

# Multiple Sclerosis: Disease Modifying Therapies

## Injections

	Interferons				Non-Interferons	
	(interferon beta-1a)			Interferon beta-1b	Glatiramer acetate	
Brand name	Avonex	Rebif	Plegridy (pegylated)	Betaseron or Extavia	Copaxone	Glatopa and mylan generic
Efficacy	2/5	2.5/5	2/5	2.5/5	2.5/5	
Safety	4.5/5				5/5	
Available Since	1996	2002	2014	1993 (Betaseron)	1996	2015
How given	Intramuscular injection	Subcutaneous injection			Subcutaneous injection	
Frequency	Every 7 days	3x/week	Every 14 days	Every other day	Daily or 3x/week	
Autoinjector	Yes				Yes	
Premixed?	Premixed			No	Premixed	
Blood tests required	CBC, LFT every 3-6 months				None	
Common side effects	<ul style="list-style-type: none"> <li>Injection site reactions</li> <li>Flu-like symptoms</li> <li>Worsening depression</li> </ul>				<ul style="list-style-type: none"> <li>Injection site reactions</li> <li>Rare post-injection systemic reaction</li> </ul>	
Pregnancy category	No adequate and well-controlled studies in pregnant women				No adverse effects in animal testing. No adequate and well-controlled studies in pregnant women	
Patient Support and financial assistance programs	Above MS 1-800-456-2255	MS Lifelines 1-877-447-3243	Above MS 1-800-456-2255	MS Pathways 1-800-788-1467 Extavia 1-866-925-2333	Shared Solutions 1-800-887-8100	GlatopaCare 1-855-452-8672

\*\*Comparative efficacy has not been determined

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## Pills or Capsules

Brand name (Generic name)	<u>Gilenya (fingolimod)</u>	<u>Aubagio (teriflunomide)</u>	<u>Tecfidera (dimethyl fumarate)</u>	<u>Mayzent (siponimod)</u>	<u>Mavenclad (cladribine)</u>
<b>Efficacy</b>	4/5	2.5/5	3.5/5	4/5	4/5
<b>Safety</b>	3/5	3.5/5	4/5	3/5	3/5
<b>Available since</b>	2010	2012	2013	2019	2019
<b>How given</b>	Once a day, 0.5 mg capsule	Once a day, 7 or 14 mg pill	Twice a day, 120 or 240 mg capsule with food	2 mg once daily after titration*	3.5 mg/kg orally divided into 2 yearly treatment courses <sup>†</sup>
<b>Tests required prior to starting</b>	Eye exam, derm exam, ECG, MRI, VZV IgG, CBC w/diff, LFT	CBC w/diff, LFT, TB test, MRI, pregnancy test	CBC w/diff, LFT, MRI	CYP2C9 genotype + same for Gilenya	CBC w/diff, HBV, HCV, VZV, pregnancy test, MRI, cancer screening
<b>Monitoring</b>	First dose observation (6 hour) Annual OCT and skin exam Liver function tests	Liver function tests monthly x6, then quarterly	Lymphocyte counts Liver function tests	First dose observation (6 hour) only for patients with certain heart conditions	CBC w/diff
<b>Mechanism of action</b>	Traps lymphocytes in lymph nodes	Limits ability of immune cells to divide rapidly	Unknown; via oxidative stress pathway	Traps lymphocytes in lymph nodes	Reduces certain WBCs
<b>Common side effects</b>	Slows HR (initially) Reduces lymphocytes	Hair thinning (12%) GI upset (18%)	Flushing (40%) GI side effects (20%, less with food)	Slows HR (initially) Reduces lymphocytes	Reduced lymphocytes Rash Hair loss Cold sores
<b>Rare side effects</b>	Macular edema (7/1000) Elevated LFTs Shortness of breath BP increase	Elevated LFTs Peripheral neuropathy Serious skin reactions	Itching (8%)	Macular edema Elevated LFTs BP increase	Tuberculosis
<b>Infection risk</b>	Lower respiratory tract Herpetic infections PML (1:11,000)	TB reactivation Other rare infections	PML (1:65,000), mostly in patients with low lymphocyte counts	Herpes infection PML	Shingles Tuberculosis PML
<b>Time to elimination</b>	Average 45 days	Up to 2 years (available 11-day rapid elimination)	5-24 hours	~10 days	~5 days
<b>Pregnancy</b>	No adequate data on developmental risk associated with the use of fingolimod.	Must avoid pregnancy. Men to use protection. Fetal risk has been demonstrated.	Fetal risk cannot be ruled out.	Reproductive and developmental studies in animals demonstrated fetal risk.	Contraindicated in pregnancy Men to use protection
<b>Patient Support and financial assistance</b>	Gilenya Go Program 1-800-445-3692	MS One to One 1-855-676-6326	Above MS 1-800-456-2255	1-877-629-9368	MS Lifelines 1-877-447-3243

\*In patients with CYP2C9\*1/\*3 or \*2/\*3 genotype, after treatment initiation, the recommended maintenance dose is 1 mg once daily

<sup>†</sup>Please look at administration directions in [package insert](#) for further details

## Multiple Sclerosis: Disease Modifying Therapies

### Intravenous Infusions

<b>Brand Name</b>	<b>Tysabri (natalizumab)</b>	<b>Lemtrada (alemtuzumab)</b>	<b>Ocrevus (ocrelizumab)</b>
<i>EFFICACY*</i>	4.5/5	5/5	5/5
<i>SAFETY</i>	2/5 in JC+, 4/5 in JC-	1.5/5	4/5
<i>Year Marketed</i>	2004	2014	2017
<i>Frequency of infusions</i>	Every 4 weeks	Year 1: 5 days, Year 2: 3 days, then as needed	First 2 infusions 2 weeks apart Then 1 every 6 months
<i>Time of infusion</i>	1 hour + 1 hour observation	4 hours + 2 hours observation, usually 8 hours total	First: 2.5 hours + 1 hour observation Then: 3.5hours + 1hour observation
<i>Common side effects</i>	<ul style="list-style-type: none"> <li>• Infusion reactions (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• Infusion reactions (90+%)</li> <li>• Thyroid disorders (34%)</li> </ul>	<ul style="list-style-type: none"> <li>• Infusion reactions (40%)</li> </ul>
<i>Serious risks</i>	<ul style="list-style-type: none"> <li>• Liver injury</li> <li>• Hypersensitivity reactions</li> </ul>	<ul style="list-style-type: none"> <li>• Platelets: ITP (2%)</li> <li>• Kidneys: anti-GBM disease</li> <li>• Hypersensitivity reactions</li> <li>• Stroke</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
<i>Infectious risks</i>	<ul style="list-style-type: none"> <li>• Herpetic infections</li> </ul>	<ul style="list-style-type: none"> <li>• Listeriosis (short-term)</li> <li>• Herpetic infections</li> </ul>	<ul style="list-style-type: none"> <li>• Respiratory</li> <li>• Herpetic</li> <li>• Reactivation of hep B</li> </ul>
<i>PML risk</i>	1/10,000 if JC ab negative 1-10/1000 if JC ab positive	Possible	Possible
<i>Cancer risk</i>	Possible	Thyroid (0.2%), Melanoma (0.3%), Lymphoproliferative	Possible (breast)
<i>Monitoring</i>	TOUCH REMS program JC ab quarterly LFTs Periodic MRI	Lemtrada REMS program for 48 months Monthly (CBC, UA) Quarterly (TSH)	IgG
<i>Pregnancy Category</i>	No adequate data on developmental risk in pregnant women. Offspring of monkeys had lower white blood cell counts	No adequate data on developmental risk in pregnant women. Can cause low thyroid in offspring. In mice, use during pregnancy can cause major birth defects	No adequate data on developmental risk in pregnant women. Can cause transient low lymphocyte counts in offspring.
<i>Patient support and financial assistance</i>	Above MS 1-800-456-2255	Lemtrada REMS program 855-676-6326	Genentech Access Solutions 1-866-422-2377