Parasites have evolved various mechanisms to evade digestion by macrophages, allowing them to survive and replicate within these immune cells. Some of these mechanisms include: 1. **Escape from phagosome-lysosome fusion:** Parasites can prevent the fusion of the phagosome (the vesicle formed when a macrophage engulfs a pathogen) with lysosomes (organelles containing digestive enzymes). This prevents the pathogen from being exposed to lysosomal enzymes that would typically degrade it. 2. **Inhibition of phagosome maturation:** Parasites can interfere with the maturation process of the phagosome, preventing it from acquiring the necessary components for digestion. By maintaining a non-acidic environment within the phagosome, parasites can avoid degradation. 3. **Modulation of host cell signaling:** Parasites can manipulate signaling pathways within the host cell to dampen the immune response or promote a favorable environment for their survival. This includes altering cytokine production and interfering with antigen presentation pathways. 4. **Escape into the cytoplasm:** Some parasites have the ability to escape from the phagosome into the cytoplasm of the host cell, where they can replicate and evade detection by the immune system. 5. **Antioxidant defense:** Parasites produce antioxidant enzymes that help them neutralize reactive oxygen species (ROS) generated by the host cell as part of the immune response. This protects the parasite from oxidative damage and promotes its survival within the macrophage. These mechanisms collectively allow parasites to subvert the host immune response and establish persistent infections within macrophages.