Division Reports and Scientific Highlights

Bacteria: Marianne Carey
Diseases of Beneficial Invertebrates: Mark Freeman
Fungi: Stefan Jaronski
Microbial Control: Dietrich Stephan
Microsporidia: George Kyei-Poku **(CAN)**
Nematode: Raquel Campos-Herrera (ES)
Virus: Elisabeth Herniou

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Bacteria Division 2019

Membership: 70 regular and 13 student members
SIP 2019:
24 contributed oral presentations (11 student)
35 poster presentations (10 student)
1 symposium, 1 cross-divisional symposium, 1 workshop

Plans for SIP 2020
Symposia:
1. Fall armyworm resistance to *Bacillus thuringiensis*
   Organizers: William Moar and Juan Luis Jurat-Fuentes
2. Vector control with entomopathogens. Organizers: Jorge Ibarra, Mario Soberon and Alejandra Bravo. Cross-divisional, one presentation from each division

Workshop: How should we evaluate new insecticidal proteins for safety?
Organizers: Mark Nelson and William Moar

New officers
1. President: Omaththage P. Perera, USA
2. President elect: Colin Berry, UK
3. Secretary/Treasurer: Neil Crickmore, UK
4. Member at large: Luca Ruiu, Italy

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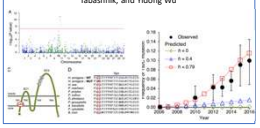
Bacteria Division highlights

Structure-function studies, resistance

1

PNAS 115 (46) 11760-11765
Dominant point mutation in a tetraspanin gene associated with field-evolved resistance of cotton bollworm to transgenic Bt cotton

Lin Jin, Jing Wang, Fang Guan, Jianpeng Zhang, Shan Yu, Shaoyan Liu, Yuanyuan Xue, Lingli Li, Shuwen Wu, Xingliang Wang, Yihua Yang, Heba Abdelgaffar, Juan Luis Jurat-Fuentes, Bruce E. Tabashnik, and Yidong Wu

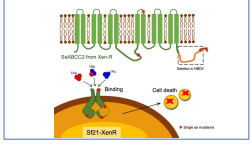


The group discovered that a point mutation in a tetraspanin gene confers dominant resistance to Cry1Ac in the cotton bollworm. This mutation increased 100-fold in frequency from 2006 to 2016 in areas of China, growing Bt cotton producing Cry1Ac.

2

Toxins, 2019, *11*(3), 172
The Spodoptera exigua ABCC2 acts as a Cry1A receptor independently of its nucleotide binding domain II

Pinos Daniel, María Martínez-Solís, Salvador Herrero, Juan Ferré and Patricia Hernández-Martínez,



This study points out that a functional analysis is required to assess the effect of the mutations in receptors on Bt resistance

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Bacteria Division Highlights

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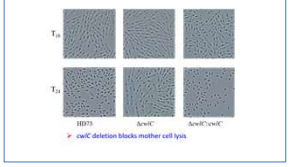
Appl. Environ. Microbiol., 2018 April. 84(7):e02640-17
Novel cell wall hydrolase CwlC from *Bacillus thuringiensis* is essential for mother cell lysis

Xiaomin Chen, Tantan Gao, Qi Peng, Jie Zhang, Yunrong Chai, Fuping Song



Our data suggest that CwlC is an essential cell wall hydrolase in *B. thuringiensis*. It's gene deletion blocks the release of spores and crystals from mother cell without affecting bioactivity, and may provide a new effective strategy for crystal encapsulation against UV light inactivation.

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Diseases of Beneficial Invertebrates 2019

Membership: 34 regular and 18 student members (total 52)
SIP 2019: 19 contributed oral presentations (5 student)
2 poster presentations
1 symposium, 1 cross-divisional symposium (with Microsporidia)

Awards: Mauro Martignoni : Gabriela Maciel-Vergara
Travel Award : Wafa Al Arimi
Travel Award : Rebecca Millard

Plans for SIP 2020:
DBI Symposium: Kelly Bateman (Cefas) and January Cano (Mahidol University)
Shrimp and other crustacean diseases

DBI-Viruses Cross Divisional:
Bryony C. Bonning (University of Florida)
Viruses and diseases of pollinators

New officers:
Member at Large: Annette Bruun Jensen, UCPH Copenhagen

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Diseases of Beneficial Invertebrates 2019

SCIENTIFIC REPORTS

OPEN

The first clawed lobster virus *Homarus gammarus* nudivirus (HgNV n. sp.) expands the diversity of the *Nudiviridae*

First virus described in clawed lobsters and the second confirmed aquatic nudivirus.

Multiple phylogenetic analyses confirm the new virus to be a novel member of the Nudiviridae: *Homarus gammarus* nudivirus (HgNV).

Fully annotated genome of HgNV, comprising a single contiguous sequence, together with diagnostic primers and reference histology and ultrastructure.

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Diseases of Beneficial Invertebrates 2019

INSECT DOCTORS – a Marie-Curie European Joint Doctoral Programme

'Educating tomorrow's insect pathologists to solve problems caused by diseases in the insect-rearing industry'

15 Ph.D. students to be recruited
- Pathogen-host interactions
- Covert infections & pathogen detection
- Increasing insect resistance against pathogens

Recruitment End Nov 19
Students start 01 May 2020

INSECT DOCTORS

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Fungus Division

Membership: 64 regular and 14 student members,
SIP 2019: 37 contributed oral presentations (8 student)
34 poster presentations (6 student)
1 symposium, organized by Jaronski and Kim
1 cross divisional symposium, with Microbial Control Division, organized by Stephan and Jaronski

Plans for SIP 2020
Potential symposia proposed:
1. Development of fungi against Asian Citrus psyllid (P. Avery and S. Jaronski)
2. Helping fungi to achieve greater efficacy from the simple to "rocket science" (Butt and Jaronski)

> refined proposals to be decided by electronic vote of Division members

New officers
1. Member-at-large: Senthil Kumar (India)

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Fungus Division Highlight for SIP2019

… A better conception about the evolution of entomopathogenicity

Horizontal gene transfer allowed the emergence of broad host range entomopathogens

Qiangqiang Zhang[a,1], Xiaoxuan Chen[a,1], Chuan Xu[a], Hong Zhao[a], Xing Zhang[a], Guohong Zeng[a], Ying Qian[a], Ran Liu[a], Na Guo[a], Wubin Mi[a], Yamin Meng[a], Raymond J. St. Leger[b], and Weiguo Fang[a,2]

[a]MOE Key Laboratory of Biosystems Homeostasis & Protection, College of Life Science, Zhejiang University, Hangzhou 310058, China; and [b]Department of Entomology, University of Maryland, College Park, MD 20742

Proc. National Academy Sciences, April 16, 2019, vol. 116, no. 16, 7982-7989.

Horizontal Gene Transmission was a key mechanism in the emergence of entomopathogenicity in *Metarhizium* from a plant-associated ancestor and in subsequent host-range expansion by some *Metarhizium* lineages.

"The broad host-range entomopathogen *M. robertsii* has 18 genes that are derived via horizontal gene transfer (HGT)" -- "indispensable for infection by processes including degradation of procuticular proteins and utilization of epicuticular lipids."

"The necessity of degrading insect cuticle served as a major selective pressure to retain these genes, as 12 are up-regulated during penetration; 6 were confirmed to have a role in penetration, and their collective actions are indispensable for infection."

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Microbial Control Division 2019

Membership: 102 regular and 8 student members,

SIP 2019: 46 contributed oral presentations (student)
37 poster presentations (10 student)
1 symposium, 1 cross-divisional symposium

Plans for Symposia SIP 2020 *(Merida, Mexico)*
- Microbial Control Options:
  - *Roma Gwynn:* Microbial control of key pests of tropical crops ; The unusual (MC) suspects (that work)
  - *Chad Keyser:* MC in the developing world
- *Cross Division Options*:
  - *Regional lead TBD:* Microbial control of key pests of tropical areas: focus on grower's perspectives
  - *Stefan Jaronski:* Microbial control of citrus psyllid (counterproposal of fall armyworm)

Election of MCD Officers
•Chair-Elect: Chad Keyser (USA) 2020-2021
•Member at large: Edith Ladurner (Italy) 2020-2022
•Student representative: Swati Mishra (USA) 2020-2022

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Microsporidia Division Year 2019 Report and Research Highlights

Membership: 31 regular and 4 student members,
SIP 2019: 7 contributed oral presentations
8 poster presentations

Cross-Divisional symposium with DBI
Microsporidia and microsporidia-like cryptomycota infecting micro-eukaryotes and metazoan parasites: 5 papers

Plans for SIP 2020 Merida, Mexico
TBD
Cross-divisional: TBD

New officers
TBD

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nature microbiology
LETTERS
https://doi.org/10.1038/s41564-019-0514-6

Evolutionary compaction and adaptation visualized by the structure of the dormant microsporidian ribosome

Jonas Barandun[1,3]*, Mirjam Hunziker[1], Charles R. Vossbrinck[2] and Sebastian Klinge[1]

The reduction of the microsporidian genome has affected the RNA and protein components of the ribosome differently.

The work presents structure of the ribosome from the microsporidium *Vairimorpha necatrix* using cryo-electron microscopy, illustrates how genome compaction has resulted in the ribosome and provides a mechanism for ribosome inhibition.

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Eukaryotic Microbiology

Takvorian et al.---*Anncaliia algerae* Polar Tube Structure

An Ultrastructural Study of the Extruded Polar Tube of *Anncaliia algerae* (Microsporidia)

Takvorian, P.M.[1,2,#,*], Han, B.[2,*], Cali, A[1*], Rice, W.J.[3], Gunther, L.[4], Macaluso, F.[4], Weiss, L.M.[2,5]

All Microsporidia share a unique, extracellular spore stage, containing the infective sporoplasm and the apparatus for initiating infection. The polar filament/polar tube when exiting the spore, transports the sporoplasm through it into a host cell. While universal, these structures and processes have been enigmatic. This study utilized several types of microscopy, describing and extending our understanding of these structures and their functions.

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nature microbiology

Article | Published: 28 January 2019

Phosphatidic acid as a limiting host metabolite for the proliferation of the microsporidium *Tubulinosema ratisbonensis* in *Drosophila* flies

Adrien Franchet, Sebastian Niehus, Gaëtan Caravello & Dominique Ferrandon

Nature Microbiology **4**, 645–655 (2019) | Download Citation

The authors found that supplementing the fly diet with yeast does not benefit the host but increases proliferation of *T. ratisbonensis*. Fatty acids and not carbohydrates or amino acids are the critical components responsible for this phenomenon. They identified phosphatidic acid was hijacked by *T. ratisbonensis* and propose that phosphatidic acid is a limiting precursor for the synthesis of the parasite membranes and, hence, of its proliferation

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Nematode Division 2019

Membership: 38 regular and 7 student members,

SIP 2019:

31 contributed oral presentations (6 students)
16 IOBC-Nem oral presentation (6 students) + 4 workshop
20 poster presentations (5 students)
1 poster IOBC-Nem presentation (1 student)

1 Nematode symposium
1 Nematode-IOBC join symposium
1 Nematode-IOBC join workshop
1 Plenary talk presentation

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Nematode Division

Plans for SIP 2020 *(Merida, Mexico)*
Symposia Nematode Division:

1. Entomopathogenic nematodes or scavengers: revisiting the emerging new nematodes classified as EPN. Organized by Adler Dillman and Raquel Campos-Herrera. Potential speakers: Torrini, Navarro, Ye, Dillman, Campos-Herrera

2. Behavioural response of EPN: revisiting the ambusher-cruiser foraging preference. Organized by Patricia Stock. Potential speakers: Wilson, Lewis, Shapiro-Ilan, Campbell, Griffin

Cross-divisional (to be determined)

1. "Omics" tools for the study of invertebrate pathology (Carlos Molina)

Workshop: Handling your nematodes: Long-term preservation of EPN (liquid N) and other day-by-day techniques (David Shapiro-Ilan and Patricia Stock)

New officers

Member at large: Adler Dillam (USA)
Student representative: Diana la Forgia (Belgium)

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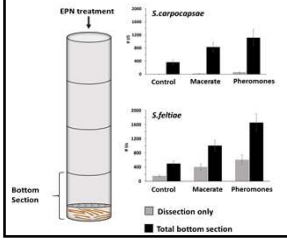
Pheromone extracts act as boosters for entomopathogenic nematodes efficacy

Oliveira-Hofman, Camila, Fatma Kaplan, Glen Stevens, Edwin Lewis, Shaohui Wu, Hans T. Alborn, Abigail Perret-Gentil, and David I. Shapiro-Ilan. *Journal of Invertebrate Pathology* 164 (2019): 38-42.

Highlights

- Pheromone treated EPNs exhibited enhanced dispersal in soil columns;
- Pecan weevils and black soldier flies had lowest survival with pheromone treated EPNs;
- Pheromones increase EPN dispersal and host mortality.

Laboratory Findings



Greenhouse Findings

Pecan Weevil *Curculio caryae*	*S. carpocapsae*	*S. feltiae*
	47% Pheromone treated IJs 27% Control IJs	84% Pheromone treated IJs 43% Control IJs
Black soldier Fly *Hermetia illucens*	79.5% Pheromone treated IJs 50% Control IJs	91% Pheromone treated IJs Larvae mortality 62% Control IJs

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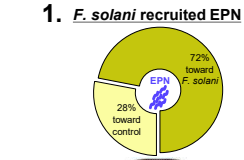
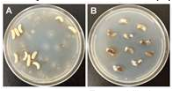
1. *F. solani* recruited EPN

Entomopathogenic nematode (EPN) ***Steinernema diaprepesi***

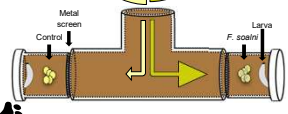


2. Benefit from *F. soalni*
Increased EPN efficacy against weevils in both microcosm and two-choice bioassay.

F. solani is nonpathogenic to weevil larvae (A), but feeds readily on weevil cadavers (B).



Live insects with fungi — Freeze killed insects with fungi



3. Benefit from EPN
Increased *F. solani* population density by killing insect.

Saprophytic fungus ***Fusarium solani***

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Virus Division

Membership: 68 regular and 23 student members (Total 91)

SIP 2019: 47 contributed oral presentations (15 students)
32 poster presentations (11 students)
Virus symposium: Covert virus infections in insects (Vera Ros, Miguel Lopez Ferber & Just Vlak)
Cross Divisional: Host-Pathogen Interaction: The Endless Race (Umut Toprak & Salvador Herrero)
Workshop:
Cancelled The forthcoming change in virus species naming to a binomial system (Bob Harrison)
Replaced by: Science Communication (Lorena Passarelli)

Plans for SIP 2020
Virus symposium: *open for discussion*
Cross-divisional symposium with DBI division: Viruses and diseases of pollinators, Bryony Bonning
Workshop: The forthcoming change in virus species naming to a binomial system, Bob Harrison

New officers
Member-at-Large: Manli Wang
Student representative: Shili Yang

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Virus Division Highlight -1

nature microbiology

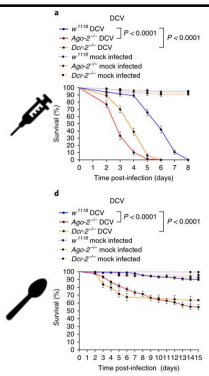
Article | Published: 29 October 2018

Immune priming and clearance of orally acquired RNA viruses in *Drosophila*

Juan A. Mondotte, Valérie Gausson, Lionel Frangeul, Hervé Blanc, Louis Lambrechts & Maria-Carla Saleh

Nature Microbiology **3**, 1394–1403 (2018) | Download Citation

- In contrast with what is observed following virus injection, oral infections initiated at larval or adult stages are cleared in adult flies.
- RNAi mutant flies also eliminated the virus, implying that RNAi is not essential for viral clearance and that other immune mechanisms act during oral infections.



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Virus Division Highlight -2

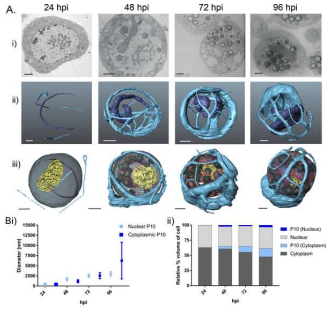
PLOS PATHOGENS

RESEARCH ARTICLE

In cultured cells the baculovirus P10 protein forms two independent intracellular structures that play separate roles in occlusion body maturation and their release by nuclear disintegration

Leo P. Graves, Louise C. Hughes, Sarah L. Irons, Robert D. Possee, Linda A. King

High-resolution 3D electron microscopy revealed P10 protein formed a peri-nuclear cage-like structure matured into a polarised mass of P10 essential for the maturation of baculovirus occlusion bodies.



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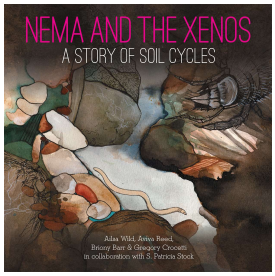
A Children's Book about the Story of an Entomopathogen

A Story of Soil Cycles
Small Friends Books
by
Ailsa Wild, Aviva Reed, Briony Barr, Gregory Crocetti and S. Patricia Stock

Hardback - August 2019 - AU $24.99
http://www.publish.csiro.au/book/7908/

When a tree cries out in pain, some unexpected heroes come to the rescue. Nema and her gang of young nematodes (tiny worms) embark on a dangerous journey underground. The Xenos, a group of wise but deadly bacteria, hitch a ride. The story of how they help the tree is full of action, life-or-death challenges and microscopic warfare. It is a story of co-operation and ancient partnership, about events happening all over the Earth, in the hidden worlds beneath our feet.



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