

# Bevacizumab – Fact Sheet

## Molecule

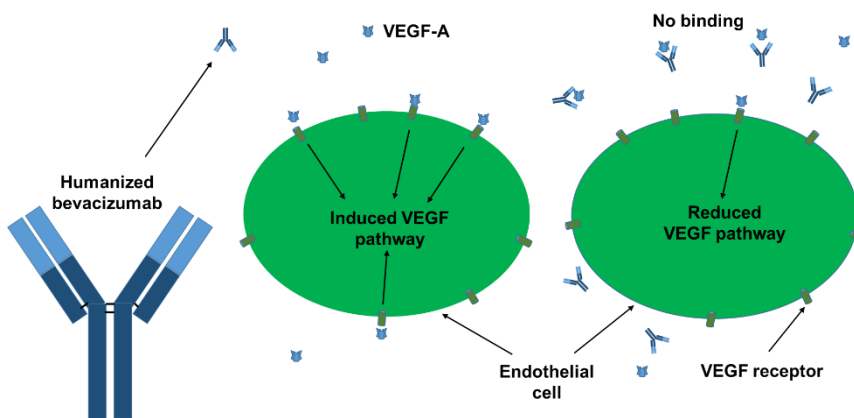
Bevacizumab (Avastin®) is a typical humanized monoclonal IgG1 / kappa antibody comprised of a tetramer of two heavy and two light chains with one N-glycosylation site per heavy chain.

## Mode of Action

Bevacizumab inhibits angiogenesis (formation of new blood vessels) by blocking the interaction of Vascular Endothelial Growth Factor A (VEGF-A) with its receptors, VEGF receptor-1 or VEGF receptor-2. Bevacizumab can therefore also slow the growth of new blood vessels in tumors.

## Indication

Bevacizumab is indicated for various cancers including metastatic colorectal cancer, non-squamous non-small cell lung cancer, metastatic renal cell carcinoma, recurrent epithelial ovarian, fallopian tube, or primary peritoneal cancer and also for a few glioblastomas.



## Patent Situation

Bevacizumab patents expired in US (2019) and will expire in EU (2022). Roche as owner of the originator will

defend these dates and all biosimilar developments in late stage will have to wait for market entry in EU until expiration of the patents.

## Market and Competitive Field

The originator product, Roche's Avastin® was approved by FDA in 2004 and by EMA in 2005. Avastin® had sales of 6.70 and 4.58 billion in 2019 and 2020, respectively, making it a popular target for biosimilar developers. Mvasi® from Amgen is already marketed and had in 2020 sales of 659 million €. Pfizer also started sales of Zirabev® (121 million € in 2020). In developing countries, non-originator biologicals are marketed as well.

**VelaLabs Portfolio**

		Bevacizumab
		Avastin®, Mvasi®, Zirabev®
<b>Clone selection/ comparability</b>		
<b>HPLC</b>	Separation based on <b>size</b> (SE-HPLC)	
	Separation based on <b>hydrophobicity</b> (RP-HPLC)	
	Detection of <b>charge variants</b> (CEX-HPLC)	
<b>Binding</b>	Binding to <b>cell surface</b> expressed target (Flow cytometry)	n.a.
	Binding to <b>soluble target</b> (ELISA)	
	Binding to specific <b>antibody or antigen</b> (SPR-BIACORE, ELISA)	
	<b>Affinity/ kinetic</b> to recombinant target (SPR-BIACORE)	
<b>Effector function</b>	Binding to C1q, <sup>1</sup> <b>CDC surrogate</b> (ELISA)	
	<b>Affinity</b> to recombinant Fc-receptors (SPR-BIACORE)	
	Reporter gene assays, <sup>2</sup> <b>ADCC surrogate</b> (Luminescence)	n.a.
	<sup>1</sup> <b>CDC</b> (Flow cytometry)	n.a.
	<sup>2</sup> <b>ADCC</b> (DELFI, Fluorescence)	n.a.
	Additional <b>bioassays</b> (Luminescence, fluorescence)	Anti-proliferation
<b>Gly</b>	Glyco-pattern with <b>Lectin Microarray</b> (45 different lectins)	
<b>(Pre)clinical application</b>		
<b>Clinics</b>	Pharmacokinetics – <b>PK</b> (ECL, ELISA)	
	Pharmacodynamics – <b>PD</b> (ECL, ELISA, flow cytometry, bioassay)	
	Immunogenicity - <sup>3</sup> <b>ADAs</b> (ECL, Biacore, ELISA, neutr. assay)	

<sup>1</sup>CDC = Complement Dependent Cytotoxicity  
<sup>2</sup>ADCC = Antibody Dependent Cellular Cytotoxicity  
<sup>3</sup>ADA = Anti-Drug Antibody

	Vela portfolio
	n.a. = not applicable