Animal name: Colobus monkeys
(*Colobus* sp.)

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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)	GnRH agonist (injection)	Progestagen (implants)	Progestagen (injection)	Progestagen (implant)	Surgical/Permanent
Contraceptive Product:	Deslorelin acetate	Luprolide acetate	Etonogestrel 68 mg	medroxyprogesterone acetate	Levonorgestrel 2x 75mg	-
Commercial Name:	Suprelorin ®	Lupron ®	Implanon® Nexplanon®	Depo-Provera®, Depo-Progevera®	Jadelle®	Castration; Vasectomy; Ovariectomy; Ovariohysterectomy; Hysterectomy; Tubal Ligation
Product Availability:	4.7mg ('Suprelorin 6') and 9.4 mg ('Suprelorin 12') widely available through veterinary drug distributors in the EU.	Luprolide acetate licenced for human use.	Manufactured by Bayer Schering Pharma AG. Available through human drug distributors.	Manufactured by Pfizer. Widely available throughout Europe through human drug distributors.	Manufactured by Organon. Available through human drug distributors	-
Restrictions and/or permit required by Importing Country:	The EAZA RMG recommends: always check with your local licencing authority.	**Data deficient**	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	-
Mechanism of action:	GnRH agonist suppress the reproductive endocrine system, preventing production of pituitary and gonadal hormones. As an agonist of the GnRH initially stimulates the reproductive system -which can result in oestrus and ovulation in females or temporary enhancement of testosterone and spermatogenesis in males- therefore additional contraception needed during this time. Please see below and refer to Deslorelin datasheet for detailed information.	GnRH agonist suppress the reproductive endocrine system, preventing production of pituitary and gonadal hormones.	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.	Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation	**Castration:** Permanent contraception by surgical gonadectomy; **Vasectomy:** Surgical procedure in which the ductus deferens are cut, tied, cauterized, or otherwise interrupted; **Ovariectomy:** removal of the ovaries; **Ovariohysterectomy:** removal of one or both ovaries and the uterus; **Hysterectomy:** removal of the uterus; **Tubal ligation:** fallopian tubes are clamped and blocked, or severed and sealed.
Insertion/Placement:	Sub-cutaneous, in a place where it can be easily detected or seen for removal at a later date (I.e. Upper inner arm); refer Suprelorin fact sheet for effective method of implant placement (tunnelisation).	Injectable	The EAZA RMG recommends sub-cutaneous, upper inner arm for visibility (aid for later removal). Intramuscular or subcutaneous.	Injectable intramuscular	Intramuscular or subcutaneous. The EAZA RMG recommends sub-cutaneous, upper inner arm for visibility (aid for later removal)	Surgical
Females		**Data deficient**				
Dose	1 implant is recommended. 4.7mg implants are recommended for a minimum duration of 6 months and 9.4mg implants are recommended for a minimum duration of 12 months.	There are various formulations available lasting from 1-6 months. Dosing information is very **data deficient**. Please contact the EAZA RMG with specific dosage advice.	1/2 an implant (0.068g) is recommended for successful contraception in these species. In some cases, a full implant may be required.	As a guide 5mg/kg BW every 45-90 days (mean = 98 days). Please contact the EAZA RMG for specific dosing advice.	1 rod is recommended.	-
Latency to effectiveness:	Deslorelin will have a latency to effect of 3-4 weeks during which a stimulation of the reproductive system will occur. In order to suppress the initial stimulation phase, the first contraceptive bout should be supplemented with an oral progestagen such as megestrol acetate pills (Ovarid/Megace; ~2mg/kg BW), 7 days before and 8 days after the implant is inserted. Alternatively, the sexes can be separated for ~4 weeks.	Same as deslorelin with an initial stimulation phase and suppression should then occur 3-4 weeks later (please refer to deslorelin and lupron datasheet for more details)	In general inhibition of ovulation after 1 day when inserted on day 1-5 of cycle or when replacing oral progestogen. As the right stage during menstrual cycle is often unknown, it is advised to use other contraceptive methods for at least 7-14 days after insertion of the implant depending on administration route.	1-3 days post injection. However, if the cycle stage is not known then extra time must be allowed; therefore, separation of the sexes or alternative contraception should be used for at least 1 week.	In general inhibition of ovulation after 1 day when inserted on day 1-5 of cycle or when replacing oral progestogen. As the right stage during menstrual cycle is often unknown, it is advised to use other contraceptive methods for at least 7-14 days after insertion of the implant depending on administration route.	-
Oestrus cycles during contraceptive treatment:	Initial oestrus and ovulation (during the 3 weeks of stimulation) then down-regulation. To prevent the stimulation phase, the megestrol acetate protocol described above is recommended.	Same as deslorelin.	Oestrus is inhibited. Menstruation in non-human primates are more or less present with regular cyclicity. This is an individual and dose-dependent response. Some will show a sexual swelling during treatment and some will not.	Oestrus behaviour may be observed. Cycling and even ovulation can occur in adequately contracepted individuals (but is unlikely and the degree of suppression is dose dependent).	Oestrus is inhibited. Menstruation in non-human primates are more or less present with regular cyclicity. This is an individual and dose-dependent response. Some will swell during treatment and some will not.	-
Use during pregnancy:	**Not recommended**	**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.	-
Use during lactation:	No contraindications once lactation established	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	-
Use in prepubertals or juveniles:	**Data deficient** in this group, see product information sheet.	**Data deficient**- see product information sheet	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.	Should only be carried out after first oestus signs have occured (+/- 4 yrs of age).
Duration	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 12months. In the database, the mean replacement interval for 4.7mg implants is 9.8 months (range: 6.0-12.0 months) and 13.0 months (range: 10.6-30.9 months) for 9.4mg implants.	This is extremely **data deficient**. Lupron® is available in various formulations lasting from 1 to 6 months, but because the release of hormone from the depot formulation varies by individual, actual duration of efficacy can vary considerably.	The duration of this product can last 2 to 3 years. We advise to replace after 2 1/2 yrs. An increased sexual swelling could be a signal that Implanon is waning/ or lost. Check if implant is stil present. The mean implant replacement time in Colobus is 2.9 years in the database (range: 1.7-4.6 years).	Dose dependant: 45-90 days in general. However, effects could last 1-2 years in some individuals.	2-3 years in various primates	Permanent

Reversibility	Deslorelin is designed to be fully reversible and we have one record of reversal in colobus in which the female conceived 8.8 months after the placement of 4.7g implants. The implant was not removed. Removal of implant may hasten time to reversal. Implants should therefore be placed in locations with thinner skin e.g. the inner arm, inner thigh, umbilical region, or armpit.	Considered reversible but every species has not been tested. Duration to reversibility extremely variable.	Designed to be fully reversible but individual variations can occur. We have two reversals in the database; in one case, the implant was removed and the female conceived 2 months after implant removal. In the second, the implant was left in place, and the female conceived after 6 years. To increase potential for full reversibility implants must be removed.	Designed to be fully reversible but individual variations can occur. Mean time to reversal in colobus is 26 months (range: 2.7 months - 8.6 years). As Depo-Provera is an injection, you will need to wait for the drug to clear from the animal's system before reversal can be expected.	Designed to be fully reversible but individual variations can occur. To increase potential for full reversibility implants must be removed.	Ovariectomies are irreversible and should only be carried out following discussion with the EEP coordinator.
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.	Same as deslorelin	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; there may be individual variation in response. Medroxyprogesterone acetate binds readily to androgen receptors and are 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 progestagens can suppress ovulation it can be expected that courtship and mating behaviour will be affected in some way. At high doses can have masculinising effect. Further research in the subject is necessary.	Aggession, masculinised behaviour after ovariectomies. No effect on behavior after tubal ligation.
Effects on sexual physical characteristics	Similar to gonadectomy.	**Data deficient** but likely similar to gonadectomy.	There might be some degree of sexual swelling and menstruation might occur. Ovulation may also occur even though pregnancy does not ensue.	See above	There might be some degree of sexual swelling and menstruation might occur. Ovulation may also occur even though pregnancy does not ensue.	Ovariectomy: Increased appetite will result in weight gain. Some dichromatic species may change colour. Tubal ligation: In Hamadyas baboon severe sexual swelling might occur. In those cases Implanon or ovariectomy is advised.
Males	**Recommended**	**Data deficient**	**Not recommended**	**Not recommended**	**Not recommended**	
Dose	Generally 1 implant is used in males in the database, although a second implant was required in some cases. Higher doses will likely be needed to mitigate testosterone-mediated behaviour than for reproductive suppression.	**Data deficient.** Usually a higher dose than in females are required in males. We would advise extrapolating from the human literature.	-	-	-	-
Latency to effectiveness:	Deslorelin will have a latency to effect of 3-4 weeks during which a stimulation of the reproductive system will occur. Alternatively, the sexes should be separated for ~2 months as viable sperm may remain in the vas deferens for up to 2 months. The initial stimulation period cannot be suppressed in males, and additional contraception should be used in females during this time.	Depending on the species there may be fertile sperm present in vas deferens for 6-8 weeks post treatment. Testosterone decreases after 3-4 weeks but sperm can stay fertile for many weeks after. Additional contraception needed during this time or separation of the sexes.	-	-	-	Depending on the individual, fertile sperm may be found in the vas deferens for as long as 2 months or more. Keep separate from fertile females for at least 6 weeks.
Use in prepubertals or juveniles:	**Data deficient** in this group, see product information sheet	**Data deficient** in this group, see product information sheet	-	-	-	**Data deficient**
Duration and Reversibility	In the database, the mean replacement interval for 4.7mg implants is 6.8 months (range: 5.5-9.1 months) and 12.3 months (range: 11.3-13.6 months) for 9.4mg implants. Deslorelin is considered reversible and we have two records of reversal in the database; males sired offspring between 12 and 75 months after the placement of 9.4mg implants. Removal of implant may hasten time to reversal. Implants should therefore be placed in locations with thinner skin e.g. the inner arm, inner thigh, umbilical region, or armpit. See product information sheet.	**Data deficient** in this group, yet but lupron is considered reversible. See product information sheet.	-	-	-	**Castration:** Irreversible and should only be carried out following discussion with the EEP coordinator; **Vasectomy:** 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. **Data deficient** in this group, see product information sheet.	Testosterone related aggression is likely to decrease. **Data deficient** in this group, see product information sheet.	-	-	-	Vasectomy will not affect androgen-dependant behaviours.
Effects on sexual physical characteristics	Decrease in body size, feminisation (reduction of testicle size) of males.	Decrease in body size, feminisation (reduction testicle size) of males. A loss of secondary sexual characteristics may occur (loss of manes in P. hamadryas).	-	-	-	Castration will likely result in the loss of secondary sexual characteristics dependent on testosterone. Males may lose muscle and overall weight if not replaced by fat. Males may become the size (weight) of females. Some dichromatic species may change colour. Vasectomy will not affect androgen-dependant sexual characteristics.
General:						
Side effects	In general weight gain as would be seen with ovariectomy or castration. Increased appetite will result in weight gain, especially in females. Males may become the size (weight) of females. Males may lose muscle and overall weight if not replaced by fat. The EAZA RMG recommends always reading the manufacturer's data sheet.	In general weight gain as would be seen with ovariectomy or castration. Increased appetite will result in weight gain, especially in females. Males may lose muscle and overall weight if not replaced by fat. Males may become the size (weight) of females. The EAZA RMG recommends always reading the manufacturer's data sheet.	Possible weight gain, possible increased or decreased frequency of bleeding during menstruation. The EAZA RMG recommends always reading the manufacturer's data sheet	Possible deleterious effects on the endometrium following prolonged use. 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 masculinisation. The EAZA RMG recommends always reading the manufacturer's data sheet	Possible weight gain, possible increased or decreased frequency of bleeding during menstruation. At high doses can have masculinising effect. The EAZA RMG recommends always reading the manufacturer's data sheet.	-

Warnings	Causes initial gonadal stimulation. Do not cut the implant. If implant is not completely removed at the end of treatment, residual circulating levels of deslorelin may affect time to reversal. **Should not be used in conjunction with Depo-Provera.**	Causes initial gonadal stimulation. **Should not be used in conjunction with Depo-Provera.**	Interaction with other drugs are known to occur and may influence protection against pregnancy. In some diabetic animals progestagens 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.	Interaction with other drugs are known to occur and may influence protection against pregnancy. In some diabetic animals progestagens 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.	Interaction with other drugs are known to occur and may influence protection against pregnancy. In some diabetic animals progestagens 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.	The procedures should always be carried out under sterile conditions, potential for infection of the surgical wound.

Reporting Requirements: In order to increase our knowledge of the efficacy of contraception methods in cercopithecidae 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) McDonald, M. M., Agnew, M. K., Asa, C. S., & Powell, D. M. (2021). Melengestrol acetate contraceptive implant use in colobus monkeys (Colobus guereza): Patterns through time and differences in reproductive potential and live births. Zoo Biology, 40(2), 124-134.

3) Wallace, P. Y., Asa, C. S., Agnew, M., & Cheyne, S. M. (2016). A review of population control methods in captive-housed primates. Animal Welfare, 25(1), 7-20.

4) Moresco, Anneke, Yedra Feltrer-Rambaud, Darcy Wolfman, and Dalen W. Agnew. "Reproductive one health in primates." American Journal of Primatology 84, no. 4-5 (2022): e23325.