FACULTY OF BIOSCIENCE & BIOINDUSTRY
TOKUSHIMA UNIVERSITY

昆虫から学ぶ発生と再生の分子機構

[キーワード：形態形成，脱分化，幼若ホルモン，脱皮・変態]

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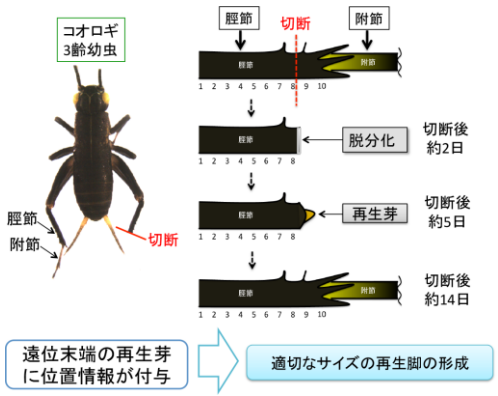
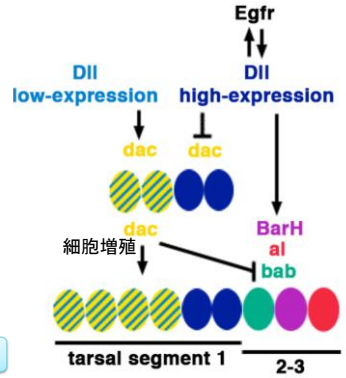
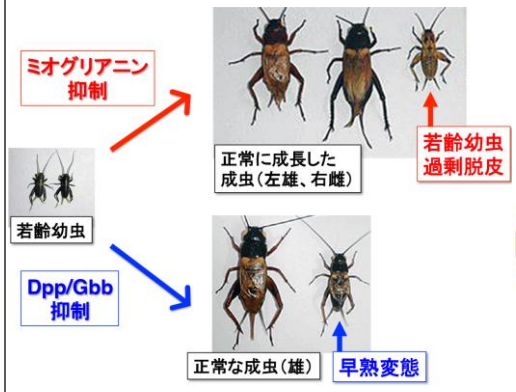
図表

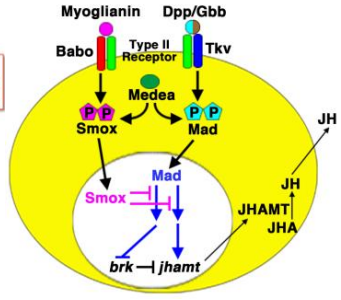
コオロギの脚再生様式と附節の再パターン形成機構





幼若ホルモン生合成のスイッチ機構





アラタ体細胞

内容：

＜再生研究＞

脚再生能力を持つ動物では、脚再生初期に未分化細胞で構成される再生芽が形成される。しかし、未分化細胞の由来が脱分化によるのか、既存の幹細胞なのか未だ明確ではなく、その分子メカニズムもほとんど解明されていない。そこで、再生モデル昆虫コオロギを用いて、RNAi法やCRISPR/Casゲノム編集法を駆使し、未分化細胞の由来とその分化誘導メカニズムの解明に取り組んでいる。脱分化機構の解明は、再生医療の実用化に向けたヒトの基礎研究にも応用分野にも発展を促すことが期待される。

＜発生・成長制御研究＞

昆虫は幼虫から成虫になる過程において、蛹を経て変態する完全変態類と蛹を経ない不完全変態類があり、いずれも幼虫から成虫へは脱皮を繰り返すことで成長する。幼若ホルモン(JH)は、昆虫の変態抑制、体サイズ決定、性成熟、寿命などあらゆる過程で多彩な生理現象の制御に関わる重要なホルモンで、幼若ホルモンが制御する変態の分子メカニズム解明にも取り組んでいる。

分野：発生生物学

専門：発生・再生生物学

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Molecular mechanisms underlying development and regeneration in insects

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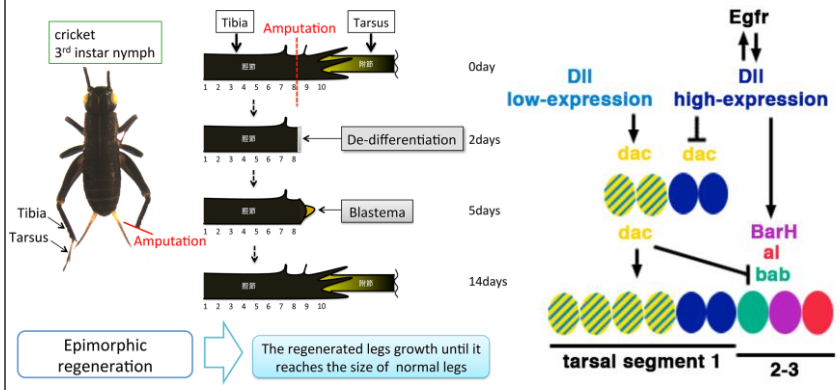
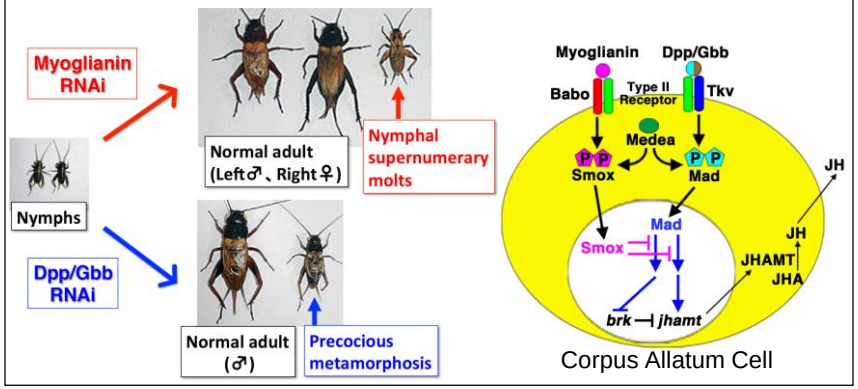
<図表>

Cricket leg regeneration and a schematic model for transcriptional regulation of tarsal re-patterning genes to form the tarsal segments



Switching mechanisms involved in Juvenile hormone biosynthesis



Content:

<Regeneration>

The principal differences between leg development and leg regeneration are in their initiation. In the amputated leg, the starting point of regeneration consists of multiple differentiated tissues and various cells. Thus, leg regeneration relies on cell de-differentiation in invertebrates as well as in vertebrates. Following leg amputation, a blastema consisting of the de-differentiated cells is formed at the amputated surface. However, the molecular mechanisms of de-differentiation and blastema formation remain to be identified, and how regenerating cells have positional identity in the leg remains unknown. We use the cricket *Gryllus bimaculatus* to elucidate the molecular mechanisms underlying development and regeneration of the leg, and we perform loss-of-function analyses using RNAi and CRISPR/Cas system.

<Development and growth regulation>

Insects undergo a morphological transformation from nymph/larvae to adult with or without pupal formation, and these processes are referred to as hemi- and holo-metamorphosis, respectively. Despite these differences, both processes are regulated by common mechanisms that involve 20-hydroxyecdysone (20E) and juvenile hormone (JH). JH regulates many aspects of insect physiology, such as development, reproduction, diapauses, and metamorphosis. Consequently, strict regulation of JH levels is crucial throughout an insect's life cycle. However, it remains unclear how JH synthesis is regulated. We also elucidate the regulatory mechanisms that provide endocrine control of insect life cycles

Keywords: morphogenesis, de-differentiation, juvenile hormone, metamorphosis

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