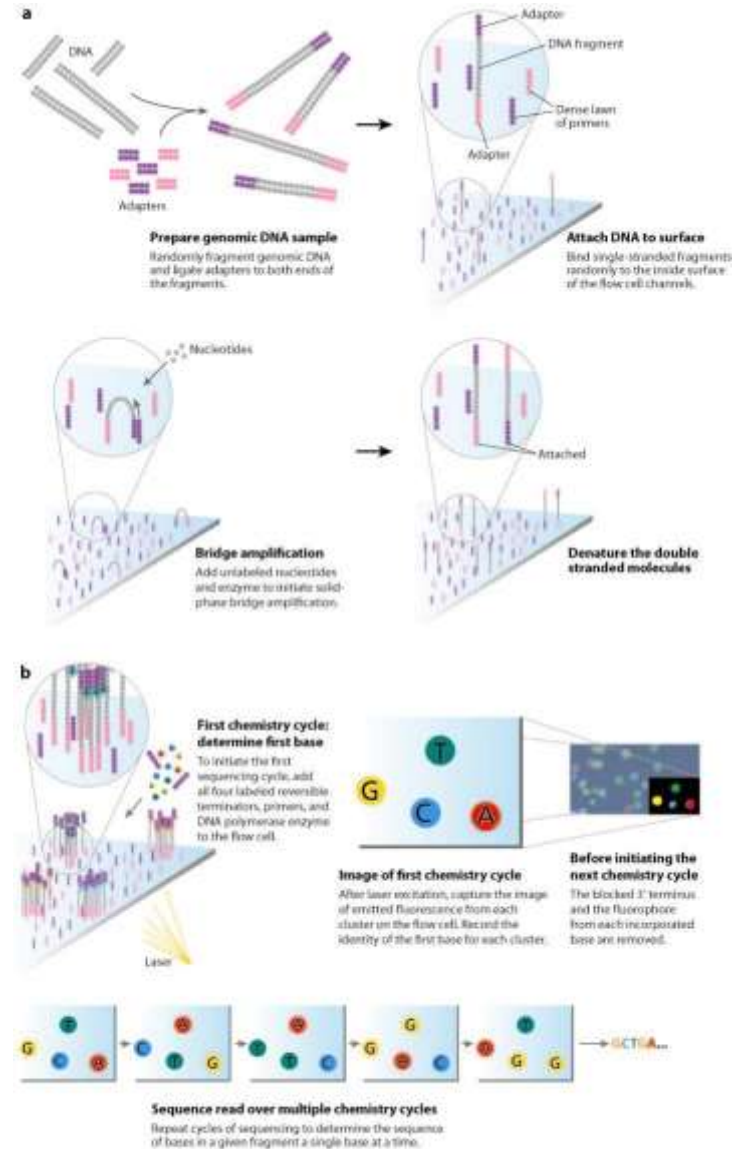
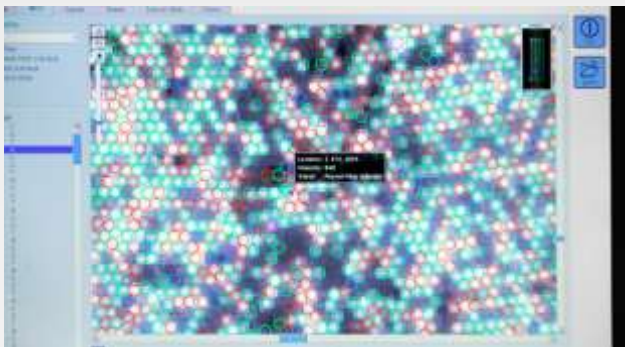
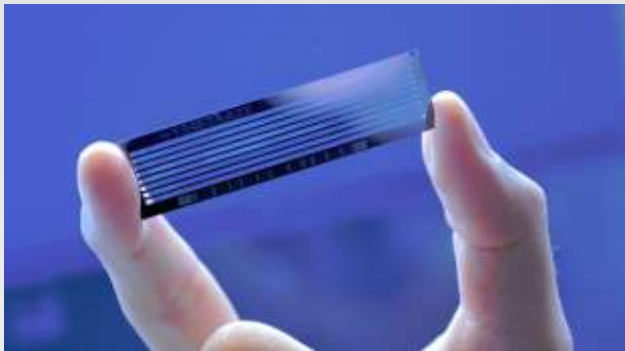


Molecular Biology

can we monitor in an unbiased way?



Next Generation Sequencing:
= high-throughput sequencing
< parallelizing the sequencing
process
vb. Illumina Genome Analyzer

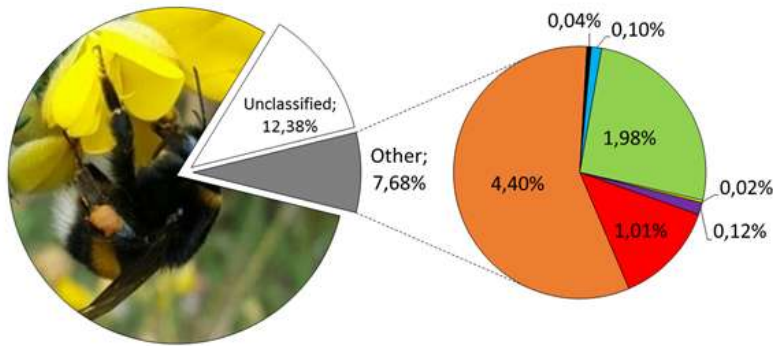


the BELBEES project

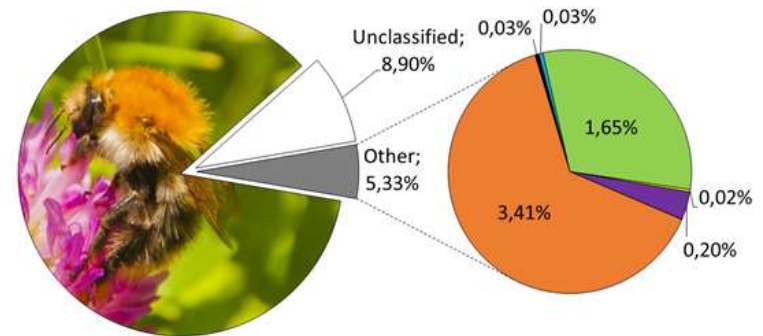


BELgian Science POlicy project: aimed to find new pathogens
 > revealed also expressed immune/detoxifying genes + visited flowers

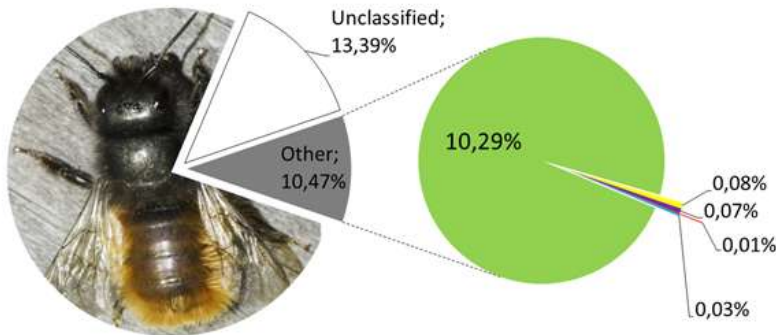
Bombus terrestris; 79,94%



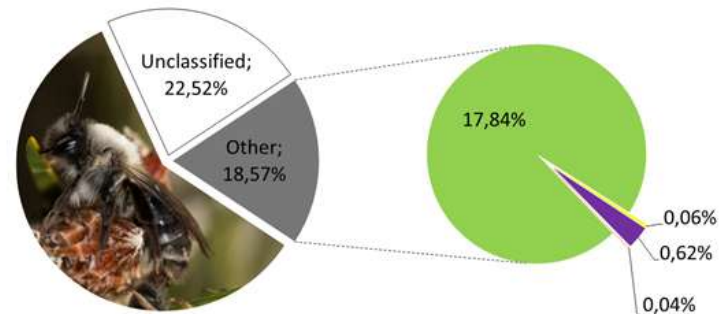
Bombus pascuorum; 85,77%



Osmia cornuta; 76,13%



Andrena vaga; 58,91%



Host
 Unclassified
 Bacteria
 Protozoa
 Nematoda
 Fungi
 Acari
 Plants
 Viruses

gaps in existing knowledge



good reference genomes > genome sequencing of 500 bee species

cfr. the i5K project at Baylor College of Medicine, USA

Baylor College of Medicine **HGSC**
HUMAN GENOME SEQUENCING CENTER

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i5K Pilot Project Summary

About the Project

The BCM-HGSC is sequencing 28 arthropod genomes as a pilot project to kickstart the i5K.

- Arthropod main page with list of all organisms

Collaboration Status Pages

- Comparative analysis of wasp genomes sheds light on the evolution of Hymenoptera and parasitoidism
- House spider, annotation, publication plan, and latest news
- Medfly genome annotation groups

The i5K is a initiative to sequence the genomes of 5,000 arthropod species. This pilot project builds on our extensive experience sequencing many arthropods over the years, including *D. melanogaster*, *D. pseudoobscura*, the honeybee, the red flour beetle, the pea aphid, the hessian fly, the centipede, and many others.

The i5K was first announced in March 2011 in a letter to Science Magazine and other press releases - for example, from the Entomological Society of America, to provide a base reference for understanding the molecular nature of

SEARCH

CONTACT

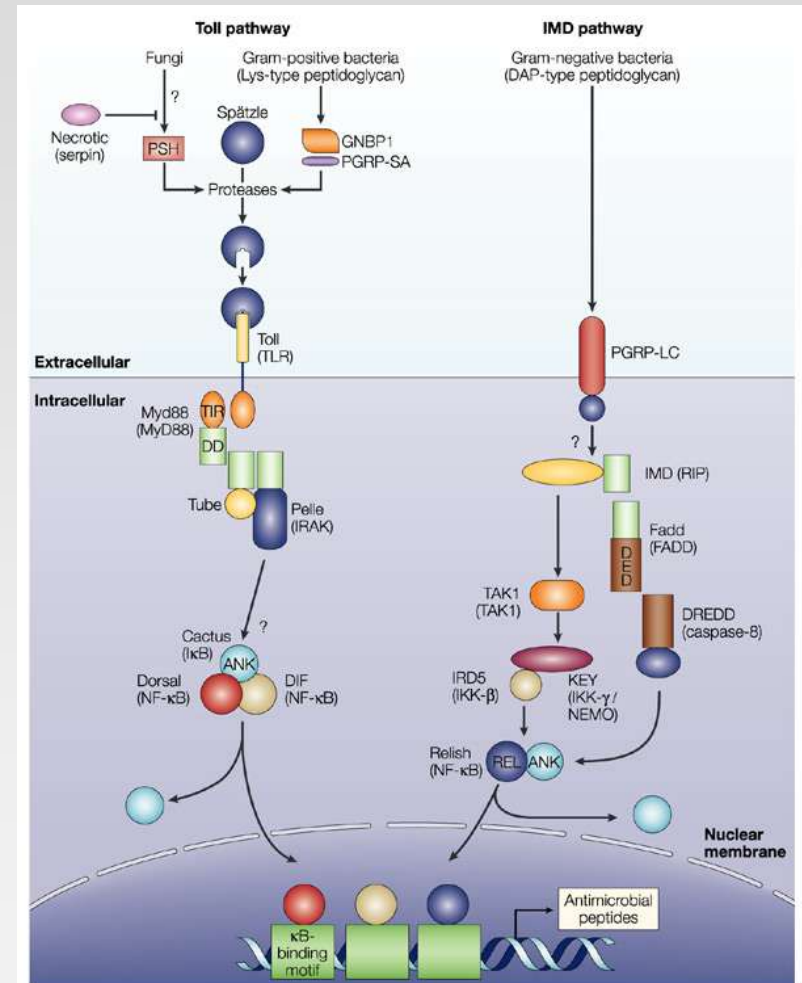
Stephen Richards, Ph.D.

gaps in existing knowledge



understanding molecular pathways and how they are affected by (combination of) stressors

cfr. Toll and Imd immune pathway



gaps in existing knowledge



developing pipelines for data processing



a single bee can tell the whole story...



*I was intoxicated by pesticides,
I had food shortage and suffer now
from an infection by a new virus!*



thank you

