Species: Black lemur (*Eulemur macaco*)

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We would recommend assessing any contraceptive bout with behavioural and hormone monitoring. For more information on this, please contact contraception@chesterzoo.org

Contraceptive methods:	GnRH agonist (implant)	Progestagen (implants)	Progestagen (injection)	Progestagen (injection)	Surgical/ Permanent
Contraceptive Product:	Deslorelin acetate	Etonogestrel 68 mg	medroxyprogesterone acetate	proligestrone 100mg/ml	N/A
Commercial Name:	Suprelorin®	Implanon® Nexplanon®	Depo-Provera®, Depo-Progevera®	Delvosteron®	Castration; Hysterectomy; Ovariectomy; Ovariohysterectomy; Tubal ligation; Vasectomy
Product Availability:	4.7mg ('Suprelorin® 6') and 9.4 mg ('Suprelorin® 12') widely available through veterinary drug distributors in the EU.	Manufactured by Bayer Schering Pharma AG. Available through human drug distributors	Manufactured by Pfizer. Widely available throughout Europe through human drug distributors.	Manufactured by MSD animal Health UK, Intervet Europe. Licensed for use in female dogs, cats, and ferrets; available through veterinary distributors	N/A
Restrictions and/or permit required by Importing Country:	The EAZA RMG recommends: always check with your local licencing authority	The EAZA RMG recommends: always check with your local licencing authority	The EAZA RMG recommends: always check with your local licencing authority	The EAZA RMG recommends: always check with your local licencing authority	N/A
Mechanism of action:	GnRH agonist suppress the reproductive endocrine system, preventing production of pituitary and gonadal hormones. GnRH agonists initially stimulate the reproductive system -which can result in oestrus and ovulation in females, or temporary enhancement of testosterone and spermatogenesis in males. Therefore additional contraception is required during this time. Please see below and refer to Deslorelin datasheet.	Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation	Anti-estrogenic activity. Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation	Anti-estrogenic activity. Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation	**Castration:** surgical removal of the testes; **Hysterectomy:** surgical removal of the uterus; **Ovariectomy:** surgical removal of the ovaries; **Ovariohysterectomy:** surgical removal of the ovaries and uterus; Tubal ligation: surgical procedure where the fallopian tubes are blocked or removed; **Vasectomy:** surgical procedure in which the ductus deferens are cut, tied, cauterized, or otherwise interrupted
Insertion/Placement:	Sub-cutaneously, in a place where it can be easily detected or seen for removal at a later date (I.e. Upper inner arm); refer to the Suprelorin® fact sheet for effective methods of implant placement (tunnelisation).	Subcutaneous in upper inner arm for visibility (aid for later removal)	Injectable intramuscular. As hand-catching is possible in prosimians, this provides greater assurance the appropriate dose is delivered	Injectable subcutaneously - do not inject intradermally or into subcutaneous fat or scar tissue	Surgical
Females					
Dose	1x 4.7mg is recommended for a **minimum** duration of 6 months. In females who will not breed again or who suffer from reproductive pathologies: 1x 9.4mg is recommended for a **minimum** duration of 12 months. **DO NOT CUT THE IMPLANT.**	Recommended 1/3 to 1/2 implant, depending on weight. **Doses are not well established.**	10mg/kg BW at 90 day intervals or 2.5 mg/kg at 30 days interval throughout the breeding season.	A dose of 50 mg/kg of Delvosteron® has been used in a collection for short term contraception being effective for approximately 3 months	NA
Latency to effectiveness:	3 weeks average as GnRH agonists initially stimulate the reproductive system- **please refer to Deslorelin datasheet for detailed information -** additional contraception is needed during this time (see product data sheet. ~2mg/kg Megestrol acetate pills daily 7 days before and 8 days after has been used to suppress initial stimulation phase).	Implants should be placed at least 1 month before the breeding season starts.	Should be injected at least 1-2 weeks before the breeding season starts.	Should be injected at least 1-2 weeks before the breeding season starts.	NA
Oestrus cycles during contraceptive treatment:	Initial oestrus and ovulation (during the 3 weeks of stimulation) then no oestrus cycle. To supress the initial oestrus and ovulation you can follow the megestrol acetate protocol mentioned above.	Oestrus is inhibited.	Oestrus behaviour may be observed. Ovulation and cycling can occur in adequately contracepted individuals (but is unlikely and the degree of suppression is dose dependent).	Oestrus behaviour may be observed. Ovulation and cycling can occur in adequately contracepted individuals (but is unlikely and the degree of suppression is dose dependent).	If ovaries are left in place, oestrus will continue to occur.
Use during pregnancy:	**Not recommended**	In non-human primates progestagens normally do not interfere with parturition.	In non-human primates progestagens normally do not interfere with parturition.	In non-human primates progestagens normally do not interfere with parturition.	NA
Use during lactation:	No contraindications once lactation established	Considered safe for nursing; Does not affect lactation, but etonogestrel is excreted in milk.	Considered safe for nursing infant.	Considered safe for nursing infant.	NA
Use in prepubertals or juveniles:	**Data deficient** in this group, see product information sheet. Suprelorin implants should be **used with caution** in females that are to breed in the future, as long term impacts on fertility have not been assessed when used in prepubertal animals.	The use of synthetic progestagens in pre-pubertals or juveniles has not been fully assessed. Possible long-term effects on fertility are not known.	The use of synthetic progestagens in pre-pubertals or juveniles has not been fully assessed. Possible long-term effects on fertility are not known.	The use of synthetic progestagens in pre-pubertals or juveniles has not been fully assessed. Possible long-term effects on fertility are not known.	
Use in seasonal breeders:	Use 1x 4.7 mg implant least 1 month prior the breeding season. In two ruffed lemur females implants were inserted in November and both females came into oestrus within a week, after which ovulation was effectively suppressed for the entire breeding season.	To minimize progestin exposure, insert 1 month before the breeding season and remove 1 month after end of breeding season. e.g., *Eulemur macaco, E. fulus, Lemur catta* insert in early September, remove end of June; V*arecia spp.* Insert in November, remove in May.	Should be injected at least 1-2 weeks before the breeding season starts. In some prosimians as few as 1 to as many of 6-7 Depo-Provera® injections were given within a single breeding season.	Should be injected at least 1-2 weeks before the breeding season starts.	

Duration	4.7 mg implants are recommended. 9.4 mg implants should be used in females who are not destined for breeding or who suffer of a reproductive pathology. Duration of efficacy has not been well established as a guide: 4.7 mg implants will suppress for a **minimum** of 6 months; 9.4mg will be effective for a **minimum** of 12 months.	2-3 years in various primates	Dose dependant: 30- 45-90 days in general. However, effects could last 1-2 years in some individuals. In black lemurs, contraception with medroxyprogesterone acetate can extend the breeding season to as much as 9 months; this requires an extension of the period of contraceptive treatment.	Dose dependant: 30-90 days in general.	Permanent
Reversibility	We have 3 records of reversals in black lemurs following contraception with 1x4.7mg implant (100% reversal rate), with most individuals conceiving in the next breeding season. Duration to reversibility extremely variable. Removal of implant to aid reversibility is recommended but often implant is difficult to recover. Implants should be placed in locations with thinner skin i.e. the armpit to ensure that locating and removing the implant when replacing contraception or if animals receive a breeding recommendation is easier.	Designed to be fully reversible but individual variations can occur. To increase potential for full reversibility implants must be removed. No black lemurs were given breeding opportunities following contraception with Implanon/Nexplanon. We hold 1 record of a reversal in lemurs, with the female giving birth two years following the estimated implant expiry. Removal of implant to aid reversibility is recommended but often implant is difficult to recover. Implants should be placed in locations with thinner skin i.e. the armpit to ensure that locating and removing the implant when replacing contraception or if animals receive a breeding recommendation is easier.	We have no records of black lemurs being allowed to breed following contraception with Depo-Provera. Across all prosimians, reversal rates are high. We have 37 records of reversal in lemurs: 8 ruffed lemur females and 17 ring tailed lemur females successfully conceived after multiple bouts of Depo-Provera®, including nulliparous females conceiving at 7 to 10 years of age. 27 females conceived either in the first or second breeding season after contraception was stopped. Depo-Provera is designed to be fully reversible but individual variations can occur.	Designed to be fully reversible but individual variations can occur	NA
Effects on Behaviour	None observed except lack of libido. There are anecdotal reports of change of hierarchy with the behavioural implications that this may have.	Effects on behaviour have not been studied, every individual may react differently. Because progestagens can suppress ovulation it can be expected that courtship and mating behaviour will be affected in some way. Further research in the subject is necessary.	Effects on behaviour have not been studied, every individual may react differently. Because it binds readily to androgen receptors and is antiestrogenic, females may experience male-like qualities (increased aggression, development of male secondary sex characteristics, etc.) Further research in the subject is necessary.	Effects on behaviour have not been studied, every individual may react differently. Because it binds readily to androgen receptors and is antiestrogenic, females may experience male-like qualities (increased aggression , development of male secondary sex characteristics, darker colouration etc.) Further research in the subject is necessary	If ovaries are left in place, there will be minimal disruption of behaviour.
Effects on sexual physical characteristics	Similar to gonadectomy but temporary. Female colouration will darken.	Females may darken in colour. Ovulation may also occur even though pregnancy does not ensue.	In lemurs, genital odorants of contracepted females are dramatically altered, which affect the behavioural response in males. Females may darken in colour.	See Above	
Males	**Data deficient**	**Not Recommended**	**Not Recommended**	**Not Recommended**	
Dose	**Data deficient.** 1x 4.7mg is recommended for a minimum duration of 6 months and 1x 9.4mg is recommended for a minimum duration of 12 months. Usually a higher dose is needed to moderate aggressive behaviour than is required for contraception.	N/A	N/A	N/A	N/A
Latency to effectiveness:	Depending on the species there may be fertile sperm present in vas deferens for 6-8 weeks post treatment or even longer. Testosterone decreases after 3-4 weeks but sperm can stay fertile for many weeks after. Either additional contraception or separation of the sexes is required for this time.	N/A	N/A	N/A	Depending on species and individual, perhaps as long as 2 months or more
Use in prepubertals or juveniles:	**Data deficient** in this group, see product information sheet	N/A	N/A	N/A	**Data deficient**
Use in seasonal breeders:	**Data deficient.** Should start at least 2 months prior the breeding season.	N/A	N/A	N/A	N/A
Duration and Reversibility	**Data deficient** in this group, but deslorelin is considered reversible. See product information sheet. We have 1 record of reversal in this species, where the male sired offspring 3 years after the placement of 1x9.4mg implant. The implant was not removed. We also have 6 records of reversals in ring tailed lemurs, with time to conception ranging from 1-4 breeding seasons after the estimated contraception expiry date. Removal of implant to aid reversibility is recommended but often implant is difficult to recover. Implants should be placed in locations with thinner skin i.e. the armpit to ensure that locating and removing the implant when replacing contraception or if animals receive a breeding recommendation is easier.	N/A	N/A	N/A	The procedure should not be used in males likely to be recommended for subsequent breeding as reversal is unlikely
Effects on Behaviour	Testosterone related aggression is likely to decrease. Limited success as tool for aggression control in black lemurs and ring-tailed lemurs, however this may have been as too low a dose was used.	N/A	In lemurs, genital odorants of contracepted females are dramatically altered, which affect the behavioural response in males	N/A	Vasectomy will not affect androgen-dependant behaviours
Effects on sexual physical characteristics	Similar to gonadectomy but temporary. Some dichromatic species may change colour if testosterone related. Decrease in body size, feminisation of males.	N/A	N/A	N/A	None observed in non-human primates
General:					

Side effects	Similar to gonadectomy; especially weight gain. Some dichromatic species may change colour.	Possible weight gain, possible increased or decreased frequency of bleeding during menstruation. The EAZA RMG recommends always reading the manufacturer's data sheet. Lemurs can develop severe endometrial hyperplasia in response of progestagen contraceptives, particularly when used long-term.	Long term use is not recommended since it can have possible deleterious effects on the uterus and mammary tissue. Progestins are likely to cause weight gain in all species. In the human literature, Depo-Provera® has been linked to mood changes. Because it binds readily to androgen receptors and is anti-estrogenic, females may experience male-like qualities (increased aggression, development of male secondary sex characteristics, etc.). Lemurs can develop severe endometrial hyperplasia in response of progestagen contraceptives, particularly when used long-term. The EAZA RMG recommends always reading the manufacturer's data sheet.	Long term use is not recommended since it can have possible deleterious effects on the uterus and mammary tissue. Progestins are likely to cause weight gain in all species. In the human literature, progestagens has been linked to mood changes. As it binds readily to androgen receptors and is anti-estrogenic, females may experience male-like qualities (increased aggression, development of male secondary sex characteristics, etc.). In some diabetic animals Delvosteron® has led to an increased insulin requirement, it is advised that the product be used with caution in diabetic animals and that urine glucose levels are carefully monitored during the month after dosing. The EAZA RMG recommends always reading the manufacturer's data sheet. Lemurs can develop severe endometrial hyperplasia in response of progestagen contraceptives, particularly when used long-term.	N/A
Warnings	Causes initial gonadal stimulation; correct administration essential - see product information sheet	Interaction with other drugs are known to occur and may influence protection against pregnancy. In some diabetic animals progestagens have led to an increased insulin requirement, it is advised that the product be used with caution in diabetic animals and that urine glucose levels are carefully monitored during the month after dosing. The EAZA RMG recommends always reading the manufacturer's data sheet.	Interaction with other drugs are known to occur and may influence protection against pregnancy. In some diabetic animals progestagens have led to an increased insulin requirement, it is advised that the product be used with caution in diabetic animals and that urine glucose levels are carefully monitored during the month after dosing. The EAZA RMG recommends always reading the manufacturer's data sheet.	Interaction with other drugs are known to occur and may influence protection against pregnancy. The EAZA RMG recommends always reading the manufacturer's data sheet.	Infection of the surgical wound might occur. Intradermal closure of the skin is advised together with prophylactic antibiotic treatment and NSAID

Reporting Requirements: In order to increase our knowledge of the efficacy of contraception methods in the Prosimian family it is recommended that all individuals on contraception be reported to the EAZA RMG.

References:

1) Asa, C.S. & Porton, I.J. (eds.) (2005) Wildlife Contraception: Issues, Methods, and Applications. The Johns Hopkins University press: Baltimore.

2) Moresco A, Feltrer-Rambaud Y, Wolfman D, Agnew DW (2021). *Reproductive one health in primates.* American Journal of Primatology. e23325. doi: 10.1002/ajp.23325.

3) Asa, CS, Porton, IJ, Junge, R (2007) Reproductive cycles and contraception of black lemurs (*Eulemur macaco macaco*) with depot medroxyprogesterone acetate during the breeding season. *Zoo Biology* , 26(4);289-298. doi.org/10.1002/zoo.20136

Disclaimer: The EAZA RMG endeavours to provide correct and current information on contraception from various sources. As these are prescription only medicines it is the responsibility of the veterinarian to determine the dosage and best treatment for an individual