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The Analysis of the Prevention of Hereditary Disease of Dogs

犬類遺傳性疾病的預防分析

Author(s): Chia-Hao Lu 魯佳皓

Class: Junior A of Department of Foreign Languages and Literature

Student ID: D0181698

Course: English Writing (6)

Instructor: Dr. Wei-Wei Shen 沈薇薇

Department: Foreign Languages and Literature

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Abstract

The diverse breeds we are familiar with nowadays actually originate from human's motivation for remaining or developing some excellent features of dogs. Those dogs with exclusive and distinguishing characteristics are commonly called purebreds. However, because purebreds have been bred purposefully in a chosen genetic base, they would consequently have the risk of hereditary disease. Hereditary disease is a series of disorders occurring on purebred dogs when genetic disadvantages are inherited generations by generations. The way of inheritance depends on different type of diseases and the syndrome can be physical disorders, organ abnormalities or even fatal symptoms. This paper aims at dealing with the repugnant diseases and protecting our best friends on three aspects: detection, contraception and regulation, enabling dog owners to worry less about hereditary disease. By doing this research I believe more people including myself can take care of their dogs more cautiously and expect the legislators to take action to allow more diseased dogs to be benefited. Even though the article offers only generalized information without professional supporting, the proper way of handling and preventing hereditary disease is comprehensibly treated and emphasized in the paper.

Keyword : dog, purebred, hereditary disease, autosomal inheritance,

Progressive Retinal Atrophy (PRA)

摘要

至今我們所熟悉的犬種，其實都是由當初人類將狗的某些優異特徵加以保留或改良後演化而來的。通常這些具有區別度特徵的狗，我們稱之為純種犬。然而，由於純種犬在選定的基因庫中繁衍，因此產生了發生遺傳性疾病的風險。遺傳性疾病是在純種犬世代間繼承基因缺陷所導致的疾病。不同的遺傳性疾病，遺傳的形式也不同，會有生理失調、器官病變甚至致死的可能。為了保護人類最好的朋友，本文將著重在如何應對此類疾病，並從三個層面：檢驗、節育以及制度中進行各別討論讓飼主面對遺傳性疾病時不至於手足無措。相信藉由這份研究報告的完成，可讓包括我在內的飼主更謹慎的呵護自己的愛犬，同時呼籲立法機關能夠制定相關法令讓更多的遺傳性病犬得以受惠。雖然本文力求簡約而缺乏專業的相關佐證，整篇文章主要採用淺顯易懂的方式，強調了處理與避免遺傳性疾病的正確措施。

關鍵字：狗、純種狗、遺傳性疾病、遺傳法則、漸進式視網膜萎縮症 (PRA)

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List of Tables

	A	a
a	Aa	aa
a	Aa	aa

Table 1

	A	A
A	AA	AA
A	AA	AA

Table 2

	A	A
A	AA	AA
a	Aa	Aa

Table 3

	A	A
a	Aa	Aa
a	Aa	Aa

Table 4

	A	a
A	AA	Aa
a	Aa	aa

Table 5



Introduction

Dogs are universally welcomed as human's friends not only for the kind and friendly heart under their furry appearances, but for their high competence in work from different kinds of field. In fact, the diversity of dogs nowadays are generally based on human's needs. Human breed dogs by the way of constantly keeping specific capabilities, striking features or any characteristic ideals, also known as *selective breeding* (高, 2011). The breeding could last for generations and eventually these dogs would stably reserve the selective features and become the familiar forms we know. Dogs with some typical characteristics to clearly distinguish their types can be registered as *purebred dogs*, with a documented pedigree in a stud book (Wikipedia, 2004). By 2001, according to the database of Fédération Cynologique Internationale (FCI, 世界畜犬聯盟), there are over 400 acknowledged breeds in the world, but some scientists think the number could be at least one thousand. To stay purebred, breeders would like to breed a type of dogs in a limited genetic base, consequently causing lots of risks behind its pure charm. Hereditary disease, also called genetic disease, is the major threat of these dogs. It can cause some physical disorders, organ abnormalities and fatal symptoms. Hereditary disease occurs when genetic disorders are inherited generations by generations, and the way of heredity usually differs depending on the kind of disease. For example, according to the committee of canine study from Japan (KUWASHII INUGAKU HENSYUU IINKAI), autosome inheritance happens most commonly. Although the parents carry the morbific gene, it doesn't mean the offspring will be affected disease but it will become a carrier for sure. Therefore, if two carriers mate with each other, the offspring could be born diseased. Because carriers are hard to be recognized in the situation without any conspicuous symptoms, controlling the spread of hereditary disease is getting challenging. To prevent the troublesome diseases, breeders, veterinarians and

legislators should responsibly cooperate with others and deal with the issue cautiously and patiently. Dogs royally devote themselves to everywhere for us after all; in payment for our buddies' contribution, we should try our best to protect them from suffering. The following is the discussion of the three parts in this paper: detection, contraception and regulation to relatively state the ways of lowering the possibility of hereditary disease occurrence with some examples.

Detection

The first step of prevention could begin with detection. In the process of diagnoses, examination is significantly reliable and most necessary. In fact, there have been clinical examinations for years to screen the diseases. But this method only works on affected dogs with certain obvious hereditary syndromes, whereas carriers will be hard to identify (Queney, 2012). Some diseases such as congenital heart defect, Canine Hip Dysplasia (CHD) or Progressive Retinal Atrophy (PRA), in most cases, are apparently related to gene disorders. For instance, PRA is a typical sample of canine hereditary diseases and it has been widely confirmed that hundreds of breeds have suffered from the disease. During the onset, a dog's visual ability becomes weak at night, which is called *nyctalopia* (Night Blindness). Then the dog would be reluctant to climb up or down the stairs. Within few months to two years, the ability in daytime degenerates accompanied with the atrophy of cone cells (picture is shown in Appendix). As a result, the pupils will gradually dilate and cause complete blindness(台灣基因, 2008). To sum up, the traditional diagnosis of hereditary disease has been based on and supported by these collective information of patients. In contrast, DNA testing provides an improved, effective and convenient manner against the traditional one. To gather testing specimens, breeders only need to open the dog's mouth, use a spoon-shaped scoop to scratch down some oral mucosa and send it to examining institutes (高, 2011). This technique makes the genes containing diseases

more detectable and it is almost operative throughout a dog's life. Nevertheless DNA testing is limited because it only indicates the abnormalities familiar by us so far.

Unfortunately the diversity of canine hereditary diseases is beyond our speculation; therefore it's difficult to correctly identify unknown syndromes from strange diseases (Queney, 2012). Still DNA testing can be the powerful principle to determine which gene causes diseases and be applied to construct a potentially affected family tree.

Contraception

Contraception, also known birth control, is aimed at preventing the overspread of hereditary diseased breeds. Once a dog is found to contain morbidic genes, breeders should avoid matting its kindred members with other breeds, especially studs. In general, genes are inherited by following the law of autosomal inheritance. Autosomal inheritance is a kind of typical transmission of genes depending on the majority of autosomes (Mosby's Medical Dictionary, 2009). Dominant genes are those hereditary copies from parents showing the dominance against recessive genes. The versions of genes will contribute to traits of every description and the dominant gene determines the only defective character shown on a breed (Starr, 2004). In table 1, we usually decide capital A as dominant gene and small a as recessive gene. The form depicts the possible results under the situation when two parents both possess the phenotype trait Aa and aa . After being distributed and reconstructed, this combination points out three likely outcomes: Aa and aa . As a result, if the trait of aa has been detected on a breed, it has the worst condition: being affected, while Aa means disease carrier without any syndromes, According to the rule of autosomal inheritance we find there is a 50% probability the descendants in filial generation will either be carriers or infected with the majority of morbidic genotypes. More, as different combination from other tables demonstrates, the probability of being diseased in Table 2 to Table 5 is relatively 0%, 0%, 0% and 25% within the following mixtures of AA , Aa and aa . Thus, when AA

mates with AA , Aa or aa , it is unlikely to cause any illness; the filial generation will be recessive gene carrier instead. But in Table 5 the problem is, despite knowing two diseased parents are doomed to have unhealthy offspring, many breeders do not know that when two breeds showing no syndromes (It could be AA or Aa .) connected to any hereditary disorders mate, diseased offspring could stand a chance of being born. If breeders are not cautious about birth control of those Aa breeds, the genetic diseases would become pain in the neck. In short, dogs should not over-produce puppies and by doing ligation surgery it can effectively decrease the likeliness of the uncontrollable spread of hereditary disease. Every dog has a right to be adored even though they have genetic disorders distinguishing them from other normal breeds.

Regulation

Last but not least, to correct the ways of dog breeding, it should highly rely on both prevailing morality in public plus regulations of authorities. Once a dog might be detected as non-purity or even a hereditary-diseased patient, we need to pay more attention to taking care of it and give love just as other normal pets. Undeniedly, those breeds affected by hereditary diseases are able to jump around, to play with people or achieve the competence in some hard work. Breeders should not egoistically and unfairly label these breeds as inferior or useless only because the genetic results are out of expectations. Meanwhile, veterinarians have the duty to honestly tell breeders about these diseases in detail and build them the proper attitude toward to help diagnose. More importantly, the fact of being hereditarily affected has to be responsibly revealed to cease the suffering in another generation (陰山敏昭, 2007). As for regulators, relating law has to be enacted to restrict the inordinate breeding for interest-oriented exploitation in some doghouses, which should be ethically condemned for the wicked excess

Conclusion

In conclusion, always noticing dog's unusual behaviors can enable breeders and vets to diminish the influence of hereditary disease upon unborn victims, that in the presence of appropriate ways and morals of breeding. Despite the fact that in this paper the supporting statistics and research are not sufficient, these ideas could still become prevalent for the reason they deal with clinical diversity of genetic disorders. Because of the paper, I understand more about breeding and the responsibility of it as a vet in the future or a breeder meanwhile. Before further innovative diagnosis is established, what we have to do is to remove the bias on non-purebreds and hereditary diseased dog breeds and take preventive measures to reduce tragedies of hereditary disease.



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Appendix



5-year-old kuma with PRA. Source: Retrieved May 23, 2015, from <http://www.akita-friends.com/kuma/>

