
Supplementary information

**Clinical translation of long-acting drug
delivery formulations**

In the format provided by the
authors and unedited

Clinical translation of long-acting drug delivery formulations Supplementary Materials

Wei Li^{1,2}, Jie Tang³, Dennis Lee⁴, Thomas R. Tice⁵, Steven P. Schwendeman³, Mark R. Prausnitz^{1*}

1 School of Chemical & Biomolecular Engineering, Georgia Institute of Technology, Atlanta, GA, USA

2 School of Pharmaceutical Sciences, Wuhan University, Wuhan, Hubei 430071, China

3 Department of Pharmaceutical Sciences and The Biointerfaces Institute, University of Michigan, Ann Arbor, MI, USA

4 Bill & Melinda Gates Foundation, Seattle, WA, USA

5 Evonik Corporation, Birmingham, AL, USA

* To whom correspondence should be addressed: prausnitz@gatech.edu

Table S1a. List of FDA-approved products using long-acting delivery formulations, Part 1.[†]

Drug name	Product name	Mechanism of controlled release	Duration of delivery	Pharmaceutical Form	Route of administration	Inactive ingredient	Inactive Ingredient class
Abarelix	Plenaxis [®]	Dissolution-based	Monthly	Suspension	Intramuscular	Carboxymethylcellulose	Celluloses
Afamelanotide	Scenesse [®]	Biodegradation-preformed	2 months	Implant	Subcutaneous	Poly(DL-lactide-co-glycolide)	Polyesters
Anecortave acetate	Retaane [®]	Dissolution-based	6 months	Suspension	Intraocular injection	Dodecahydrate tyloxapol Sodium chloride Sodium phosphate, dibasic Sodium phosphate, monobasic	Polyether alcohols Salts Salts Salts
Aripiprazole	Abilify [®] Maintena [®]	Dissolution-based	Monthly	Suspension	Intramuscular	Carboxymethylcellulose sodium Mannitol Sodium phosphate monobasic Sodium hydroxide	Celluloses Sugar alcohols Salts Alkalies
Aripiprazole lauroxil	Aristada [®]	Dissolution-based	1, 2 months	Suspension	Intramuscular	Sorbitan monolaurate Polysorbate 20 Sodium chloride Sodium phosphate monobasic Sodium phosphate dibasic anhydrous Water	Esters Polyethers Salts Salts Salts Water
Bimatoprost	Durysta [®]	Biodegradation-preformed	3 months	Implant	Intracameral	Poly(DL-lactide) Poly(DL-lactide) acid end Poly(DL-lactide-co-glycolide) Polyethylene glycol	Polyesters Polyesters Polyesters Polyethers
Buprenorphine	Probuphine [®]	Non-biodegradable	6 months	Implant	Subdermal	Poly(ethylene-vinyl acetate) copolymer	Polyolefins
Buprenorphine	Sublocade [®]	Biodegradation-formed in situ	Monthly	Solution	Subcutaneous	Poly-(DL-lactide-co-glycolide) N-methyl-2-pyrrolidone	Polyesters Solvents
Degarelix	Firmagon [®]	Dissolution-based	Monthly	Solution	Subcutaneous	Mannitol Water	Sugar alcohols Water
Dexamethasone	Ozurdex [®]	Biodegradation-preformed	6 months	Implant	Intraocular	Ester terminated 50:50 poly(DL-lactide-co-glycolide) Acid terminated 50:50 poly DL-lactide-co-glycolide	Polyesters Polyesters
Dexamethasone	Dextenza [®]	Hydrogel	Monthly	Insert	Intracanalicular	4-arm polyethylene glycol (PEG) N-hydroxysuccinimidyl glutarate (20K); Trilysine acetate N-hydroxysuccinimide-fluorescein	Polyethers Peptides Amines

						Sodium phosphate dibasic Sodium phosphate monobasic Water	Salts Salts Water
Dexamethasone	Dexycu [®]	Dissolution-based	Monthly	Suspension	Intraocular	Acetyl triethyl citrate	Esters
Estradiol valerate	Delestrogen [®]	Dissolution-based	Monthly	Injectable	Intramuscular	Benzyl benzoate Benzyl alcohol Castor oil	Benzoate esters Alcohols Lipids
Etonogestrel/ethinyl estradiol	Nuvaring [®]	Non-biodegradable	Monthly	Vaginal ring	Vaginal	Ethylene vinylacetate copolymers Magnesium stearate	Polyolefins Salts
Etonogestrel	Implanon [®]	Non-biodegradable	3 years	Implant	Subdermal	Ethylene vinyl acetate copolymer	Polyolefins
Etonogestrel	Nexplanon [®]	Non-biodegradable	3 years	Implant	Subdermal	Ethylene vinyl acetate Barium sulfate	Polyolefins Salts
Fluocinolone acetonide	Iluvien [®]	Non-biodegradable	3 year	Implant	Intraocular	Polyimide tube Polyvinyl alcohol Silicone adhesive Water	Polyimides Polyvinyls Silicones Water
Fluocinolone acetonide	Retisert [®]	Non-biodegradable	30 months	Implant	Intraocular	Microcrystalline cellulose Polyvinyl alcohol Magnesium stearate Silicone elastomer	Celluloses Polyvinyls Salts Silicones
Fluocinolone acetonide	Yutiq [®]	Non-biodegradable	3 years	Implant	Intraocular	Polyimide tube Polyvinyl alcohol Silicone adhesive Water	Polyimides Polyvinyls Silicones Water
Fluphenazine decanoate	Prolixin [®]	Dissolution-based	1.5 months	Solution	Intramuscular	Sesame oil Benzyl alcohol	Lipids Alcohols
Fulvestrant	Faslodex [®]	Dissolution-based	Monthly	Injectable	Intramuscular	Ethanol Benzyl alcohol Benzyl benzoate Castor oil	Alcohols Alcohols Benzoate esters Lipids
Ganciclovir	Vitrasert [®]	Non-biodegradable	5 -8 months	Implant	Intraocular	Magnesium stearate (0.25%) Polyvinyl alcohol Ethylene vinyl acetate polymers	Salts Polyvinyls Polyolefins
Goserelin acetate	Zoladex [®]	Biodegradation-preformed	1, 3 months	Implant	Subcutaneous	Lactide/glycolide copolymer	Polyesters

Haloperidol decanoate	Haldol Depot®	Dissolution-based	Monthly	Solution	Intramuscular	Sesame oil	Lipids
Histrelin acetate	Vantas®	Non-biodegradable	12 months	Implant	Subdermal	Stearic acid 2-hydroxyethyl methacrylate 2-hydroxypropyl methacrylate Trimethylolpropane trimethacrylate Benzoin methyl ether Perkadox-16 Triton X-100	Acids Esters Esters Esters Ethers Peroxides Polyethers
Histrelin acetate	Supprelin LA®	Non-biodegradable	12 months	Implant	Subcutaneous	2-hydroxyethyl methacrylate 2-hydroxypropyl methacrylate Trimethylolpropane trimethacrylate Benzoin methyl ether Perkadox-16 Triton X-100	Esters Esters Esters Ethers Peroxides Polyethers
Lanreotide	Somatuline Depot®	Dissolution-based	Monthly	Solution	Subcutaneous	Acetic acid Water	Acids Water
Leuprolide acetate	Eligard®	Biodegradation-formed in situ	Monthly or every 3, 4 or 6 months	Suspension	Subcutaneous	Poly (DL-lactide-co-glycolide) polymer N-methyl-2-pyrrolidone (NMP)	Polyesters Solvents
Leuprolide acetate	Lupron Depot®	Biodegradation-preformed	1,3,4,6 months	Suspension	Intramuscular	Glycolic acids copolymer D-mannitol Carboxymethylcellulose sodium Polysorbate 80 Water Glacial acetic acid	Polyesters Sugar alcohols Celluloses Polyethers Water Acids
Leuprolide acetate	Lupron Depot-PED®	Biodegradation-preformed	1, 3 months	Suspension	Intramuscular	Purified gelatin DL-lactic and glycolic acids copolymer D-mannitol Carboxymethylcellulose sodium Polysorbate 80 Water Glacial acetic acid	Proteins Polyesters Sugar alcohols Celluloses Polyethers Water Acids
Leuprolide acetate	Lutrate Depot®	Biodegradation-preformed	3 months	Suspension	Intramuscular	Poly(lactic acid) Triethylcitrate Polysorbate 80 Mannitol Carmellose sodium	Polyesters Esters Polyethers Sugar alcohols Celluloses

Leuprolide acetate	Viadur [®]	Non-biodegradable	1 year	Implant	Subcutaneous	Polyurethane Polyethylene Titanium alloy Sodium chloride Sodium carboxymethyl cellulose Povidone Magnesium stearate Water Polyethylene glycol Silicone medical fluid	Polyurethanes Polyolefins Metals Salts Celluloses Polyvinyls Salts Water Polyethers Silicones
Leuprolide acetate	Fensolvi [®]	Biodegradation- formed in situ	6 months	Suspension	Subcutaneous	Poly (DL-lactide-coglycolide) N-methyl-2-pyrrolidone	Polyesters Solvents
Leuprolide acetate*	Lupaneta Pack [®]	Biodegradation- preformed	Every 1, 3 months	Suspension	Intramuscular	Poly(lactic acid) D-mannitol Carboxymethylcellulose sodium Polysorbate 80 Water Glacial acetic acid Gelatin	Polyesters Sugar alcohols Celluloses Polyethers Water Acids Proteins
Levonorgestrel	Skyla [®]	Non-biodegradable	3 years	Intrauterine device	Intrauterine	Polydimethylsiloxane Silver Colloidal silica Polyethylene Barium sulfate	Silicones Metals Silicon dioxides Polyolefins Salts
Levonorgestrel	Kyleena [®]	Non-biodegradable	5 years	Intrauterine device	Intrauterine	Polyethylene Polydimethylsiloxane Colloidal silica Silver Barium sulfate Polypropylene	Polyolefins Silicones Silicon dioxides Metals Salts Polyolefins
Levonorgestrel	Mirena [®]	Non-biodegradable	5 years	Intrauterine device (IUD)	Intrauterine	Polydimethylsiloxane Polyethylene Barium sulfate	Silicones Polyolefins Salts
Levonorgestrel	Liletta [®]	Non-biodegradable	6 years	Intrauterine device (IUD)	Intrauterine	Polydimethylsiloxane	Silicones
Levonorgestrel	Jadelle [®]	Non-biodegradable	5 years	Implant	Subdermal	Polydimethylsiloxane Anhydrous colloidal silica	Silicones Silicon dioxides

Levonorgestrel	Norplant [®]	Non-biodegradable	5 years	Implant	Subdermal	Dimethylsiloxane/methylvinylsiloxane copolymer	Silicones
Medroxyprogesterone acetate and estradiol cypionate	Lunelle [®]	Dissolution-based	Monthly	Suspension	Intramuscular	Methylparaben Polyethyleneglycol Polysorbate 80 Propylparaben Sodium chloride Water	Parabens Polyethers Polyethers Parabens Salts Water
Medroxyprogesterone acetate	Depo-Provera [®]	Dissolution-based	3 months	Suspension	Intramuscular	Hydrochloric acid Polyethylene glycol 3350 Methylparaben Polysorbate 80 Propylparaben Sodium chloride Sodium hydroxide Water	Acids Polyethers Parabens Polyethers Parabens Salts Alkalies Water
Medroxyprogesterone acetate	Depo-SubQ [®] Provera 104 [®]	Dissoluton-based	3 months	Suspension	Subcutaneous	Methylparaben Polyethylene glycol Polysorbate 80 Propylparaben Sodium chloride Water	Parabens Polyethers Polyethers Parabens Salts Water
Mometasone furoate	Propel [®]	Biodegradation-preformed	Monthly	Implant	Contour sinus	Poly(DL-lactide-co-glycolide) Polyethylene glycol	Polyesters Polyethers
Mometasone furoate	Propel [®] mini	Biodegradation-preformed	Monthly	Implant	Contour sinus	Poly(DL-lactide-co-glycolide) Polyethylene glycol	Polyesters Polyethers
Mometasone furoate	Sinuva [®]	Biodegradation-preformed	3 months	Implant	Ethmoid sinus	Poly(DL-lactide-co-glycolide) Polyethylene glycol	Polyesters Polyethers
Naltrexone	Vivitrol [®]	Biodegradation-preformed	Monthly	Suspension	Subcutaneous	Poly(lactide-co-glycolide) Carboxymethylcellulose sodium Polysorbate 20 Sodium chloride Water	Polyesters Celluloses Polyethers Salts Water
Octreotide acetate	Sandostatin [®] LAR [®]	Biodegradation-preformed	Monthly	Suspension	Intramuscular	Poly(DL-lactide-co-glycolide) polymer Mannitol Carboxymethylcellulose sodium Water	Polyesters Sugar alcohols Celluloses Water
Olanzapine pamoate	Zyprexa [®] Relprevv [®]	Dissolution-based	2 to 4 weeks	Suspension	Intramuscular	Carboxymethylcellulose sodium Mannitol Polysorbate 80	Celluloses Sugar alcohols Polyethers

						Sodium hydroxide Water	Alkalies Water
Paliperidone palmitate	Invega [®] Sustenna	Dissolution-based	Monthly	Suspension	Intramuscular	Polysorbate 20 Poly(ethylene glycol) 4000 Citric acid monohydrate Disodium hydrogen phosphate anhydrous Sodium dihydrogen phosphate monohydrate Sodium hydroxide Water	Polyethers Polyethers Acids Salts Salts Alkalies Water
Paliperidone palmitate	Invega Trinza [®]	Dissolution-based	3 months	Suspension	Intramuscular	Polysorbate 20 Poly(ethylene glycol) 4000 Citric acid monohydrate Sodium dihydrogen phosphate monohydrate Sodium hydroxide Water	Polyethers Polyethers Acids Salts Alkalies Water
Pasireotide	Signifor LAR [®]	Biodegradation- preformed	Monthly	Suspension	Intramuscular	Poly(DL-lactide-co-glycolide) Mannitol Carboxymethylcellulose sodium Poloxamer 188 Water	Polyesters Sugar alcohols Celluloses Polyethers Water
Progesterone	Progestasert [®]	Non-biodegradable	12 months	Intrauterine device	Intrauterine	Barium sulfate Silicone fluid Ethylene vinyl acetate copolymer	Salts Silicones Polyolefins
Risperidone	Perseris [®]	Biodegradation- formed in situ	Monthly	Solution	Subcutaneous (abdominal)	Poly(DL-lactide-co-glycolide) N-methyl-2-pyrrolidone	Polyesters Solvents
Segesterone acetate and ethinyl estradiol	Annovera [®]	Non-biodegradable	12 months	Vaginal ring	Vaginal	Silicone elastomer Titanium dioxide Dibutyltin dilaurate Silicone medical adhesive	Silicones Metals Organotins Silicones
Somatropin	Nutropin Depot [®]	Biodegradation- preformed	Monthly	Suspension	Subcutaneous	Poly(lactide-co-glycolide) Carboxymethylcellulose Polysorbate 20 Sodium chloride Water	Polyesters Celluloses Polyethers Salts Water
Testosterone	Testopel [®]	Dissolution-based	3-6 months	Pellets	Subcutaneous	Stearic acid NF Polyvinyl pyrrolidone	Acids Polyvinyls
Testosterone enanthate	Delatestryl [®]	Dissolution-based	Monthly	Injectable	Intramuscular	Chlorobutanol Sesame oil	Alcohols Lipids

Testosterone undecanoate	Aveed [*]	Dissolution-based	Monthly	Solution	Intramuscular	Castor oil Benzyl benzoate	Lipids Benzoate esters
Triamcinolone acetonide	Zilretta [*]	Biodegradation-preformed	3 months	Suspension	Intra-articular	Poly(DL-lactide-co-glycolide) 75:25 (PLGA 75:25) Sodium Chloride (NaCl) Carboxymethylcellulose Sodium (CMCS) Polysorbate 80	Polyesters Salts Celluloses Polyethers
Triamcinolone acetonide	Triesence [*]	Dissolution-based	2-3 months	Suspension	Intraocular	Polysorbate 80 Carboxymethylcellulose sodium Sodium chloride Potassium chloride Calcium chloride Magnesium chloride Sodium acetate Sodium citrate Water	Polyethers Celluloses Salts Salts Salts Salts Salts Water
Triptorelin pamoate	Trelstar [*]	Biodegradation-preformed	Monthly or every 3, 6 months	Suspension	Intramuscular	Poly(DL-lactide-co-glycolide) Mannitol Carboxymethylcellulose sodium Polysorbate 80	Polyesters Sugar alcohols Celluloses Polyethers
Triptorelin	Triptodur [*]	Biodegradation-preformed	6 months	Suspension	Intramuscular	Poly(DL-lactide-co-glycolide) Mannitol Carboxymethylcellulose sodium Polysorbate 80	Polyesters Sugar alcohols Celluloses Polyethers
* Also contains norethindrone acetate administered daily by mouth as a tablet.							

† The data were obtained from product package insert labels (<https://www.accessdata.fda.gov/scripts/cder/daf/>).

Table S1b. List of FDA-approved products using long-acting delivery formulations, Part 2.[†]

Drug name	Product name	Active indication	Indication category	Approval year	Status in the US	Company name
Abarelix	Plenaxis [®]	Hormone-dependent prostate cancer	Oncology	2003	Discontinued	Praecis Pharmaceuticals
Afamelanotide	Scenesse [®]	Erythropoietic protoporphyria	Hematology	2019	Marketed	Clinuvel Pharmaceuticals
Anecortave acetate	Retaane [®]	Wet age-related macular degeneration	Ophthalmology	2005	Discontinued	Alcon
Aripiprazole	Abilify Maintena [®]	Schizophrenia	Psychiatry	2013	Marketed	Otsuka
Aripiprazole lauroxil	Aristada [®]	Schizophrenia	Psychiatry	2015	Marketed	Alkermes
Bimatoprost	Durysta [®]	Reduction of intraocular pressure	Ophthalmology	2020	Marketed	Allergan
Buprenorphine	Probuphine [®]	Opiate dependence	Addiction medicine	2016	Discontinued	Titan Pharmaceuticals
Buprenorphine	Sublocade [®]	Opiate dependence	Addiction medicine	2017	Marketed	Indivior
Degarelix	Firmagon [®]	Hormone-dependent prostate cancer; Hormone refractory prostate cancer; Metastatic prostate cancer	Oncology	2008	Marketed	Ferring Pharmaceuticals
Dexamethasone	Ozurdex [®]	Ocular inflammation; Diabetic macular edema; Macular edema; Retinal venous occlusion; Uveitis	Ophthalmology;	2009	Marketed	Oculex Pharmaceuticals
Dexamethasone	Dextenza [®]	Allergic conjunctivitis; Ocular inflammation; Ocular pain	Ophthalmology	2018	Marketed	Ocular Therapeutix

Dexamethasone	Dexycu [®]	Ocular inflammation	Ophthalmology	2018	Marketed	Icon Bioscience
Estradiol valerate	Delestrogen [®]	Hypoestrogenism; advanced prostate carcinoma	Endocrinology; Oncology;	1954	Marketed	Par Pharmaceutical
Etonogestrel/ethinyl estradiol	Nuvaring [®]	Estrogen deficiency; Hormone deficiency	Endocrinology	2001	Marketed	Merck
Etonogestrel	Implanon [®]	Female contraception	Obstetrics/Gynecology	2006	Discontinued	Organon
Etonogestrel	Nexplanon [®]	Female contraception	Obstetrics/Gynecology	2011	Marketed	Merck
Fluocinolone acetonide	Iluvien [®]	Diabetic macular edema; Uveitis	Ophthalmology	2014	Marketed	EyePoint Pharmaceuticals
Fluocinolone acetonide	Retisert [®]	Uveitis	Ophthalmology	2005	Marketed	pSivida
Fluocinolone acetonide	Yutiq [®]	Non-infectious posterior segment uveitis	Ophthalmology	2018	Marketed	EyePoint Pharmaceuticals
Fluphenazine decanoate	Prolixin [®]	Schizophrenia	Psychiatry	1974	Discontinued	Mylan
Fulvestrant	Faslodex [®]	Fallopian tube cancer; Metastatic breast cancer; Metastatic ovary cancer; Peritoneal tumor; Precocious puberty	Oncology, Endocrinology	2002	Marketed	AstraZeneca
Ganciclovir	Vitraser [®]	Cytomegalovirus retinitis	Ophthalmology	1996	Discontinued	Chiron Vision
Goserelin acetate	Zoladex [®]	Breast tumor; Endometriosis; Hormone-dependent prostate cancer; Salivary gland cancer; Uterine fibroids;	Oncology, Endocrinology	1989	Marketed	AstraZeneca

		Uterus tumor				
Haloperidol decanoate	Haldol Depot®	Schizophrenia	Psychiatry	1986	Marketed	Janssen
Histrelin acetate	Vantas®	Hormone-dependent prostate cancer; Precocious puberty	Oncology, Endocrinology	2004	Marketed	Valera Pharmaceuticals
Histrelin acetate	Supprelin LA®	Central precocious puberty	Endocrinology	2007	Marketed	Endo Pharmaceuticals
Lanreotide	Somatuline Depot®	Acromegalic	Endocrinology	2007	Marketed	Ipsen Pharma
Leuprolide acetate	Eligard®	Hormone-dependent prostate cancer	Oncology	2002	Marketed	Tolmar
Leuprolide acetate	Lupron Depot®	Advanced prostatic cancer	Oncology	1989	Marketed	Takeda
Leuprolide acetate	Lupron Depot-PED®	Central precocious puberty	Endocrinology	1993	Marketed	Takeda
Leuprolide acetate	Viadur®	Advanced prostate cancer	Oncology	2000	Discontinued	Alza
Leuprolide acetate	Lutrate Depot®	Advanced prostatic cancer	Oncology	2018	Discontinued	GP Pharm
Leuprolide acetate	Fensolvi®	Central precocious puberty	Endocrinology	2020	Marketed	Tolmar
Leuprolide acetate*	Lupaneta Pack®	Pain due to endometriosis	Endocrinology	2012	Marketed	AbbVie
Levonorgestrel	Skyla®	Female contraception	Obstetrics/Gynecology	2013	Marketed	Bayer HealthCare Pharmaceuticals
Levonorgestrel	Kyleena®	Dysmenorrhea; Endometrioid carcinoma; Female contraception; Hypermenorrhea; Menorrhagia	Obstetrics/Gynecology, Oncology	2016	Marketed	Schering AG

Levonorgestrel	Mirena®	Female contraception; Heavy menstrual bleeding	Obstetrics/Gynecology	2000	Marketed	Bayer
Levonorgestrel	Liletta®	Female contraception	Obstetrics/Gynecology	2015	Marketed	Medicines360
Levonorgestrel	Jadelle®	Female contraception	Obstetrics/Gynecology	1996	Discontinued	Bayer
Levonorgestrel	Norplant®	Female contraception	Obstetrics/Gynecology	1990	Discontinued	Wyeth-Ayerst
Medroxyprogesterone acetate	Depo-Provera®	Female contraception	Obstetrics/Gynecology	1992	Marketed	Upjohn
Medroxyprogesterone acetate	Depo-SubQ Provera 104®	Female contraception; endometriosis	Obstetrics/Gynecology; Endocrinology	2004	Marketed	Pfizer
Medroxyprogesterone acetate and estradiol cypionate	Lunelle®	Female contraception	Obstetrics/Gynecology	2000	Discontinued	Upjohn
Mometasone furoate	Propel®	Sinusitis	Ear, nose and throat	2011	Marketed	Intersect ENT
Mometasone furoate	Propel® Mini	Sinusitis	Ear, nose and throat	2012	Marketed	Intersect ENT
Mometasone furoate	Sinuva®	Treatment of nasal polyps	Ear, nose and throat	2017	Marketed	Intersect ENT
Naltrexone	Vivitrol®	Alcoholism; Opiate dependence	Addiction medicine	2006	Marketed	Alkermes
Octreotide acetate	Sandostatin LAR®	Acromegaly; Carcinoma; Diarrhea; Gigantism; Neuroendocrine tumor	Endocrinology, Oncology	1998	Marketed	Novartis
Olanzapine pamoate	Zyprexa Relprevv®	Schizophrenia	Psychiatry	2009	Marketed	Eli Lilly
Paliperidone	Invega Sustenna®	Schizoaffective disorder;	Psychiatry	2009	Marketed	Johnson & Johnson

palmitate		Schizophrenia				
Paliperidone palmitate	Invega Trinza®	Schizophrenia	Psychiatry	2015	Marketed	Janssen
Pasireotide	Signifor LAR®	Acromegaly; Cushing's disease; Gigantism	Endocrinology	2014	Marketed	Novartis
Progesterone	Progestasert®	Female contraception	Gynecology	1976	Discontinued	Alza
Risperidone	Perseris®	Schizophrenia	Psychiatry	2018	Marketed	Indivior
Segesterone acetate and ethinyl estradiol	Annovera®	Female contraception	Obstetrics/Gynecology	2018	Marketed	Population Council
Somatropin	Nutropin Depot®	Treatment of children growth failure	Endocrinology	1999	Discontinued	Genentech
Testosterone	Testopel®	Male hypogonadism	Endocrinology	1972	Marketed	Bartor
Testosterone enanthate	Delatestryl®	Male hypogonadism	Endocrinology	1953	Discontinued	Endo Pharmaceuticals
Testosterone undecanoate	Aveed®	Male hypogonadism	Endocrinology	2014	Marketed	Bayer Schering Pharma AG
Triamcinolone acetonide	Zilretta®	Pain; Synovitis	Rheumatology	2017	Marketed	Flexion
Triptorelin pamoate	Trelstar®	Breast tumor; Endometriosis; Female infertility; Hormone-dependent prostate cancer; Metastatic prostate cancer; Precocious puberty; Sexual deviation	Oncology, Endocrinology, Obstetrics/Gynecology	2000	Marketed	Debiopharm
Triptorelin	Triptodur®	Hormone-dependent prostate cancer	Oncology	2017	Marketed	Debiopharm

Triamcinolone acetanide	Triesence®	Sympathetic ophthalmia; Temporal arteritis; Ocular inflammation	Ophthalmology	2007	Marketed	Alcon
* Also contains norethindrone acetate administered daily by mouth as a tablet.						

† The data were obtained from product package insert labels (<https://www.accessdata.fda.gov/scripts/cder/daf/>).

Table S2. FDA-approved products using long-acting delivery formulations for local delivery at site of administration[†]

Drug name	Product name	Mechanism of controlled release	Duration of delivery	Pharmaceutical Form	Route of administration	Active indication	Indication category
Anecortave acetate	Retaane®	Dissolution-based	6 months	Suspension	Intraocular	Wet age-related macular degeneration	Ophthalmology
Bimatoprost	Durysta®	Biodegradation-preformed	3 months	Implant	Intracameral	Reduction of intraocular pressure	Ophthalmology
Dexamethasone	Ozurdex®	Biodegradation-preformed	6 months	Implant	Intraocular	Ocular inflammation; Diabetic macular edema; Macular edema; Retinal venous occlusion; Uveitis	Ophthalmology;
Dexamethasone	Dextenza	Hydrogel	Monthly	Insert	Intracanalicular	Allergic conjunctivitis; Ocular inflammation; Ocular pain	Ophthalmology
Dexamethasone	Dexycu®	Dissolution-based	<3 months	Suspension	Intraocular	Ocular inflammation	Ophthalmology
Fluocinolone acetonide	Iluvien®	Non-biodegradable	3 year	Implant	Intraocular	Diabetic macular edema; Uveitis	Ophthalmology
Fluocinolone acetonide	Retisert®	Non-biodegradable	30 months	Implant	Intraocular	Uveitis	Ophthalmology
Fluocinolone acetonide	Yutiq®	Non-biodegradable	3 years	Implant	Intraocular	Non-infectious posterior segment uveitis	Ophthalmology
Ganciclovir	Vitraser®	Non-biodegradable	5 – 8 months	Implant	Intraocular	Cytomegalovirus retinitis	Ophthalmology
Levonorgestrel	Skyla®	Non-biodegradable	3 years	Intrauterine device	Intrauterine	Female contraception	Obstetrics/Gynecology
Levonorgestrel	Kyleena®	Non-biodegradable	5 years	Intrauterine device	Intrauterine	Female contraception	Obstetrics/Gynecology
Levonorgestrel	Mirena®	Non-biodegradable	5 years	Intrauterine device	Intrauterine	Female contraception	Obstetrics/Gynecology
Levonorgestrel	Liletta®	Non-biodegradable	6 years	Intrauterine device	Intrauterine	Female contraception	Obstetrics/Gynecology
Mometasone furoate	Propel®	Biodegradation-preformed	Monthly	Implant	Contour sinus	Sinusitis	Ear, nose and throat
Mometasone furoate	Propel® Mini	Biodegradation-preformed	Monthly	Implant	Contour sinus	Sinusitis	Ear, nose and throat
Mometasone furoate	Sinuva®	Biodegradation-preformed	3 months	Implant	Ethmoid sinus	Sinusitis	Ear, nose and throat
Progesterone	Progestasert®	Non-biodegradable	12 months	Intrauterine device	Intrauterine	Female contraception	Obstetrics/Gynecology
Triamcinolone acetonide	Triesence®	Dissolution-based	2 – 3 months	Suspension	Intraocular	Sympathetic ophthalmia; Temporal arteritis; Ocular inflammation	Ophthalmology
Triamcinolone acetonide	Zilretta®	Biodegradation-preformed	3 months	Suspension	Intra-articular	Pain; Synovitis	Rheumatology

[†] The data were obtained from product package insert labels (<https://www.accessdata.fda.gov/scripts/cder/daf/>).

Table S3. Indications of FDA-approved long-acting drug products[†]

Active indication	Number of approved products
Addiction medicine	3
Alcoholism	1
Opiate dependence	2
Ear, nose and throat	3
Sinusitis	3
Endocrinology	21
Acromegaly	3
Cushing's disease	1
Children growth failure	1
Endometriosis	4
Gigantism	2
Hormone deficiency	1
Hypoestrogenism	1
Male hypogonadism	3
Precocious puberty	5
Hematology	1
Erythropoietic protoporphyria	1
Obstetrics/Gynecology	15
Female infertility	1
Female contraception	12
Heavy menstrual bleeding	1
Sexual deviation	1
Oncology	22
Breast cancer	3
Carcinoma	2

Fallopian tube cancer	1
Metastatic ovary cancer	1
Neuroendocrine tumor	1
Peritoneal tumor	1
Prostate cancer	11
Salivary gland cancer	1
Uterus tumor	1
Ophthalmology	19
Allergic conjunctivitis	1
Cytomegalovirus retinitis	1
Diabetic macular edema	2
Macular edema	1
Ocular inflammation	4
Ocular pain	1
Reduction of intraocular pressure	1
Retinal venous occlusion	1
Sympathetic ophthalmia	1
Temporal arteritis	1
Uveitis	4
Wet age-related macular degeneration	1
Psychiatry	9
Schizophrenia	8
Schizoaffective disorder	1
Rheumatology	1
Synovitis	1

† The data were obtained from product package insert labels
(<https://www.accessdata.fda.gov/scripts/cder/daf/>).

Table S4. Companies with long-acting drug products^{†,‡}

Company	Number of approved products		Company	Number of approved products
Alcon	2		Johnson & Johnson	1
Alkermes	2		Medicines360	1
AbbVie	1		Merck	2
Allergan	1		Mylan	1
Alza	2		Novartis	2
AstraZeneca	2		Ocular Therapeutix	1
Bartor	1		Oculex	1
Bayer	4		Organon	1
Chiron Vision	1		Otsuka	1
Clinuvel	1		Par Pharmaceutical	1
Debiopharm	2		Praecis	1
Eli Lilly	1		Pfizer	1
EyePoint	2		pSivida	1
Endo	2		Population Council	1
Flexion	1		Schering AG	1
Ferring	1		Tolmar	2
Genentech	1		Takeda	2
GP Pharm	1		Upjohn	2
Intersect ENT	3		Valera	1
Indivior	2		Wyeth-Ayerst	1
Ipsen	1			
Icon Bioscience	1			
Janssen	2			

† The data were obtained from product package insert labels (<https://www.accessdata.fda.gov/scripts/cder/daf/>).

‡ Company names are those at the time of FDA approval.