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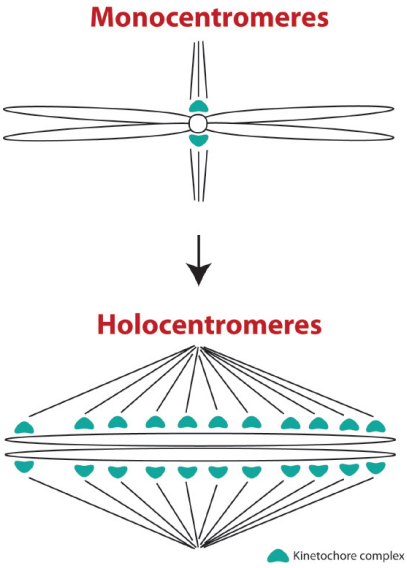
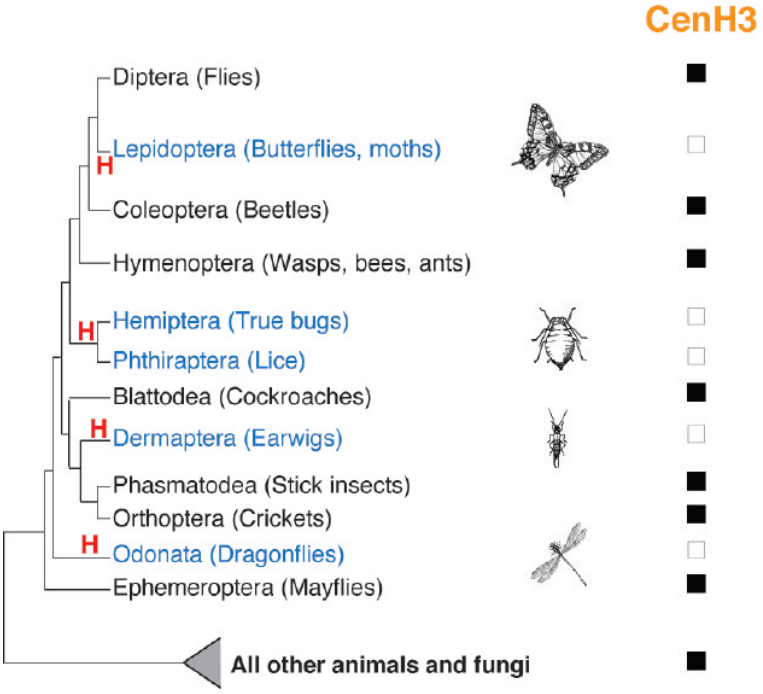
In our lab we are combining evolution-guided and molecular-genomic approaches to study unusual variations that occurred over the course of millions of years of evolution. We specifically focus on the diversity of centromeres, specialized chromosomal regions that fulfill critical roles during cell division.



In all eukaryotes centromeres enable the assembly of the kinetochore protein complex and the attachment of spindle microtubules to ensure the faithful segregation of sister chromatids during mitosis. Given this essential function it is surprising that different strategies of centromere organization have evolved. While most eukaryotes have monocentric chromosomes where spindle attachment is restricted to a single chromosomal region resembling such classic X-shape like structures under the microscope, many lineages have evolved holocentric chromosomes where spindle microtubules attach along the entire length of the chromosome. In fact,

holocentric sister chromatids lie in parallel to one another. Though holocentromeres have been known since more than 70 years the **evolutionary transition from monocentromeres to holocentromeres has remained enigmatic** despite the fact that it represents one of the most dramatic change in centromeric architecture.

We recently found that the histone H3 variant, CenH3 presumed to be the defining component of centromeres is lost in lineages associated with all independent transitions to holocentric chromosomes in insects. Using genomic, evolutionary and biochemical approaches we are characterizing this **novel CenH3 independent chromosomes segregation and kinetochore assembly pathway** in holocentric cell line systems. We aim to understand how CenH3 that is otherwise essential for centromere function in most eukaryotes, could have become dispensable in holocentric insect. These studies will also provide the first insights into the **evolutionary transition from a monocentromere to a holocentromere**.



The red **H** indicates indipendent transitions to holocentric chromosomes. Holocentric insect orders are highlighted in blue. Black box indicates CenH3 presence, empty box indicates CenH3 absence.