= Arp2 / 3 complex =

Arp2 / 3 complex is a seven @-@ subunit protein complex that plays a major role in the regulation of the actin cytoskeleton . It is a major component of the actin cytoskeleton and is found in most actin cytoskeleton @-@ containing eukaryotic cells . Two of its subunits , the Actin @-@ Related Proteins ARP2 and ARP3 closely resemble the structure of monomeric actin and serve as nucleation sites for new actin filaments . The complex binds to the sides of existing (" mother ") filaments and initiates growth of a new (" daughter ") filament at a distinctive 70 degree angle from the mother . Branched actin networks are created as a result of this nucleation of new filaments . The regulation of rearrangements of the actin cytoskeleton is important for processes like cell locomotion , phagocytosis , and intracellular motility of lipid vesicles .

The Arp2 / 3 complex was named after it was identified by affinity chromatography from Acanthamoeba castellanii , though it had been previously isolated in 1989 in a search for proteins that bind to actin filaments in Drosophila melanogaster embryos . It is found in most eukaryotic organisms , but absent from a number of Chromalveolates and plants .

= = Mechanisms of actin polymerization by Arp2 / 3 = =

Many actin @-@ related molecules create a free barbed end for polymerization by uncapping or severing pre @-@ existing filaments and using these as actin nucleation cores . However , the Arp2 / 3 complex stimulates actin polymerization by creating a new nucleation core . Actin nucleation is an initial step in the formation of an actin filament . The nucleation core activity of Arp2 / 3 is activated by members of the Wiskott @-@ Aldrich syndrome family protein (WASP , N @-@ WASP , WAVE , and WASH proteins) . The V domain of a WASP protein interacts with actin monomers while the CA region associates with the Arp2 / 3 complex to create a nucleation core . However , de novo nucleation followed by polymerization is not sufficient to form integrated actin networks , since these newly synthesized polymers would not be associated with pre @-@ existing filaments . Thus , the Arp2 / 3 complex binds to pre @-@ existing filaments so that the new filaments can grow on the old ones and form a functional actin cytoskeleton . Capping proteins limit actin polymerization to the region activated by the Arp2 / 3 complex , and the elongated filament ends are recapped to prevent depolymerization and thus conserve the actin filament .

The Arp2 / 3 complex simultaneously controls nucleation of actin polymerization and branching of filaments . Moreover , autocatalysis is observed during Arp2 / 3 @-@ mediated actin polymerization . In this process , the newly formed filaments activate other Arp2 / 3 complexes , facilitating the formation of branched filaments .

The mechanism of actin filament initiation by Arp2 / 3 has been disputed . The question is where the complex binds the filament and nucleates a " daughter " filament . Historically two models have been proposed . Recent results , and the balance of opinion in the field , favour the side branching model , in which the Arp2 / 3 complex binds to the side of a pre @-@ existing (" mother ") filament at a point different from the nucleation site . Although the field lacks a high @-@ resolution crystal structure , data from electron microscopy , together with biochemical data on the filament nucleation and capping mechanisms of the Arp2 / 3 complex , favour side branching . In the alternative barbed end branching model , Arp2 / 3 only associates at the barbed end of growing filaments , allowing for the elongation of the original filament and the formation of a branched filament . This model , which is based on kinetic analysis and optical microscopy , is decreasingly favoured by the field .

= = Cellular uses of Arp2 / 3 = =

The Arp2 / 3 complex appears to be important in a variety of specialized cell functions that involve the actin cytoskeleton . The complex is found in cellular regions characterized by dynamic actin filament activity : in macropinocytic cups , in the leading edge of motile cells (lamellipodia) , and in motile actin patches in yeast . In mammals and the social amoeba Dictyostelium discoideum it is required for phagocytosis . The complex has also been shown to be involved in the establishment of

cell polarity and the migration of fibroblast monolayers in a wound @-@ healing model . In mammalian oocytes , the Arp2 / 3 complex is involved in oocyte asymmetric division and polar body emission , which result from the failure of spindle migration (a unique feature of oocyte division) and cytokinesis . Moreover , enteropathogenic organisms like Listeria monocytogenes and Shigella use the Arp2 / 3 complex for actin @-@ polymerization- dependent rocketing movements . The Arp2 / 3 complex also regulates the intracellular motility of endosomes , lysosomes , pinocytic vesicles , and mitochondria . Moreover , recent studies show that the Arp2 / 3 complex is essential for proper polar cell expansion in plants . Arp2 / 3 mutations in Arabidopsis thaliana result in abnormal filament organization , which in turn affects the expansion of trichomes , pavement cells , hypocotyl cells , and root hair cells .