

# Nano-CT characterization reveals coordinated growth of a rudimentary organ necessary for soldier development in the ant *Pheidole hyatti*

---

## What is the Manuscript Microscope Sentence Audit?

The Manuscript Microscope Sentence Audit is a research paper introspection system that parses the text of your manuscript into minimal sentence components for faster, more accurate, enhanced proofreading.

## Why use a Sentence Audit to proofread your manuscript?

- **Accelerated Proofreading:** Examine long technical texts in a fraction of the usual time.
- **Superior Proofreading:** Detect subtle errors that are invisible to traditional methods.
- **Focused Proofreading:** Inspect each individual sentence component in isolation.
- **Reliable Proofreading:** Ensure every single word of your manuscript is correct.
- **Easier Proofreading:** Take the hardship out of crafting academic papers.

Bonus 1: **Improved Productivity:** Rapidly refine rough drafts to polished papers.

Bonus 2: **Improved Authorship:** Cultivate a clear, concise, consistent, writing style.

Bonus 3: **Improved Reputation:** Become known for rigorously precise publications.

**Manuscript Source:** <https://www.biorxiv.org/content/10.1101/2021.03.05.434146v1>

**Manuscript Authors:** Sophie Koch, Rui Tahara, Angelly Vasquez-Correa & Ehab Abouheif

### Features of the Sentence Audit:

The Sentence Audit combines two complementary proofreading approaches:

1. Each sentence of your text is parsed and displayed in isolation for focused inspection.
2. Each individual sentence is further parsed into Minimal Sentence Components for a deeper review of the clarity, composition and consistency of the language you used.

The Minimal Sentence Components shown are the smallest coherent elements of each sentence of your text as derived from it's conjunctions, prepositions and selected punctuation symbols (i.e. commas, semicolons, round and square brackets).

The combined approaches ensure easier, faster, more effective proofreading.

### Comments and Caveats:

- The sentence parsing is achieved using a prototype natural language processing pipeline written in Python and may include occasional errors in sentence segmentation.
- Depending on the source of the input text, the Sentence Audit may contain occasional html artefacts that are parsed as sentences (E.g. "Download figure. Open in new tab").
- Always consult the original research paper as the true reference source for the text.

### Contact Information:

To get a Manuscript Microscope Sentence Audit of any other research paper, simply forward any copy of the text to [John.James@OxfordResearchServices.com](mailto:John.James@OxfordResearchServices.com).

All queries, feedback or suggestions are also very welcome.

### Research Paper Sections:

The sections of the research paper input text parsed in this audit.

[illegible]

**Title**      **Nano-CT characterization reveals coordinated growth of a rudimentary organ necessary for soldier development in the ant *Pheidole hyatti***

### **S1 [001]      Abstract**

**S1 [002]**      The growth of imaginal discs in holometabolous insects is coordinated with larval growth to ensure the symmetrical and proportional development of the adult appendages.

The growth ...  
... of imaginal discs ...  
... in holometabolous insects is coordinated ...  
... with larval growth ...  
... to ensure the symmetrical ...  
... and proportional development ...  
... of the adult appendages.

**S1 [003]**      In ants, the differential growth of these discs generates distinct castes – the winged male and queen castes and the wingless worker caste.

In ants, ...  
... the differential growth ...  
... of these discs generates distinct castes – the winged male ...  
... and queen castes ...  
... and the wingless worker caste.

**S1 [004]**      In the hyperdiverse ant genus *Pheidole*, the worker caste is composed of two morphologically distinct subcastes: small minor workers and larger, big-headed soldiers.

In the hyperdiverse ant genus *Pheidole*, ...  
... the worker caste is composed ...  
... of two morphologically distinct subcastes: ...  
... small minor workers ...  
... and larger, ...  
... big-headed soldiers.

**S1 [005]**      Although these worker subcastes are completely wingless, soldier larvae develop rudimentary forewing discs that are necessary for generating the disproportionate head-to-body scaling of the big-headed soldier subcaste.

Although these worker subcastes are completely wingless, ...  
... soldier larvae develop rudimentary forewing discs ...  
... that are necessary ...  
... for generating the disproportionate head-to-body scaling ...  
... of the big-headed soldier subcaste.

**S1 [006]** However, it remains unclear whether rudimentary forewing discs in soldier larvae are coordinated with other imaginal discs, and whether disc growth and coordination patterns vary between the minor worker and soldier subcastes.

However, ...  
... it remains unclear ...  
... whether rudimentary forewing discs ...  
... in soldier larvae are coordinated ...  
... with other imaginal discs, ...  
... and ...  
... whether disc growth ...  
... and coordination patterns vary ...  
... between the minor worker ...  
... and soldier subcastes.

**S1 [007]** Here we show, using quantitative nano-CT three-dimensional analyses, that growth of the soldier rudimentary forewing discs is coordinated with the increase in volume of the leg and eye-antennal (head) discs as well as with larval size.

Here we show, ...  
... using quantitative nano-CT three-dimensional analyses, ...  
... that growth ...  
... of the soldier rudimentary forewing discs is coordinated ...  
... with the increase ...  
... in volume ...  
... of the leg ...  
... and eye-antennal ...  
... (head) ...  
... discs ...  
... as well ...  
... as with larval size.

**S1 [008]** We found that the growth rate of the rudimentary forewing discs differs from the leg discs but is similar to the growth of the head (eye-antennal) discs relative to larval size, suggesting that growth of each type of imaginal disc may be differentially regulated.

We found ...  
... that the growth rate ...  
... of the rudimentary forewing discs differs ...  
... from the leg discs ...  
... but is similar to the growth ...  
... of the head ...  
... (eye-antennal) ...  
... discs relative ...  
... to larval size, ...  
... suggesting ...  
... that growth ...  
... of each type ...  
... of imaginal disc may be differentially regulated.

**S1 [009]** In addition to their larger size, the soldier eye-antennal discs increase in width as they undergo morphogenesis to generate the characteristic shape of the large soldier head, suggesting that the rudimentary forewing discs may regulate their patterning in addition to their growth.

In addition ...  
... to their larger size, ...  
... the soldier eye-antennal discs increase ...  
... in width ...  
... as they undergo morphogenesis ...  
... to generate the characteristic shape ...  
... of the large soldier head, ...  
... suggesting ...  
... that the rudimentary forewing discs may regulate their patterning ...  
... in addition ...  
... to their growth.

**S1 [010]** Finally, we observe little growth of the leg and eye-antennal discs during the bipotential stage, while in minor worker development these discs grow at similar rates to one another in coordination with larval size to generate the smaller minor worker subcaste.

Finally, ...  
... we observe little growth ...  
... of the leg ...  
... and eye-antennal discs ...  
... during the bipotential stage, ...  
... while in minor worker development these discs grow ...  
... at similar rates ...  
... to one another ...  
... in coordination ...  
... with larval size ...  
... to generate the smaller minor worker subcaste.

**S1 [011]** Our results suggest that rudimentary organs with regulatory functions may participate in new patterns of inter-organ coordination and regulation to produce novel phenotypes and complex worker caste systems.

Our results suggest ...  
... that rudimentary organs ...  
... with regulatory functions may participate ...  
... in new patterns ...  
... of inter-organ coordination ...  
... and regulation ...  
... to produce novel phenotypes ...  
... and complex worker caste systems.

**S1 [012]** We provide characterization of larval development and imaginal disc growth and morphogenesis with the aim of highlighting this as an emerging system for the study of rudimentary organs during development and evolution.

We provide characterization ...  
... of larval development ...  
... and imaginal disc growth ...  
... and morphogenesis ...

... with the aim ...  
... of highlighting this ...  
... as an emerging system ...  
... for the study ...  
... of rudimentary organs ...  
... during development ...  
... and evolution.

## **S2 [013]    Introduction**

**S2 [014]**    During development, each organ is specified and undergoes growth and differentiation – a process that is intrinsically regulated, yet also coordinated, with that of other organs and with the growth of the whole organism (Andersen et al., 2013; Droujinine & Perrimon, 2016).

During development, ...  
... each organ is specified ...  
... and undergoes growth ...  
... and differentiation – a process ...  
... that is intrinsically regulated, ...  
... yet also coordinated, ...  
... with that of other organs ...  
... and with the growth ...  
... of the whole organism ...  
... (Andersen et al., 2013; ...  
... Droujinine & Perrimon, 2016).

**S2 [015]**    This ‘inter-organ coordination’ is phylogenetically widespread and has been especially well documented in the holometabolous insects, which includes flies, butterflies, beetles, and ants (Andersen et al., 2013; Engel, 2015; Droujinine & Perrimon, 2016; Busse et al., 2018; Gontijo & Garelli, 2018; Rosello-Diez et al., 2018; Koch & Abouheif, 2020).

This ‘inter-organ coordination’ is phylogenetically widespread ...  
... and has been especially well documented ...  
... in the holometabolous insects, ...  
... which includes flies, ...  
... butterflies, ...  
... beetles, ...  
... and ants ...  
... (Andersen et al., 2013; ...  
... Engel, 2015; ...  
... Droujinine & Perrimon, 2016; ...  
... Busse et al., 2018; ...  
... Gontijo & Garelli, 2018; ...  
... Rosello-Diez et al., 2018; ...  
... Koch & Abouheif, 2020).

## **End of Sample Audit**

---

This is a truncated Manuscript Microscope Sample Audit.

To get the full audit of this text (or any other research paper),  
forward a copy of the research paper to John James at  
[John.James@OxfordResearchServices.com](mailto:John.James@OxfordResearchServices.com)

---