

The origin and evolution of Dalmatian and relation with other croatian native breeds of dog

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SUMMARY

It is known for a long time that Dalmatian dog have different metabolism of proteins due to lack of one liver enzyme. Final product of proteins breakdown is uric acid, while other dogs excrete allantoin eliminated by urine. It was considered that such metabolic process of proteins breakdown is identical to humans and if it is found in any other dog, it can be considered that this dog is closely related to Dalmatian. Besides this metabolic closeness, there is relation in color of the coat between Croatian native breeds of dogs. It is observed explicit similarity in genetic coat formulas. Typical spotted of Dalmatian dogs not being observed at other breeds, very often is manifested at Istrian hound. Group of sight hounds dogs was discovered in eastern Bosnian. They showed tendency of transforming from sight hounds constitution to hounds. It seems very significant because it gives us reason for reflexes about Dalmatian dog's origin and all transformations it was going through till the present time.

Keywords: Dalmatian, origin, evolution, Istrian hound, Old Croatian Sight Hound.

RÉSUMÉ

Origine et évolution du Dalmatien et relation avec les autres races autochtones des chiens de Croatie

Le métabolisme des protéines des dalmatiens est connu depuis longtemps pour être particulier. Le produit final du métabolisme des protéines est l'acide urique alors que les autres chiens excrètent l'allantoïne dans leur urine. Cette différence est due à une déficience en une enzyme hépatique. Ce catabolisme protéique est identique chez l'homme et si on le retrouve chez d'autres chiens, on peut alors considérer qu'un lien de parenté avec le dalmatien existe. C'est le cas chez les chiens d'origine croate chez qui nous pouvons également remarquer une similitude de couleur de pelage. Ceci est explicitement démontré par les codes génétiques du pelage. Ainsi, les taches typiques des dalmatiens ne sont jamais observées chez les chiens d'autres races à l'exception des *Istrian hound*. De plus, un groupe de lévrier proche du dalmatien a été découvert en Bosnie-Est ayant tendance à évoluer vers les "hound". Ceci nous permet de comprendre les origines du dalmatien et son évolution jusqu'à nos jours.

Mots clés : Dalmatien, origine, évolution, *Istrian hound*, *Old Croatian Sight Hound*.

The Origin of Dalmatian

According to the current state-of-the-art in cynology, the present dog breeds have developed from four primordial dogs the remainders of which were discovered by archeologists in the 19th century, and were named after the researcher who found them or the historical period they grew close to man. These four primordial dogs included *Canis f. palustris* or peat dog, *Canis f. matris optima* or bronze dog, *Canis f. intermedius* and *Canis f. leineri*. These four primordial dogs lived in different geoclimatic areas and differed according to modifications in body structure, thus creating four basic constitution types: lupoid, mollosoid, braccoid and graioid. The large numbers of current dog breeds have developed within these four constitution types over thousands of years of their living with man. Initially, the formation of various dog breeds proceeded sporadically, by natural selection within a large group of dogs of the same type in geographically confined areas, without mixing with dogs from other groups. Thus, a particular phenotype associated with the respective genotype was created.

However, during the last few centuries, man has intentionally and with premeditation created some specific dog types

intended for strictly determined purpose, using an empirical method of cross breeding a small number of dogs of different breed types, their further inbreeding, followed by strict selection in order to achieve the conceived shape and work properties. This mode of breed creation can be considered artificial. While naturally occurring breeds possess a broad genome with numerous allelomorph genes, artificial breeds have a limited genome array with little alleles, and are prone to frequent constitutional defects ranging from the loss of basic constitution in terms of asthenic and connective tissue labile constitution through the occurrence of constitutional defects such as anomalies in the number of teeth and dentition structure, umbilical hernia, hip dysplasia, cryptorchidism...

Yet, many naturally developed breeds have become extinct during the past 100 years and man has tried to restore the breeds by inbreeding from scarce remainders. This so-called "breed pass through the bottleneck" has resulted in the current situation in which these breeds should also be considered as being artificially created.

In addition to particular breed standard describing in detail its physical and work properties, the origin of the breed is occasionally briefly noted, frequently in the form of short

stories about wrecked ships and rescued seamen, or about heroic march by famous medieval rulers to remote countries. However, these were based on the concepts valid at the time. The standard on Dalmatian postulates its alleged descent from ancient Egyptian dog of graioid constitution and offers evidence for the presence of the name *Canis dalmaticus* in the Croatian territory in church documents from the 14th and 18th centuries, and an illustration representing the dog from the 18th century. These documents have been accepted as reliable evidence for the Dalmatian dog place of origin on the Adriatic Sea eastern coast and its inland up to the Drava river, thus having officially dismissed any speculation about the country of origin of Dalmatian that are found in the large body of literature on this dog. This is additionally substantiated by data found in Venetian archives. In his annual report on the situation in the area under his supervision, Zorzo, Venetian governor on the island of Pag at the turn of the 16th to 17th century, wrote about his spy on the Velebit Mountain informing him on the possible troop movements on the other side of the mountain, beyond the borders of Venetian Republic. The spy wearing colorful peasant dress rode a small white horse, followed by a white dog with black spots [18].

Relation between Dalmatian and Istrian hound

In the 20th century, Dalmatian raised interest in medical circles. BENEDICT (1916-1917) and then TRIMBLE and KEELER (1938) found the protein metabolism in Dalmatian dog to differ from that in other dogs [22]. Due to the lack of the liver enzyme uricase, Dalmatian was found to excrete uric acid as end product of protein degradation, whereas other dogs degrade it to allantoin which is then excreted in urine [25, 26]. Such a metabolic cascade of protein degradation was considered to be identical to that found in humans. Therefore, Dalmatian was accepted as a model to study the development of urinary calculi and gout in man. In addition, the finding of such a phenomenon in any other dog was found to indicate its close relationship to the breed of Dalmatian [20, 21]. This concept has been supported by studies conducted in a number of dog breeds [5, 6, 8, 9, 10, 11, 14, 15, 16, 20, 27].

Our studies performed as part of the project launched by the Croatian Ministry of Science, entitled Autochthonous Dog Breeds in the Croatian Territory, have shown the Istrian hound to have identical protein metabolism [2], and according to scientific logic it should be considered a close relative to Dalmatian.

The more so, besides this metabolic proximity, there is also contiguity in hair color if genetically analyzed as described by WILLIS (1984). He used ten known series of allelomorph gene pairs denoting color, color intensity and distribution, occurrence of white hair, color marmorings, occurrence and distribution of stains, and trout-like or dotted color pattern on white surface [23]. However, any of these features may be expressed in a varying intensity, depending on the number of alleles in the series. Therefore, on writing genetic formula where the initial letter corresponds to the gene title for the

respective feature, an additional letter for particular allele should frequently be added to present the basic meaning of the gene code in more detail.

If this principle is applied in an attempt to determine the gene basis of color in Dalmatian, Istrian hound, Tornjak and Posavian hound, all autochthonous breeds from the Croatian territory, the formulas are found to be very much alike. For Dalmatian genetic formula by WILLIS is CC DD gg ssws TT, it's means that basic color of dog is white with appearance of melanin (CC), that appearance of melanin is intensive (DD), that gene is responsible for black coat on white background (gg), gene for extremely white spottiness (ssws), and finally dominant gene for typically spots (TT). The formula is almost identical in Dalmatian, Istrian hound and Tornjak, always including the same allelomorph groups and differing in the occurrence of the base pair gene homozygosity or heterozygosity. The typical dotted pattern of Dalmatians (figure 1), which is explained by the occurrence of one of the alleles of so-called T-series according to Willis and is not observed in other breeds, is frequently also found in Istrian hounds (figure 2) as well as in Posavian hound and in Tornjak. Also there is possibility how others breeds are related with Dalmatian (for example: Dogo argentino, Greyhound).

ZAJC and KUS [24] examined the population structure of Dalmatians and Istrian hounds and estimated their phylogenetic relationships to some other breeds. Genetic distance among Dalmatian, Istrian hound and Greyhound is relatively low, in contrast to the distance between these three breeds and German shepherd. Their results indicated that the hound lineage gave rise to the separate breeds of Greyhounds, Istrian hounds and Dalmatians much more recently.

Relation between Dalmatian and Greyhound

At the beginning of the 1980s, a group of greyhound-like dogs were discovered owing to the effort of Šandor Horvat, a renowned Croatian cynologist, in Orašje, now Croatian enclave in east Bosnian Posavina, Bosnia and Herzegovina. By their body constitution, these dogs corresponded completely to the current English Greyhound, even including rose-shaped auricles. Yet, they were smaller, male reaching 60-70 cm in height, whereas females were by 5-10 cm shorter. The dogs were of white color, with three body sites where black spots that may vary through dark-brown, light-brown, wheat-red to ochre yellow occurred. These spots were primarily located on the head, i.e. on the auricle and partly on the face (usually unilaterally). The second most common localization was tail root, followed by thorax and/or loin (usually unilaterally). For as long as they can remember, the inhabitants of Orašje and surrounding villages had raised these dogs, popularly known as *hrti* (greyhound) for races organized on the occasion of parish feast. We have conditionally termed them Old Croatian Sight Hounds because the Croats have preserved them by breeding down to the present [3] (figure 3). Besides racing, these dogs were also used in hunting, primarily hare, which they spotted by sight, caught in run and brought to the owner.



FIGURE 1 : Characteristic pigmentation in Dalmatian.



FIGURE 2 : Dalmatian dog pigmentation in Istrian hound.



FIGURE 3 : Old Croatian Sight Hound.



FIGURE 4 : Celtic coin.

As greyhound hunting was banned in former Yugoslavia, and so was hunting with dogs that were not registered in the kennel club pedigree registry, the hunters and veterinarians from the area were obliged to kill these dogs as hunting-ground pests.

At the same time, many dog breeders from the area used to work abroad, where they met greater and faster although obviously identical dogs, and they began to bring them home to replace the domestic ones, now termed Old Sight Hounds to differentiate them from the new ones. These were the two main reasons for definitive extinction of the group of autochthonous greyhounds in the area. If some individual dogs had survived to the 1990s, they must have been killed in mine-fields during the war. There are no such dogs in the area since 1995. It should be noted that the characteristic Dalmatian dotted spots occurred in these dogs, also observed on the skin, whereas only individual hairs showed pigmentation in the hair coat covering the pigmented skin segments.

The descent of these dogs is very interesting indeed. They appear to represent last remainders of Celtic dogs, as they are identical to those impressed on Celtic coins dating some 2500 years back [1, 13] (figure 4).

At that time, the Celts set forth for their great migration around Europe, to finally reach British islands. Most probably, they took their cattle along, accompanied by dogs, which the current English Greyhounds must have derived from

[13]. A remainder of these dogs in the Balkans region is presented in a drawing on a Greek vase. It is believed that this dog was subsequently adopted by the Romans, who named it *Canis Castorius* (figure 5).

A figure of this dog with long legs and elongated, narrow head is also engraved on the medieval Bosnian tomb-stone (stećak) made around 1440 and found in Cista (Dalmatia hinterland), now mounted in front of the Museum of Croatian Archeological Monuments in Split [17] (figure 6).



Lovački pas antičke Grčke kojeg Rimljani kasnije zovu " Canis Castorius"

FIGURE 5 : Antique Greek vase with a drawing presenting a greyhound-like dog.



FIGURE 6 : Medieval Bosnian tomb-stone (stećak) with a greyhound-like dog figure (Dalmatia hinterland, mid-15th century).



FIGURE 8 : Old Slavonia arms according to Pavao Riter Vitezović (dating from 1701-1702). (with permission from Banac I.: Grbovi – biljezi identiteta. Zagreb; Grafički zavod Hrvatske, 1991).

In the second half of the 1980s, a pair (the last one) of these dogs was transferred to the Zagreb School of Veterinary Medicine. The male was white with black spots on the head and a small mark on the thorax and loin unilaterally, 70 cm in height. The female was much shorter, about 60 cm in height, and had ocher-yellow spots instead of black ones at the same body sites as the male. The pair accommodated soon to free life in the School ground. Monitoring them for years revealed pronounced primigenial features in their instincts. So, the female had preserved the instinct of bringing food to the offspring in its own stomach, which has been completely forgotten in current thoroughbred dogs, and has been observed in some groups of paria dogs and dingo. Our intention was to create a number of distinct lineages of the dog through inbreeding over 3-4 generations in order to restore the breed. However, we were out of breeder luck and managed to reach only F2 generation. Yet, some interesting modifications could already be observed in F1, and in F2 generation in particular; the body constitution began to change, the dogs were increasingly losing their graioid properties while the braccoid constitution was more pronounced. The dogs grew shorter, their skeleton turned crude, extremity bones stronger, and their thorax broadened; changes on the



FIGURE 7 : English faience figurine.



FIGURE 9 : Dubrovnik hound (A detail from the painting entitled Last Supper, by unknown author from mid-18th century; kept at the Franciscan Monastery in Zaostrog, Makarska littoral, Dalmatia).

head were most pronounced, with extended neurocranium and shortened splanchnocranium; a mild frontal stop appeared, while the auricles lost their rose-like shape, now resembling the pointer auricles, high seated, folded at the base and held along the cheeks. Pigmentation changed as well. The spots enlarged, while their color ranged from black through chestnut dark-brown to light ocher-yellow. Even the appearance of long hair with the tail richly covered with hair >6 cm long was observed in one descendant.

Historical constitution changing in Dalmatian

The tendency of the graioid constitution transformation to braccoid constitution appears to be of special relevance, pointing to the Dalmatian origin and constitution changes it has been through down to the present. There are documents suggesting that Dalmatian used to be of a greyhound-like constitution in the past. The oldest of these documents dating from 1374 is the report sent by the Đakovo Bishop's residence steward to Petar Horvat on the bishop's estate business, listing

and describing in detail all animal species on the estate, including dogs. Among others, a white dog with black spots catching live game at the run, named *Canis Dalmaticus*, is described [19]. In addition, there is a medieval English faience figurine presenting a greyhound-like dog with black spots on its body distributed so as to remind of the Dalmatian dog spots (figure 7).

Historical sources indicate that Dalmatians were raised at Đakovo Bishop's residence as early as the 14th century [19], who were obliged to provide a number of cavalymen accompanied by these dogs raised and trained for fight, primarily against enemy's cavalry, to fight in the Battle of Mohács [7]. Accordingly, these were Dalmatians of greyhound-like body constitution. The battle outcome is known, where the Christians sustained the most crushing defeat by the Turks.

This evidence also includes old arms of the Croatian Triune Kingdom, where the Slavonia arm differs from the current one. The current Slavonia arms consist of two horizontal undulated lines that represent the rivers of Sava and Drava, with a figure of marten in-between. The old arms of east (Danube-region) Slavonia do not include the figure of marten but of three greyhound-like dogs in red, the red color symbolizing war. In 1701, Pavao Riter Vitezović called them "self-hunters: they go out alone and come back home with the prey" (figure 8).

Turks ruled east Slavonia for almost 150 years thereof, and Dalmatian dogs almost disappeared completely in north Croatia, being only preserved in the surroundings of Dubrovnik under the name of Dubrovnik hound (figure 9), with a constitution resembling today's Dalmatian, and in Zadar, where it was recorded as *small dane* during Napoleon's occupation of Dalmatia. It remains unknown whether this dog was autochthonous in the area or had maybe arrived there with the French. However, this dog also disappeared until the beginning of the 20th century.

An interesting note is found in the manuscript by PETAR BAKIĆ, bishop of Đakovo, from 1719, entitled *De vita populi et de cultura armentorum et pecorum Diacovae et eius Districtus anno Domini 1719* (On the population living and cattle breeding in Đakovo and its surroundings in the year 1719), bringing some citations from bishop Petar Horvat's records from 1374, even extending his text by stating that Dalmatian "is mostly raised by the nobility and other distinguished persons in Croatia for hunting and personal guard in peace and war in particular, while also being raised by the population at large. On hunting, this dog is used for catching live game at the run, while in war it attacks enemy's horses bravely and sharply, thus causing confusion and even defeat of the enemy's cavalry. It is still raised in Croatia and has spread all over European countries".

In his doctoral dissertation thoroughly and precisely describing English Greyhound, LEVRIER (1983) has provided an interesting schematic presentation of its constitution modification. According to him, this breed of dog shows a tendency to produce offspring ever more resembling dogs of braccoid constitution, characterized by firm skeleton, strong head, low-laid auricles, short body height, and broad thorax. Finally, those English Greyhounds that are basically white in

color with black marks on the head, trunk and loin, black spots in the form of typical Dalmatian pigmentation are frequently observed.

There are some interesting documents from the 19th century that point to another change in the constitution of Dalmatian. As it seems, at that time it began to resemble Great Dane-like dogs. At the time, *Deutsche Dogge* was called Great Dane by the French (the name still being quite frequently used in the French cynotehnic literature). However, it seems to have applied exclusively to a dane named Harlequin, while Dalmatian was called small Dane (*Le petit danois*). This name is also found in Dalmatia (Zadar) at the time of Napoleon's Illyricum. Dalmatian dog was called *small daneš* (small dane), and harlequin dane was referred to as *big daneš* (great dane). Following the breeding of Dalmatian across European countries and in the USA reveals Dalmatian dogs of sturdy, robust and stronger constitution, and of sharp, even fighting temper, their body very much alike the Great Dane's body, while the head has lost the braccoid type features, i.e. the stop is more pronounced, the muzzle is stronger and broadened, and the lips are enlarged, giving the profile a square appearance, like the Great Dane.

On the other hand, when describing hounds from the Austro-Hungarian territory, Austrian braccologist LASKA (1897) includes Dalmatian among them, with a note that this dog has a Dane-like body and a Greyhound-like head. This description is accompanied by a collective sketch presenting different dogs, predominated by the head of Dalmatian of a typical graioid constitution (figure 10).

In conclusion, the old Celtic Greyhound should be considered the origin of English Greyhound in the new home country of the Celts, whereas the rest of these dogs in their primordial habitat have resulted in the creation of Dalmatian, Istrian hounds, and in part Posavian hound. In its original form, it had survived until recently, conditionally named Old Croatian Sight Hound.

However, there is another Celtic dog that also accompanied the Celts on their migration around Europe, which they had left forgotten in Scandinavian countries. There it was



FIGURE 10 :Dalmatian dog (in the middle) according to Laska (1897).

named Schillerstoevare, whereas in our areas it has survived in two forms, short haired and wire haired types, with Balkan hounds representing the former, and Barak the latter. These two types have morphologically differentiated, yet not substantially, and have influenced the formation of other breeds in the area. These dogs must have been involved in the creation of Posavaz hounds, or Posavaz hounds together with Balkanian hound may have produced tricolor hound.

Conclusion

Biochemical evidence for the close relationship among the mentioned dog breeds, the compatibility of their genetic color formulas, along with observations recorded during Old Croatian Sight Hound inbreeding and historical modification of the Dalmatian constitution have just raised serious suspicion rather than being considered a definitive scientific proof of the presented hypotheses. However, scientific methods are now available that can be used to determine the exact grade of kinship among particular breeds. Using analysis of DNA microsatellite polymorphisms by some of the accepted scientific methods of population genetic analysis, new breed specific and group-breed specific markers have been detected on a daily basis. To date, the procedure has been used to analyze the Croatian shepherd and Tornjak, to be followed by other Croatian autochthonous dogs. This will enable the hypotheses presented herewith to be verified or rejected in the near future. Finally, Zajc and Kus researched population genetics of Dalmatian, Istrian hound and Greyhound. Authors concluded that their phylogenetic relations are much closed, special when they were compared with other breeds. Number of involved dogs in project was relatively small but information can be useful for future research.

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