The centrosome is an organelle that serves as the main microtubule organizing center (MTOC) of the animal cell as well as a regulator of cell-cycle progression.

The centrosome is thought to have evolved only in the metazoan lineage of eukaryotic cells.

Fungi and plants lack centrosomes and therefore use other MTOC structures to organize their microtubules.

Although the centrosome has a key role in efficient mitosis in animal cells, it is not essential in certain fly and flatworm species.

Centrosomes are composed of two orthogonally arranged centrioles surrounded by an amorphous mass of protein termed the pericentriolar material (PCM). The PCM contains proteins responsible for microtubule nucleation and anchoring including γ-tubulin, pericentrin and ninein. In general, each centriole of the centrosome is based on a nine triplet microtubule assembled in a cartwheel structure, and contains centrin, cenexin and tektin.

In many cell types the centrosome is replaced by a cilium during cellular differentiation. However, once the cell starts to divide, the cilium is replaced again by the centrosome.

Chromosomal instability is a hallmark of cancer and correlates with the presence of extra centrosomes, which originate from centriole overduplication. Overduplicated centrioles lead to the formation of centriole rosettes, which mature into supernumerary centrosomes in the subsequent cell cycle. While extra centrosomes promote chromosome missegregation by clustering into pseudo-bipolar spindles, the contribution of centriole rosettes to chromosome missegregation is unknown. We used multi-modal imaging of cells with conditional centriole overduplication to show that mitotic rosettes in bipolar spindles frequently harbor unequal centriole numbers, leading to biased chromosome capture that favors binding to the prominent pole. This results in chromosome missegregation and aneuploidy. Rosette mitoses lead to viable offspring and significantly contribute to progeny production. We further show that centrosome abnormalities in primary human malignancies frequently consist of centriole rosettes. As asymmetric centriole rosettes generate mitotic errors that can be propagated, rosette mitoses are sufficient to cause chromosome missegregation in cancer [1)].

1)

Cosenza MR, Cazzola A, Rossberg A, Schieber NL, Konotop G, Bausch E, Slynko A, Holland-Letz T, Raab MS, Dubash T, Glimm H, Poppelreuther S, Herold-Mende C, Schwab Y, Krämer A. Asymmetric Centriole Numbers at Spindle Poles Cause Chromosome Missegregation in Cancer. Cell Rep. 2017 Aug 22;20(8):1906-1920. doi: 10.1016/j.celrep.2017.08.005. PubMed PMID: 28834753.