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# Snake Reproductive System

Taksa Vasaruchapong

## *Abstract*

Like other animals, the reproductive system of snake is one of the important systems that allow the living organisms to reproduce their offspring. Snake reproductive system has been studied for more than 50 years. In this review article, the basic anatomy, biology, physiology, common problem and biotechnology of the snake reproductive system will be discussed and demonstrated some differences from the mammals.

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**Keywords:** reproductive, anatomy, physiology, medicine, snake

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## Introduction

The reproductive system is one of the important systems that allow the living organisms to reproduce their offspring. Snake reproductive system has been studied for more than 50 years that cover almost every aspect including basic biology, anatomy, physiology, medicine, surgery and biotechnology. Snake has the reproductive system that alike the mammals but there are some different on its biology, anatomy and physiology.

### Snake reproductive anatomy

**Male reproductive tract** consists of yellowish or cream, oval shape testes located at two third of body coelom of which the right testis is located cranial to the left testis. Each testis is connected to the spermatic duct that line caudally along the intestine and pass the cloaca to hemipenis at the base of the tail. Snake has two hemipenis, the right and the left, which are kept separately inverted in hemipenis sac in the base of the tail (Jacobson, 2007; Denardo, 2006). The hemipenis of each species has particular size and shape which can be used for species identification (Jintakune, 2000).

**Female reproductive tract** consists of long and slender ovaries located at two third of body coelom which is the same location of male testes. The cranial part of oviduct is dilated to form infundibulum then line caudally along the intestine. The oviducts are opened to the cloaca separately as the vagina without forming the uterus. The vagina is opened into the cloaca through urogenital opening or separate opening into the cloaca (Jacobson, 2007).

**Sex differentiation** in snake is performed by inserting the blunted-tip sexing probe into the hemipenis sac. Therefore, sexing probe can be inserted in male much deeper than in female (Fitch, 1960). Some species have sexual dimorphism, such as pythons and boas, which male has a pair of pelvic spur beside the cloaca larger than female (Denardo, 2006).

### Snake reproductive biology

Snake has both seasonal and non seasonal breeding. Most of snakes in Thailand are seasonal bred once a year during the beginning of winter to summer season. Female releases pheromone as a chemical signal from anal scent gland. Male will track the pheromone by tongue flick to search for female (Carpenter, 1980). If there are more than one male presented, they will compete for female by trying to push the other down which is called combat dance. Male will copulate female by using only one hemipenis depended on the suitable position of particular side. The ejaculation can take place for several hours. For some instance, female can store sperms in the seminal receptacle on the oviduct wall that lead to the delayed fertilization. Snake has both oviparous and ovoviviparous which has different time of gravidity. The oviparous snakes will lay eggs

after two months of gravidity. The eggs will be incubated for the other two or three months to hatch depends on species. The ovoviviparous snakes will give birth to their offspring after four or five months of gravidity depends on species too. The snake eggs, as in the other reptiles, have different biology from avian eggs. Snake eggs need to be steady in the same position with proper temperature and humidity until hatching. Rotation of the eggs, like avian eggs, can lead to embryonic death. The sex determination of offspring is based on the chromosome that differed from Crocodilia and Chelonia which are temperature-dependent sex determination (Denardo, 2006).

### Snake reproductive physiology

The physiological study of snake reproductive system has been limited when compared with the mammals. In many literatures revealed that it is controlled by seasonal and hormonal changes.

**Male reproductive physiology:** Testes consist of seminiferous tubules that used for spermatogenesis. Spermatozoa have long and spindle-shaped head with flagellum. Sperm maturation takes place in the epididymis before entering the spermatic duct and pass to the hemipenis without the evidence of any accessory gland. Then the sperm enter the spermatic sulcus in the middle of hemipenis into female vagina. The follicular stimulating hormone stimulates the spermatogenesis while the luteinizing hormone stimulates the Leydig's cell to produce testosterone in the same fashion as mammals (Licht, 1974). In monocled cobra (*Naja kaouthia*), the serum testosterone level has an annual cycle pattern. The concentration is started to increase from January to the highest concentration in September and then decline to the base level in December (Meesook, 2008). That is correlated with the present of spermatozoa in cloaca and the copulatory plug at the opening of hemipenis sac.

**Female reproductive physiology:** In the beginning of breeding season, the multiple follicles develop to graffian follicles along with vitellogenesis to store yolk in ova. After ovulation, the ova pass infundibulum into the oviduct which all ova are fertilized. In oviparous snakes, the shell formation occurs in the oviduct and the eggs will be laid after two months of gravidity. In ovoviviparous snakes, the embryo will develop in their individual fetal membrane within the oviduct. The embryo derived the nutrients from yolk while oxygen and water are derived from the diffusion in the oviduct. The follicular stimulating hormone stimulates the follicle growth and lead to vitellogenesis. The luteinizing hormone stimulates ovulation and change follicles to corpus luteum that produce progesterone (Licht, 1974; Edwards and Jones, 2001). In monocled cobra, the serum estrogen has rapid increased in September to the highest level during October to November and decrease to the base level in December (Meesook, 2008).

### Common problem in snake reproduction

Snake is ectothermal animal which the ambient environment plays an important role for controlling its physiological condition. Therefore, the ambient temperature has influence in almost entire process of reproduction especially breeding cycle and egg-laying. If the snakes in captivity are failed to match their optimum environment, they will not proceed to breed, fertilization, abortion or egg retention. Moreover, there are some methods of sex determination, such as improper sexing probe or pushing the hemipenis to evert out of hemipenis sac or popping technique, can injure the hemipenis and sometimes lead to hemipenile prolapse.

**Hemipenile prolapsed:** The most common problem of male reproductive tract in snake farm, Queen Saovabha Memorial Institute is hemipenile prolapse. It is mostly occurred after copulation and snake cannot reduce its hemipenis back into the sac due to stenosis of the opening or traumatic injury after copulation. The correction of hemipenile prolapse depended on the period and the degree of infection. If the hemipenis has only swelling without infection, the hypertonic substance such as sugar or salt can help to reduce the edema and allow pushing hemipenis back into the sac. Then, the pressure bandage is recommended for preventing the protusion of hemipenis. But if the prolapse is left with the unnoticed period until being dried and infected, the surgical amputation of hemipenis is considered.

**Egg retention:** Egg retention is found in the gravid snakes that were captured and donated to snake farm, Queen Saovabha Memorial Institute. Despite of the stress during capture and fail to adapt to the new environment, the egg retention is the consequence. If only a few number of eggs retained near the cloaca, the gently manipulation can be performed to remove the eggs through cloaca. Another method is bathing the snake in tap water for half an hour to stimulate the contraction that may lead to lay the egg. But if there are a large number of eggs or eggs retained in a far distance from cloaca, the general anesthesia is recommended. Under anesthesia, the muscle is more relaxed that allow gently manipulation through cloaca can be possible. The surgical removal by opening the oviduct should be performed after the failure to correct as the previous methods described.

### The biotechnology in snakes

There have been a number of studies on snake biotechnology such as semen collection by ventral massage from the testes area to the cloaca (Mengden et al., 1980, Zacariotti et al., 2007), semen storage Mengden et al., 1980, Fahrig et al., 2007) and artificial insemination (Mengden et al., 1980; Mattson et al., 2007). Each study has the different purposes such as the conservation on rare species or the improvement of genetic variation on the captive snakes. But most of these techniques still need more studies prior to adapt for the practical use.

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