

Biocare Basics: Avidin and Streptavidin

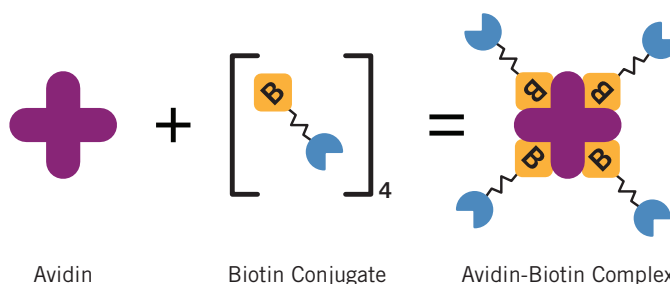
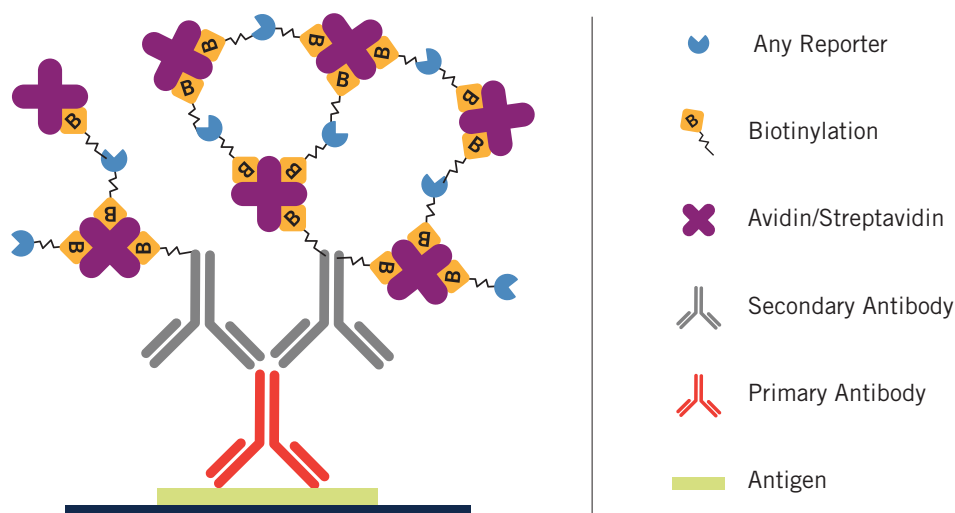
Biocare Basics: Avidin and Streptavidin

The binding affinity of biotin with avidin and its homologs has been utilized for laboratory procedures for decades. Avidin is a naturally occurring tetrameric glycoprotein found in egg albumin and avian tissues.⁴ Biotin, also known as vitamin B7, is a molecular coenzyme of carboxylases that can be found in all living cells.⁴ Together, they form one of the strongest non-covalent bonds in nature and the strongest known interaction between a ligand and a protein.^{4,5} This interaction occurs rapidly and is extremely stable once it forms. These advantages historically made avidin-biotin binding a favored mechanism for immunohistochemistry (IHC) applications.

Avidin and its homologs have four binding sites for biotin.⁴ Avidin is very stable, being relatively resistant to heat, changes in pH, and denaturing agents.⁴ Originally, biotinylated antibodies and avidin were used in IHC staining procedures.² However, despite avidin's great advantages, its limitations have led to the popularity of avidin derivatives instead.³ Avidin has a relatively high isoelectric point of 10.5, meaning that it carries a net neutral charge at a pH of 10.5.⁴ At pH levels below 10.5, avidin carries a positive charge, making it prone to nonspecific interactions with any negatively charged components in cells.⁴ This has the potential to cause background staining issues.

Streptavidin is a homolog of avidin derived from the bacterium *Streptomyces avidinii*. Like avidin, it binds four biotin molecules with a similar dissociation constant, and it is resistant to changes in pH, enzymatic degradation, and chemical denaturing agents, which makes it highly attractive in a laboratory setting.^{1,4} Avidin and streptavidin have virtually identical tertiary and quaternary structures.³ However, streptavidin only shares a 30% sequence homology with avidin, and unlike avidin, it has a near-neutral isoelectric point of 5 to 6.3. As a result, streptavidin is less prone to background staining issues than avidin.

Biocare's 4plus detection line utilizes streptavidin staining technology to provide the cleanest, clearest biotin-based IHC staining possible. The 4plus detection system utilizes biotinylated secondary antibodies with binding affinity for enzyme-linked streptavidin. A long spacer arm has been positioned between the biotin and the secondary antibody, which provides a significant increase in sensitivity when coupled with streptavidin conjugates. The 4plus detection system can be used with either horseradish peroxidase (HRP) or alkaline phosphatase (AP) chromogen labels. To learn more, please visit us at biocare.net or call 1-800-799-9499.



1. Dundas, Christopher M.; Demonte, Daniel; Park, Sheldon (2013). Streptavidin-biotin technology: improvements and innovations in chemical and biological applications. *Applied Microbiology and Biotechnology*, 97(21), 9343-9353. doi:10.1007/s00253-013-5232-z 2. Guesdon, J. L., Ternynck, T., & Avrameas, S. (1979). The use of avidin-biotin interaction in immunoenzymatic techniques. *Journal of Histochemistry & Cytochemistry*, 27(8), 1131-1139. https://doi.org/10.1177/27.8.90074 3. Jain, A., & Cheng, K. (2017). The principles and applications of avidin-based nanoparticles in drug delivery and diagnosis. *Journal of controlled release : official journal of the Controlled Release Society*, 245, 27-40. https://doi.org/10.1016/j.jconrel.2016.11.016 4. McMahon, R. J., Haugland, R. P., & You, W. W. (2010). Coupling of Antibodies with Biotin. In *Avidin-biotin interactions: Methods and applications* (pp. 13-22). essay, Humana. 5. Patrick S Stayton; Stefanie Freitag; Lisa A Klumb; Ashutosh Chilkoti; Vano Chu; Julie E Penzotti; Richard To; David Hyre; Isolda Le Trong; Terry P Lybrand; Ronald E Stenkamp (1999). Streptavidin-biotin binding energetics. , 16(1-4), 39-44. doi:10.1016/s1050-3862(99)00042-x