**Biological Therapy in Rheumatology**

| **Group** | **Drug Name** | **Brief Description** | **Dose** | **Side Effects** | **Used In** |
| --- | --- | --- | --- | --- | --- |
| Anti TNF-α | Etanercept (Enbrel) | Recombinant dimeric fusion protein (human p75 TNF receptor + Fc fragment of human IgG1). It binds only soluble TNF-α | 50 mg weekly, or 25 mg twice weekly, SC injection | Injection-site inflammation, demyelinating and psychological complications, infections (less than other anti TNF), pancytopenia, ?? lymphoma, not used in active hepatitis or NIHA III-IV congestive heart failure | RA, PsA, AS, JIA, adult Still's, WG, ???SLE |
| Infliximab (Remicade) | Chimeric Humanized monoclonal antibody (mouse anti-TNF + human IgG1). Binds soluble and membrane bound TNF-α | 3-10 mg/Kg/ dose at 0,2,6 weeks, then every 8 weeks slow IV infusion | Infusion-related allergy, demyelinating and psychological complications, infections, pancytopenia, ?? lymphoma. MTX reduce its immunogenicity, not used in active hepatitis or NIHA III-IV CHF | RA, PsA, AS, JIA, uvieties associated JIA, ???SLE |
| Adalimumab (humira) | Recombinant fully human monoclonal antibody. Binds soluble and membrane bound TNF-α | 40 mg every other week, SC injection | Injection-site inflammation, demyelinating and psychological complications, infections, pancytopenia, ?? lymphoma, not used in active hepatitis or NIHA III-IV congestive heart failure | RA, PsA, AS, JIA, ???SLE |
| Certolizumab | Recombinant fully human monoclonal antibody, lacking Fc portion of IgG. Binds soluble TNF-α, bound to 2 polyethylene glycol (PEG) molecules, increasing its half life and improve distribution | 200 mg every 2 weeks, or 400 mg at weeks 0,2,4 then every 4 weeks, SC injection | Injection-site inflammation, demyelinating and psychological complications, infections, pancytopenia, ?? lymphoma, not used in active hepatitis or NIHA III-IV congestive heart failure | RA, ???SLE |
| Golimumab | Recombinant fully humanized monoclonal antibody. Binds soluble and membrane bound TNF-α | 100 mg every 4 weeks, SC injection | Injection-site inflammation, demyelinating and psychological complications, infections, pancytopenia, ?? lymphoma, not used in active hepatitis or NIHA III-IV congestive heart failure | RA, PsA, AS, JIA, ???SLE |
| Anti-TNF production  | Apermilast | Type 4 phosphodiesterase inhibitor (PDE-4), involved with inhibition of TNF production | Under trial | Under trial | RA |
| Anti IL-1 | Anakinra  | Anti IL-1 |  |  | RA, sJIA, SLE arthritis |
| Anti IL-6 | Tocilizumab  | Fully humanized monoclonal antibody against IL-6 receptor (both soluble and membrane bound). IL-6 helps differentiation of B, T cells | 8 mg/kg/dose | Neutropenia, increased infection risk, pneumonia most common, then HZV, bronchitis, pyelonephritis. Elevation of liver function tests (enzymes and bilirubin), elevated cholesterol, TGs, HDLP | RA, ??SLE |
| Anti IL-17 | Secukinumab | Humanized monoclonal antibody against IL-17, inhibiting migration of macrophages and neutrophils | 150 mg daily subcutaneous psoriatic treatment |  | Psoriasis, ???RA |
| AntiIL-12/IL-23 | Ustekinumab | Humanized monoclonal antibody against p40 sybunit of IL-12/IL-23 |  |  | ??? PsA |
| Other anti IL |  | Anti IL10, IL15, IL18 |  |  | ??SLE |
| T cell co-stimulatory blocking | Abatacept  | Fully humanized soluble fusion protein against cytotoxic T-lymphocyte associated antigen 4 (CTLA-4). Inhibit second signal required for T-cell activation. | 500-1000 mg (10 mg/kg/dose) IV infusion at 0,2,4 weeks, then every 4 weeks | Non significant infection risk, less side effects that anti TNF. Used with caution in COPD, contra-indicated in HBV,HCV or active infection, or latent TB. | RA, poJIA, ??SLE |
| T cell targets | Efalizumab | Monoclonal anti CD11a, preventing T cell activation |  |  | Cutaneous SLE manifestations |
| Anti B cells | Rituximab | Chimeric anti CD 20 monoclonal antibody, preventing proliferation of immature and mature B cells | Two 500-1000 mg IV infusion, 2 weeks apart, repeated every 6-12 months, or on demand | Mild infusion reaction, ?? risk of increased infection. Progressive multifocal leukoencephalopathy (PML) rare but fatal complication. Contra-indicated in chronic HBC, HCV, or in active infection | Non Hodjkins Lymphoma, RA, SLE, HCV cryo-globulinemia |
| Veltuzumab | Anti CD 20, preventing proliferation of immature and mature B cells | Under trial | Under trial | Under trial |
| Ofatumumab  | Under trial | Infusion delivery, non convenient for patients | Chronic lymphocytic leukemia, RA |
| Ocrelizumab | Trials stopped due to increased risk of opportunistic infection |
| Epratuzumab | Fully humanized anti CD 22 | Under trial | Under trial | SLE |
| Abetimus | B cell tolerogen (4 dsDNA epitopes) |  |  | SLE |
| Edratide | B cell tolerogen |  |  | SLE |
| Belimumab  | Humanized monoclonal Anti BLyS (B lymphocyte stilmulator) antibody |  |  | SLE |
| Atacicept  | BLyS blocker |  |  | SLE |
| Anti complement | Eculizumab | Monoclonal anti C5 antibody |  |  | Paroxysmal nocturnal hematuria, ??SLE |
| Anti protein kinases | Anti JAK | Tofacitinib | Oral Janus Kinase (JAK) inhibitor, blocking signaling for cytokine proliferation, inhibiting lymphocyte functions and proliferation | Orally taken | Long-term immunosuppression, dose dependent change in cholesterol | RA |
| Anti SyK | Fostamatinib | Spleen Tyrosine kinase (SyK) inhibitor, blocking signaling to immune cells, inhibit IL-6 and MMPs production | 100 mg twice daily or 150 mg once (oral) | Nausea, diarrhea | RA, less effective than anti TNF |
| Anti MAPK  |  | Mitogen-activated protein kinase (MAPK) inhibitor | Under trials, did not show promising results in RA treatment |