

Dermatopharmacology
Sophia Akhiyat, MD, FAAD
Reference: AliKhan Review of Dermatology

- Antibiotic generations

Class	Generation	Type
Penicillin	1st	Dicloxacillin Oxacillin
	2nd	Ampicillin Amoxicillin
	3rd	Carbenicillin Pipercillin
Cephalosporin	1st	Cefadroxil Cefalexin
	2nd	Cefaclor Cefuroxime Cefoxitin Cefotetan
	3rd	Cefixime Cefdinir Cefotaxime Ceftazidime Cefpodoxime Ceftriaxone
	4th	Cefepime
	5th	Ceftaroline

- Drug-drug interactions

Cephalosporins + aminoglycoside	Nephrotoxicity
Cefotetan + alcohol	Disulfiram reaction
Azathioprine + ACEi, sulfa drugs (sulfasalazine, dapsone), folic acid antagonists (methotrexate, TMP-SMX)	Myelosuppression
Azathioprine + warfarin	Decreased anticoagulant effect

Azathioprine + cyclosporine	
Azathioprine + allopurinol, febuxostat	Myelosuppression
Azathioprine + mycophenolate mofetil	Bone marrow toxicity
Azathioprine with systemic corticosteroids + hepatitis B vaccine	Decreased response
Azathioprine + TNF α inhibitor (etanercept, adalimumab, infliximab)	Hepatosplenic T cell lymphoma
Azathioprine + cyclosporine or methotrexate	Hypersensitivity syndrome (1-4 weeks)
Cephalosporins + aminoglycosides	Nephrotoxicity
Penicillin or cephalosporin + probenecid	Prolonged renal excretion → ^ penicillin and cephalosporin levels
Hydroxychloroquine + chloroquine	Agranulocytosis (because of chloroquine)
Chloroquine in myasthenia gravis	
Bexarotene + simvastatin	Hyperlipidemia (cytochrome p450 3A4 inhibition that raises bexarotene levels)
Bexarotene + gemfibrozil	Hyperlipidemia (cytochrome p450 3A4 inhibition that raises bexarotene levels)
Acitretin + alcohol	^ Etretinate
Acitretin + methotrexate	Hepatotoxicity
Erythromycin + warfarin, mexiletine, theophylline, statins	Drug-drug interaction via cytochrome p450 3A4 inhibition of erythromycin; Rhabdomyolysis (statins)
Erythromycin + terfenadine, astemizole, cisapride, quinolones	QT prolongation / torsades de pointes
Erythromycin estolate in pregnancy	Hepatotoxicity (intrahepatic cholestasis in mother); Cardiovascular malformation in fetus; Pyloric stenosis in fetus

Clarithromycin in renal dysfunction	
Fluoroquinolones + cytochrome 1A2 inhibitors (warfarin, theophylline, caffeine, antiarrhythmics)	QT prolongation / torsades de pointes
Fluoroquinolones + zileuton, Beta blockers	
Fluoroquinolones + cyclosporine	^ Creatinine
Vancomycin + aminoglycosides	Nephrotoxicity
Rifampin + OCPs, warfarin, azoles, CCBs, statins, cyclosporine	^ drug clearance resulting in decreased efficacy (rifampin is a cytochrome p450 inducer)
Rifampin + isoniazid	Hepatotoxicity
Methotrexate + folic acid inhibitors (TMP-SMX), dapsone, azathioprine, displacing plasma proteins (tetracyclines, phenytoin, phenothiazines, NSAIDs, salicylates)	Myelosuppression
TMP-SMX + dapsone	^ dapsone levels
TMP-SMX + MTX	Hematologic toxicity
TMP-SMX + cyclosporine	Nephrotoxicity
TMP-SMX + ACEi/ARB	Hyperkalemia
Linezolid + SSRI, MAOi, TCA (doxepin)	Serotonin syndrome
Quinupristin, dalfopristin + cytochrome p450 3A4 inhibitor	
Daptomycin + statins	Myopathy (check CPK)
Acyclovir / valacyclovir or famciclovir / penciclovir + azathioprine	Drowsiness, lethargy
Acyclovir / valacyclovir or famciclovir / penciclovir + probenecid	^ bioavailability; v renal clearance
Itraconazole + cytochrome p450 3A4 inhibitors (pimozide, quinidine,	

cisapride, erythromycin)	
Itraconazole + levomethadyl, dofetilide, statins, midazolam, triazolam, nisoldipine, ergot alkaloids (sumatriptan)	
Fluconazole (cytochrome p450 2C9 inhibitor) + cytochrome p450 3A4 inhibitors (pimozide, quinidine, cisapride, erythromycin), terfenadine, astemizole, voriconazole, statins	QT prolongation
Ketoconazole + cisapride, terfenadine, astemizole	QT prolongation
Terbinafine + cytochrome p450 C2D6 substrate (doxepin, amitriptyline)	
Benzyl benzoate + alcohol	Disulfiram reaction
Albendazole + theophylline	^ Theophylline levels
Thiabendazole + theophylline	^ Theophylline levels
Spironolactone + K ⁺ increasing agent (ACEi/ARB)	Hyperkalemia
Danazol, stanozolol + statins	Myopathy
Glycopyrrolate, oxybutynin + doxepin (TCA), atenolol, digoxin	Anticholinergic effects

- Give together

Prednisone + vitamin D + calcium + PPI +/- bisphosphonate = osteoporosis ppx
Cyclophosphamide + ondansetron + dexamethasone = GI side effect treatment
Dapsone + cimetidine + vitamin E = decreased hemolytic anemia and metHb
Cyclosporine + nifedipine = hypertension treatment
Methotrexate + folic acid = decreased risk of myelosuppression and side effects
Methotrexate + TNF α inhibitor = decreased risk of anti-drug antibodies

- Bacterial ribosome

50S ribosomal subunit	Retapamulin (L3) Macrolides (erythromycin, azithromycin, clarithromycin) Clindamycin Linezolid (23S) Quinupristin, dalfopristin
30S ribosomal subunit <i>AT the bottom</i>	Aminoglycosides (neomycin, gentamicin) Tetracyclines (demeclocycline, doxycycline, minocycline)

- Idiosyncratic reactions

Methotrexate	Interstitial pulmonary fibrosis Pancytopenia
Dapsone	Agranulocytosis (3-12 weeks; 7 weeks)
Ketoconazole	Hepatotoxicity
Terbinafine	Liver failure

- Progressive multifocal leukoencephalopathy side effect

- Ustekinumab (reversible)
- Rituximab

- Hemolytic anemia side effect

- Dapsone
- Silver sulfadiazine
- TMP-SMX
- Antimalarials
- Cefotetan (2nd generation)
- Rifampin

- Porphyria

- Silver sulfadiazine (unmasking)
- Rifampin (increase sensitivity in ALA synthetase)
- Voriconazole (pseudoporphyria)
- Griseofulvin (worsen porphyria)

- GI side effects

- Azathioprine
- Mycophenolate mofetil
- Cyclophosphamide
- Chlorambucil
- Antimalarials (chloroquine >)
- Dapsone
- MEK inhibitors (trametinib)
- Ipilimumab
- Erythromycin
- Fluoroquinolones
- TMP-SMX
- Itraconazole
- Fluconazole
- Ketoconazole
- Griseofulvin
- Baseline enzyme check
 - Azathioprine → thiopurine methyltransferase (TPMT)
 - Dapsone → G6PD
 - IVIG → immunoglobulin levels (IgA), rheumatoid factor, cryoglobulins
 - Potassium iodide → TSH, free T4
- Treats and causes / exacerbates it
 - Psoriasis (pustulosis) & TNFa inhibitors
 - Dermatomyositis with hydroxychloroquine & drug-induced dermatomyositis
 - PRP & phototherapy (phototesting recommended)
 - Pemphigus vulgaris & gold
 - nbUVB & drug-induced lichenoid eruption (hydrochlorothiazide)
- Neutropenia side effect
 - Ticarcillin/clavulanate
 - Silver sulfadiazine
- Hyperpigmentation of skin and nails
 - Tetracyclines
 - Diltiazem
 - Hydroxyurea
 - Cyclophosphamide
 - Antimalarials (quinacrine → yellow)
- Cyclosporine and increased creatinine
 - Increased Cr from baseline?
 - >50% from baseline? **Discontinue cyclosporine**
 - >30% from baseline? **Recheck in 2 weeks**

- >30% still? **Decrease dose by 1 mg/kg for 4 weeks, then recheck**
 - >30% from baseline still? **Discontinue**
 - <30% from baseline? **Continue**
 - Cr within 10% of baseline? **Continue at lower dose**
- Phototoxicity
 - Methotrexate
 - Tetracycline (demeclocycline > doxycycline)
 - Hydroxyurea
- Hypersensitivity cross-reactivity (B-lactam ring)
 - **Cephalosporin → penicillin; 2%**
 - **Penicillin → cephalosporin; 5-10%**
- Decreased absorption with divalent cations (calcium, iron, zinc, magnesium, bismuth, aluminum)
 - Fluoroquinolones
 - Tetracyclines
- Nail effects
 - Demeclocycline > doxycycline > tetracycline > minocycline (photo-onycholysis)
 - Dicloxacillin (shore nails)
 - Cloxacillin (onychomadesis, photo-onycholysis)
 - Lomefloxacin, enoxacin, sparfloxacin* >> ciprofloxacin > norfloxacin > ofloxacin >> levofloxacin (photo-onycholysis)
 - Caused by **UVA** and **visible light*** (sparfloxacin)
- Pustular eruption
 - EGFRi
 - BRAF inhibitors
 - MEK inhibitors
 - Li+
 - Phenytoin
 - Systemic corticosteroids
- Antacids decrease absorption
 - Mycophenolate mofetil
 - Azithromycin
 - Itraconazole
- Bite prophylaxis
 - **Amoxicillin/clavulanate #1**
 - Azithromycin (*Pasteurella multocida*, *Eikenella corrodens*)
- Cytochrome p450 3A4 inhibitor

- Macrolides (erythromycin, clarithromycin)
- Gemfibrozil, simvastatin (bexarotene is metabolized by cytochrome p450 3A4)
- Cutaneous anthrax
 - Penicillin
 - Erythromycin
 - Fluoroquinolone
- Hearing loss (ototoxicity)
 - Macrolides
 - Vancomycin (renal failure)
 - Itraconazole
 - Aminoglycosides
- MRSA coverage
 - Doxycycline, minocycline
 - Vancomycin
 - Ceftaroline (5th generation)
 - TMP-SMX
 - Mupirocin
 - Retapamulin
 - Rifampin
 - Clindamycin
- Doxycycline as the treatment of choice
 - Lymphogranuloma venereum (Chlamydia trachomatis)
 - Rickettsia (RMSF, rickettsialpox, Q fever, trench fever, ehrlichiosis)
 - Lyme disease
- QT prolongation / torsades de pointes
 - BRAF inhibitors (vemurafenib, dabrafenib)
 - Erythromycin
 - Fluoroquinolones
 - Fluconazole
 - Ketoconazole
 - Voriconazole
 - Pimozide
- Antifungals

Antifungal medication	Mechanism of action
Terbinafine* Naftifine Butenafine	Allylamine → dermatophytes Inhibits squalene epoxidase preventing squalene → lanosterol → ergosterol ^ squalene → fungicidal

*first-line onychomycosis	v ergosterol → fungistatic
Azoles: Ketoconazole Fluconazole Itraconazole Voriconazole Efinaconazole	Imidazole → dermatophytes, yeasts Inhibits lanosterol 14a demethylase (cyt450) preventing lanosterol → ergosterol v ergosterol → fungistatic
Echinocandins: Caspofungin Micafungin Anidulafungin	Inhibits B-1,3-D-glucan synthase
Flucytosine	Interferes with DNA and RNA synthesis Synergistic with amphotericin B.
Tavaborole	Inhibits aminoacyl-transfer ribonucleic acid synthetase
Ciclopirox	Chelates and inhibits iron-dependant mitochondrial enzymes
Griseofulvin	Inhibits alpha and beta tubulin preventing spindle and cytoplasmic microtubules; Binds to keratin in keratin precursor cells fungistatic
Nystatin	Binds to Candida cell membrane sterols → ^ permeability

- Azoles and ciclopirox >> allylamines / benzylamines for Candida
Allylamine (terbinafine) > azoles (clotrimazole, oxiconazole) for tinea pedis
- Antiparasitic

Ivermectin	Binds glutamate-gated Cl channels and hyperpolarizes
Albendazole	Stops tubulin polymerization
Thiabendazole	Inhibits fumarate reductase
Permethrin	Inhibits Na channels

Malathion	Organophosphate inhibits acetylcholinesterase
Spinosad	Instigates arthropod motor neurons
Lindane	Organochlorine that decreases neurotransmission

- CYP isoforms

	Substrate	Inducers (less effective)	Inhibitors (toxicity)
CYP1A2	Warfarin; Theophylline; Caffeine; Pimozide	Fluoroquinolones; Macrolides (erythromycin); Ketoconazole	Rifampin; Phenytoin; Barbiturates; Cigarette smoke; Cimetidine
CYP2C9	Warfarin; Phenytoin; Sulfonamides; Fluvastatin, losartan, rosuvastatin	Fluconazole; TMP-SMX	Carbamazepine; Rifampin; Cimetidine;
CYP2D6 25% of all drug metabolism	TCA (doxepin, amitriptyline); <u>B-blockers (metoprolol, propranolol);</u> Antidysrhythmics (flecainide, propafenone); Antipsychotics (clozapine, pimozide)	Rifampin; Anticonvulsants (phenytoin, carbamazepine);	SSRIs (fluoxetine, sertraline); Pimozide; <u>Terbinafine</u>
CYP3A4 50% of all drug metabolism	Warfarin; Carbamazepine; Doxepin;	Rifampin; Griseofulvin; Anticonvulsants (phenytoin,	Azole antifungals (ketoconazole, itraconazole, voriconazole, fluconazole, posaconazole);

	Sertraline; Antidysrhythmics (amiodarone, digoxin, quinidine); CCBs (diltiazem, nifedipine); Chemotherapy (doxorubicin, vinblastine, cyclophosphamide); H1 antihistamines ; Statins (lovastatin, simvastatin, atorvastatin); OCPs ; Tacrolimus ; Cyclosporine ; Benzodiazepine; Protease inhibitors ; Colchicine Bexarotene	carbamazepine); Dexamethasone; St. John's wort	Macrolides (erythromycin , clarithromycin but NOT azithromycin); Metronidazole; Protease inhibitors; SSRIs (fluoxetine, sertraline); Grapefruit juice ; CCBs; Furosemide ; Ciprofloxacin ; Gemfibrozil ; Cimetidine ; Terbinafine is a safe antifungal for patients on a statin, cyclosporine, warfarin, a calcium channel blocker, OCPs, or others.
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“Queen Barbara’s Phenny - she refuses greasy carbs and alcohol chronically”

(*inducers: quinidine, barbiturates, phenytoin, rifampin, griseofulvin, carbamazepine, chronic alcohol intake*)

“PICK EGS” (*inhibitors: protease inhibitors, isoniazid, cimetidine, ketoconazole, erythromycin, grapefruit juice, sulfonamides*)

Butalbital and phenobarbital both cause decreased absorption of griseofulvin.

P-450 inducers

- “GC DRIPS”
- Griseofulvin
- Carbamazepine
- Dexamethasone/Dilantin
- Rifampin
- Imipenem/INH
- Phenobarbital
- Smoking/St. John’s wort

P-450 inhibitors

- “PACKED a PINT of CATS”
- Protease inhibitors
- Acyclovir, Amphotericin
- Cimetidine, Coumadin, Cipro
- Ketoconazole (also fluconazole)
- Erythromycin
- Diuretics, Digoxin, Disulfuram
- Prednisone
- Itraconazole
- Naringenin (Bergamottin-Grapefruit)
- Theophylline
- Ca channel blockers
- Allopurinol
- Terfenadine (prodrug of fexofenadine, no longer on market)
- Sulfonamides, SSRIs

- Sunscreen ingredients

	UV wavelength protective coverage		
	UVA1 (340-400 nm)	UVA2 (320-340 nm)	UVB (290-320 nm)
Inorganic filter agents			
Titanium dioxide			
Zinc oxide			
Organic filter agents			
P-aminobenzoic acid (PABA)			
Padimate-O			
Cinoxate			
Octinoxate			
Trolamine salicylate			
Oxybenzone			
Sulisobenzone			
Dioxybenzone			
Meradimate			
Avobenzone			
Octocrylene			
Ecamsule (Mexoryl SX)			
Ensulizole			
Menthyl anthranilate			
Octyl methoxycinnamate			
Octyl salicylate			
Phenylbenzimidazole sulfonic acid			

- Highest risk medications for drug-induced eruption:
 - **Aminopenicillins**
 - **Anticonvulsants**
 - **TMP/SMX**
 - **NSAIDs**
- Drug timeline and culprits:

Rash	Onset	Resolution	Spread	Drugs
Morbilliform	1-2 weeks	1-2 weeks	axilla, groin → trunk, upper extremities → lower extremities	B-lactams (penicillins, cephalosporins) TMP/SMX especially in AIDs Anticonvulsants (lamotrigine, carbamazepine) Allopurinol
DRESS DIHS	2-6 weeks		face, upper trunk, upper extremities morbilliform → diffuse edematous	TMP/SMX in slow acetylators Anticonvulsants • Mostly aromatic anticonvulsants like phenytoin, carbamazepine, and phenobarbital ○ Carbamazepine in Northern Europeans HLA B3101 ○ Unable to detoxify arene oxide metabolites in phenobarbital, phenytoin, carbamazepine • Lamotrigine when coadministered with valproate • <i>Switch to valproic acid or levetiracetam, which are safe non-aromatic non-arene oxide producing anticonvulsants.</i> Allopurinol in Han Chinese (HLA B5801) and renal failure Minocycline in glutathione S transferase deficiency Dapsone concomitant hemolysis and methHb Abacavir in HIV Nevirapine
AGEP	<4 days *only 1 exposure needed		face, intertriginous → diffuse	B-lactams (penicillin, ampicillin, cephalosporin) Macrolides (erythromycin, azithromycin) Calcium channel blockers (diltiazem) Antimalarials (hydrochlorothiazide) Terbinafine Post-operative antibiotics (1 exposure!)
Phototoxic				Tetracyclines (demeclocycline > doxycycline >>

			minocycline) NSAIDs (naproxen, piroxicam) Fluoroquinolones Amiodarone Psoralen Phenothiazines (chlorpromazine, prochlorperazine) Voriconazole St. John's wort HCTZ
Pseudo-porphyrria			NSAIDs (naproxen, nalidixic acid) Thiazides (HCTZ) Voriconazole Furosemide Tetracyclines Tanning beds UVA
LCV	1-3 weeks (7-10 days)	3-4 weeks	B-lactams (penicillins, cephalosporins) Sulfonamides Minocycline Fluoroquinolones NSAIDs Aspirin Montelukast Propylthiouracil Hydrochlorothiazide, hydralazine TNFα inhibitors , methotrexate, rituximab OCPs G-CSF Isotretinoin Levamisole tainted cocaine Allopurinol Radiocontrast media

• Medication-induced drug reactions:

Rash	Drugs
Pityriasis rosea	ACE inhibitors (captopril, metoprolol, gold) B-blockers (propranolol, metoprolol) gold NSAIDs Bismuth Barbiturates (phenobarbital) Isotretinoin Clonidine

	Metronidazole
Erythroderma	Allopurinol Sulfa drugs (TMP-SMX) Antiepileptics (phenytoin, carbamazepine) HAART Dapsone Isoniazid Minocycline
Pemphigus vulgaris	ACE inhibitors (captopril > enalapril, lisinopril) D-penicillamine Gold Phenobarbital Beta-lactams (amoxicillin) Nifedipine B-blockers (metoprolol) Piroxicam <i>Non-thiols that cause acantholysis through immune mechanisms.</i>
Pemphigus foliaceus	D-penicillamine #1 ACE inhibitors (captopril > enalapril, lisinopril) ARBs (losartan) <i>Thiols directly cause acantholysis.</i> <i>More typical than drug-induced pemphigus vulgaris.</i>
Linear IgA bullous dermatosis	Vancomycin #1 ACE inhibitors (captopril > enalapril, lisinopril) Furosemide B-lactams Cephalosporins NSAIDs Phenytoin Sulfonamides Lithium
Erythema multiforme	OCPs NSAIDs Antibiotics (sulfonamides) Antiepileptics TNFa inhibitors (adalimumab, etanercept, infliximab)
SJS/TEN	Carbamazepine (HLA-B 1502, 3101) Abacavir (HLA-B 5701) Allopurinol (HLA-B 5801)

	Anticonvulsants (lamotrigine,* carbamazepine, phenytoin, phenobarbital, clobazam, NOT valproic acid) Antibiotics (sulfonamides TMP-SMX,* penicillin, cephalosporins, minocycline, quinolones, antifungals terbinafine) NSAIDs NNRTIs (nevirapine, abacavir, efavirenz, etravirine) Contrast medium <i>Lamotrigine does not cross-react with other aromatics. TMP-SMX does not cross-react with non-antibiotic sulfonamides like HCTZ or diabetes medications.</i>
Fixed drug eruption	Sulfonamides (TMP-SMX)** (#1 genitalia) NSAIDs (naproxen, dipyron)** (#1 lips, trunk, extremities) Tetracyclines Phenolphthalein (laxative) Barbiturates ASA OCPs Carbamazepine Barbiturates Metronidazole Pseudoephedrine (#1 non-pigmented) NSAIDs Acetaminophen (paracetamol) Tetrahydrozoline
Photo-onycholysis	Tetracycline Photodynamic therapy Fluoroquinolones Taxanes (paclitaxel) Psoralens
Lichen planus	Hydrochlorothiazide Beta-blockers (propranolol, metoprolol) ACE inhibitors (captopril) Allopurinol Antimalarials (hydroxychloroquine, chloroquine, quinacrine) TNFa inhibitors (adalimumab, infliximab, etanercept) D-penicillamine Gold Mercury amalgam Copper Quinidine CCBs (thiazides) <i>chronic eczematous eruption in elderly</i>

	NSAIDs Hepatitis B vaccine (oral and bullous) Metformin
Bullous pemphigoid	Gliptins (sitagliptin) #1 Furosemide ACE inhibitors (captopril, enalapril) PD1 inhibitors (pembrolizumab, nivolumab) PDL1 inhibitors (atezolizumab, avelumab, dumalumab) CTLA4 inhibitors (ipilimumab) Cephalosporins B-lactams D-penicillamine Sulfasalazine Spironolactone TNFa inhibitors NSAIDs Gold Anticonvulsants SSKI Bumetanide Phototherapy
Pseudoporphyria	NSAIDs (naproxen, nalidixic acid) Thiazide diuretics (hydrochlorothiazide) Furosemide Tetracyclines (doxycycline) OCPs
Acute generalized exanthematous pustulosis	B-lactams (amoxicillin)* Calcium channel blockers (diltiazem) Macrolides (erythromycin, azithromycin) Pristinamycin Terbinafine Hydroxychloroquine Carbamazepine Acetaminophen Metronidazole
Phototoxic drug eruption	Tetracycline (doxycycline) Fluoroquinolones Psoralens NSAIDs Diuretics (furosemide)
Bromoderma, iododerma	Bromide Iodine-containing (amiodarone)

	Radiographic contrast media		
Palmoplantar erythrodysesthesia	Cytarabine for AML Doxorubicin Capecitabine, 5 fluorouracil Multikinase inhibitors (sorafenib, sunitinib, busulfan, taxanes, clofarabine, pralatrexate)		
Subacute cutaneous lupus erythematosus +anti-Ro/SSA	Terbinafine Hydrochlorothiazide* (most common) ACE inhibitors (captopril) NSAIDs (piroxicam) Griseofulvin Calcium channel blockers (nifedipine) Beta-blockers Antihistamines Proton pump inhibitors (omeprazole) Docetaxel TNFa inhibitors (etanercept) D-penicillamine Penicillin Azathioprine Glyburide <i>"THANG" antifungals and antihypertensives</i>		
Systemic lupus erythematosus	Procainamide (slow acetylators) Hydralazine (slow acetylators) Methyldopa Isoniazid D-penicillamine Minocycline TNFa inhibitors (infliximab > etanercept > adalimumab) Quinidine Phenytoin Chlorpromazine Propylthiouracil Methimazole PUVA TMP-SMX		
	anti-histone	p-ANCA	anti-dsDNA
	Procainamide Hydralazine	Minocycline Hydralazine	TNFa inhibitors (infliximab >

	Methyldopa Isoniazid Chlorpromazine Propylthiouracil Sulfonamides Methimazole Propylthiouracil etanercept > adalimumab) D-penicillamine
Dermatomyositis	Hydroxyurea-induced DM - Usually arises after 5 years of being on medication (long latency) - Always amyopathic (NO muscle involvement); CK - - ANA- Non-hydroxyurea induced DM - Drugs Statins - D-penicillamine - Cyclophosphamide - BCG vaccine TNFa inhibitors PPIs (omeprazole) - Usually arises within 2 months of being on medication - Myopathic (muscle involvement); CK + - ANA+/-
Interstitial granulomatous drug eruption	CCBs (nifedipine, diltiazem) ACE inhibitors (captopril, enalapril) TNFa inhibitors (adalimumab, etanercept, infliximab) in RA Statins HCTZ Furosemide B-blockers Antihistamines Anakinra Thalidomide
Sarcoidosis	INFa, ribavirin in hepatitis C HAART in HIV TNFa inhibitors Vemurafenib Ipilimumab Alemtuzumab
Eruptive xanthomas	Primary: Type 1, 4, 5 hyperlipoproteinemia Secondary:

	Oral retinoids (acitretin, isotretinoin, bexarotene) Protease inhibitors (indinavir) Olanzapine Estrogen replacement
Sweet's syndrome	G-CSF GM-CSF ATRA TMP/SMX Minocycline OCPs Furosemide Hydralazine
Acne	Anabolic steroids Androgens (testosterone) Corticosteroids Halogens (iodide, bromide) Isoniazid OCPs with androgen-like progestins Lithium Phenytoin Vitamins B2, B6, B12 EGFR inhibitors (cetuximab, panitumumab) Tyrosine kinase inhibitors (gefitinib, erlotinib, lapatinib) mTOR inhibitors (sirolimus, tacrolimus) Multikinase inhibitors (sunitinib, sorafenib) MEK inhibitors (trametinib) BRAF inhibitors (vemurafenib) Treat with oral doxycycline starting the day of EGFR inhibitor treatment and do not use irritating topicals like retinoids or benzoyl peroxide.
Eosinophilic granulomatosis with polyangiitis	Leukotriene inhibitors (montelukast) especially p-ANCA+ anti-IgE antibodies (omalizumab)
Polyarteritis nodosa	Minocycline
Acquired trichomegaly	Cyclosporine Phenytoin Minoxidil EGFR inhibitors (cetuximab) Topiramate Tacrolimus

	Interferon a Danazol Prostaglandin F2a Topical latanoprost/bimatoprost
Psoriasis	TNFa inhibitors
Reticular erythematous mucinosis	OCPs

- Penicillamine can cause drug-induced pemphigus vulgaris, lichenoid drug eruption, elastosis perforans serpiginosa, and pseudoxanthoma elasticum.
- TNFa inhibitors can cause small or medium vessel vasculitis, interstitial granulomatous dermatitis, lupus erythematosus (systemic, cutaneous), new-onset psoriasiform eruption, and palmoplantar pustulosis.
- Methotrexate can cause accelerated rheumatoid nodulosis (hands) and methotrexate-induced papular eruption favoring extremities.
- Tyrosine kinase inhibitors

Drug	Reaction
BRAF inhibitors (vemurafenib)	SCC/KA Keratosis pilaris Erythema nodosum Phototoxicity Changing nevi <i>All reduced with addition of MEK inhibitor</i>
EGFR inhibitors (cetuximab)	Acneiform Paronychia Pyogenic granulomas Hair changes
MEK inhibitors (trametinib) HER2 (trastuzumab) BTK (ibrutinib)	Acneiform Paronychia Pyogenic granulomas Hair changes Bleeding, petechiae, and purpuric eruptions (ibrutinib)
BCR/Abl (imatinib)	Keratosis pilaris Pigmentary changes Periorbital edema
VEGF/PDGF (sorafenib)	Hand-foot-skin reaction

	Genital eruptions Splinter hemorrhages Pigmentary changes (sunitinib yellowish)
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- Immune checkpoint inhibitors
 - PD1 inhibitors
 - Pembrolizumab
 - Nivolumab
 - PDL1 inhibitors
 - Atezolizumab
 - Avelumab
 - Dumalumab

Lichenoid drug eruption	Pruritus, eczema, psoriasiform
Vitiligo	Exanthems
Bullous pemphigoid	SJS/TEN
Sarcoidosis	Connective tissue diseases (SCLE)

- PCP - phenytoin, carbamazepine, and phenobarbital - are aromatic hydrocarbons that can cause DRESS.