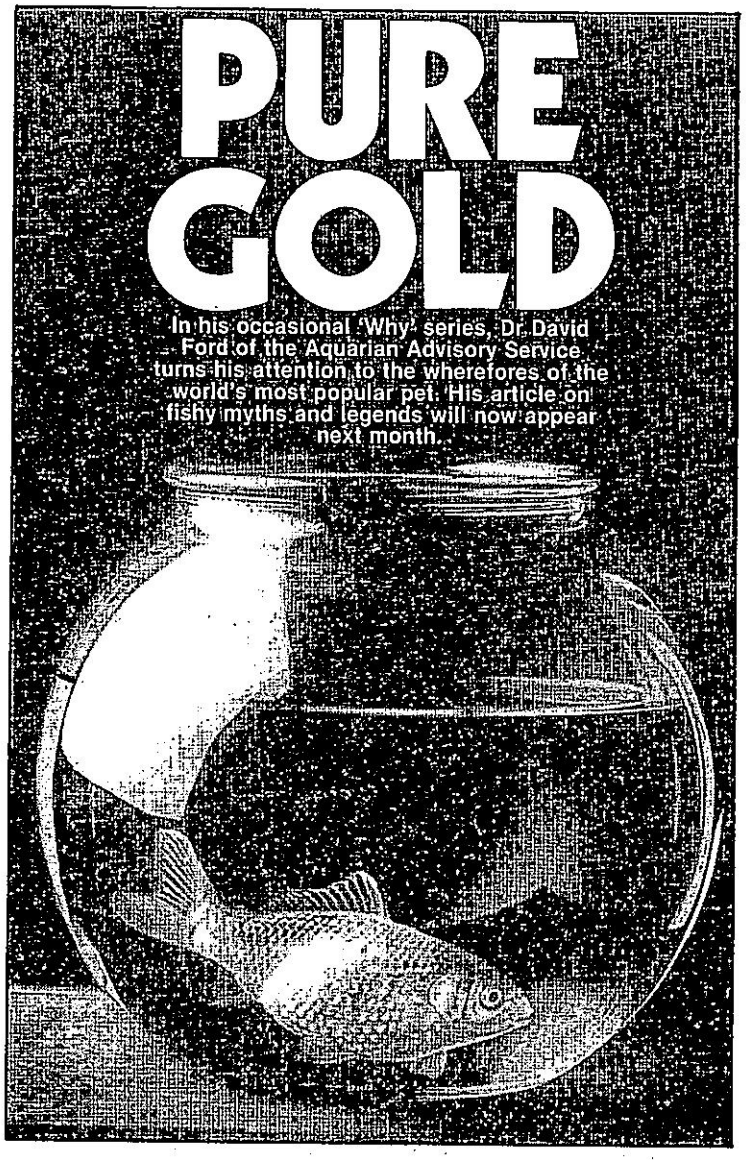
PURE GOLD

In his occasional 'Why' series, Dr David Ford of the Aquarian Advisory Service turns his attention to the wherefores of the world's most popular pet. His article on fishy myths and legends will now appear next month.



The most popular pet in all the world is the common goldfish — it outnumbers dogs, cats and budgies added together. Often the first pet a child ever owns is the goldfish bought from the petshop, or won at a local fair. The fish resides in a goldfish bowl for twenty years or more, swimming round and round while the child grows up, leaves home to marry and has children of her own, who one day get a goldfish . . . and so it goes on.

Carassius auratus

The goldfish belongs to the family of fishes called Cyprinidae and is one of the genus *Carassius,* which includes *Carassius carassius,* the Crucian Carp and *Carassius auratus gibelio,* the Prussian Carp. The proper name for the goldfish is *Carassius auratus auratus* (Linnaeus), to distinguish it absolutely from its cousins.

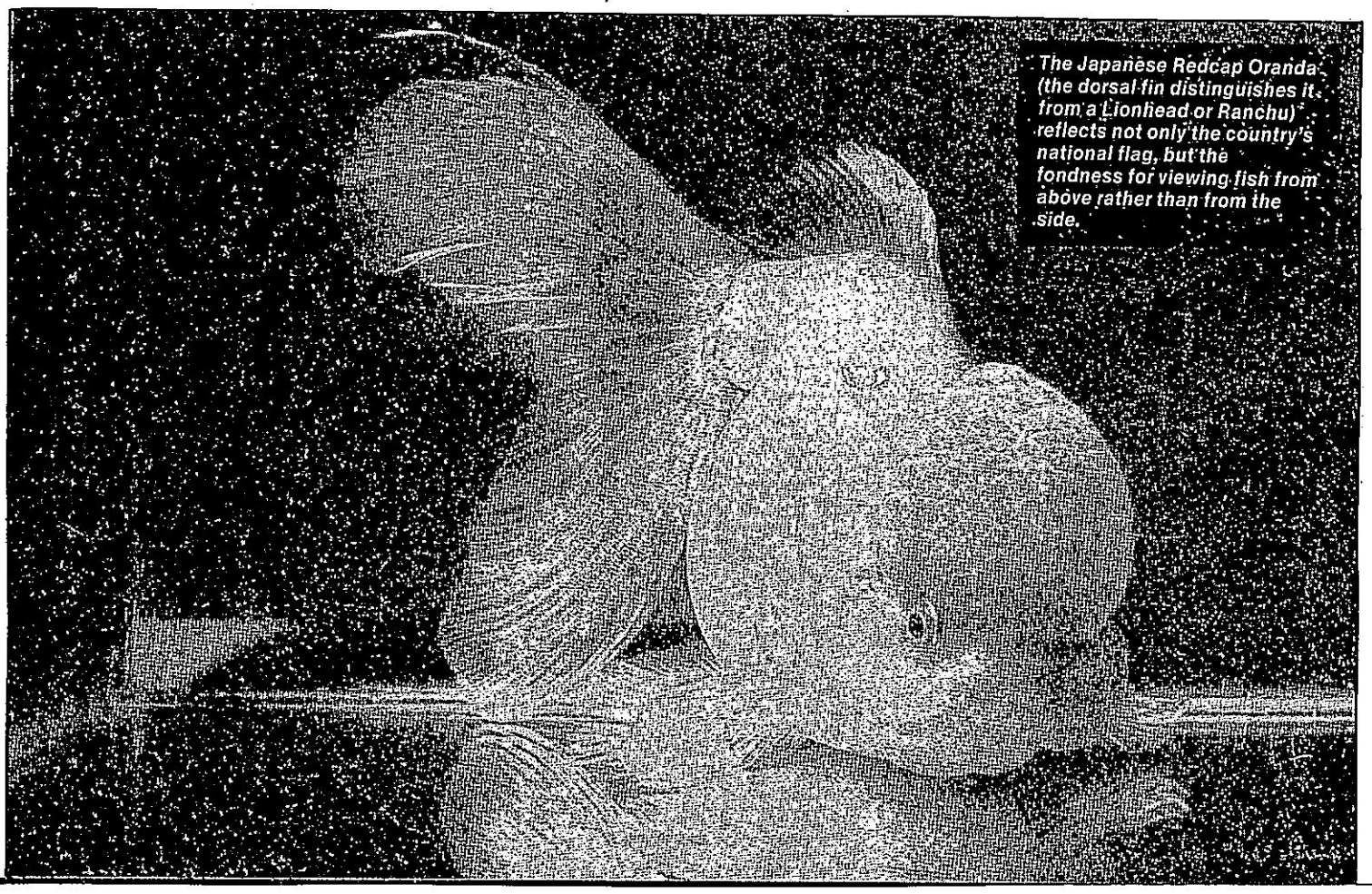
The *Carassius* Carp was farmed by the Chinese more than a thousand years ago as a food fish, but 'sports' formed that were more decorative than the olive-brown Carp. Red-scaled fish were described in writings of the Tsin Dynasty of 265 to 419 AD. These were selectively bred into the classic gold colour and kept as pets in ponds during the Sung Dynasty of 960 to 1279 AD. There is documentary evidence of coloured Carp, called Chin-yü in Chinese, in artifacts from these Dynasties. Then coloured varieties, including combinations of gold, silver, red and black were kept in clay aquaria during the Ming Dynasty of 1368 to 1644. The first record of a Twin-tailed variety was during the 1500's and in the 1600's the transparent scaled varieties were described. By 1726 the form lacking a dorsal fin was shown in the Chinese Imperial encyclopedia. These books also recorded round-bodied goldfish and the upturned eyes variety.

The Japanese entered the scene as early as the 1500's and they have developed their own special varieties, such as the Lionhead and Shubunkin. In the early 17th century the first goldfish varieties arrived in Europe on the returning Far Eastern trading ships. There are records of the fish proving popular in England, France, Italy, Germany and Holland, and in the Scandinavian countries and Russia by the 18th century.

It was 1870 before large numbers were imported into America, when breeding farms were established and their own variety, the Comet, developed.

National Characters

It is strange how the goldfish varieties reflect the customs of the societies that produce them. The Chinese, with their class-worship, bred the celestial eyed goldfish to gaze up at their Emperor. The Japanese, with their love of form and colour, bred the Shubunkin with its Koi colours. Several varieties with no dorsal fin, such as the Japanese Lionhead, were bred as a



The Japanese Redcap Oranda (the dorsal fin distinguishes it from a Lionhead or Ranchu) reflects not only the country's national flag, but the fondness for viewing fish from above rather than from the side.

consequence of the Japanese habit of viewing the goldfish in shallow pots, i.e. from overhead rather than the side.

The French wanted flowing fins like a negligee, and so developed the Veiltail. The English chose the impossible, of course — a blue goldfish — and eventually bred the Bristol Blue. The Americans looked for 'speed and drive' and so evolved the Comet. Twentieth Century commercialism has given the impetus for a plethora of varieties, some so far removed from the original goldfish that they look like different species. The Bubble-eye, Pompon, Red-cap and more, were all bred to attract customers and so bring profit, rather than prestige.

The original, or common, goldfish remains the hardiest of the varieties and so it is the best-seller, with a huge market developing throughout the world. This market was catered for by the Italians; with their sunshine and abundant water insects, fish farms in Italy were very productive and Italian goldfish were the normal supply for all the petshops and fairs of Europe up to the late 1950's and early 1960's. The Italian trade was then devastated by disease — the so-called 'Italian Disease' was actually erythrodermatitis caused by the bacteria *Aeromonas salmonicida,* giving body ulcers that proved over 90% fatal.

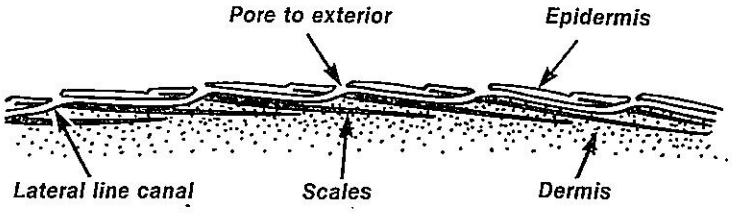
European dealers, therefore, turned to American goldfish, which were free of the disease at that time. The Americans were mass-producing the fish for their home market, so supplies were easily switched to Europe. Over 100,000,000 goldfish a year were produced by Ozark in Missouri, Grassyfork in Indiana, Billy Bland in Arkansas, Mt. Parnell in Pennsylvania, Hunting Creek and Three Springs in Maryland. Some 50,000,000 were sold into the hobby trade but as many again were sold as bait fish for trot-line fishing and as feeder fish for large species — sad, but true! Obviously the brighter the fish, the better its function as bait, hence the American goldfish were bred for a deep golden, almost red colour.

The Asian fish farmers were quick to see a marketing opportunity because the (then) mighty dollar meant the goldfish were fairly expensive. Cheaper Asian fish appeared in Europe in the early 1980's, a trend that continues to this day, with Far Eastern varieties of the fancy goldfish now being mass-produced and shipped in large numbers to the developed countries.

Here again, the goldfish varieties reflect national, economic, even political character. As cheap Asian imports have become established, the quality of the goldfish has deteriorated. The fat golden Italian fish gave way to the colourful American variety, but the modern Asian goldfish loses its colour after a few years, or even months, and turns pale or white. My postbag is full of letters complaining of goldfish losing their gold colour. It is a consequence of in-breeding or unselective breeding, because of commercial pressure to produce quantity at the expense of quality.

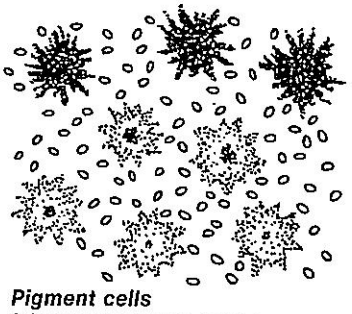
Colour is a Chemical

The reasons for the gold and other colours in goldfish are to be found in the structure of the goldfish's 'skin'. The scales are semi-transparent in the species, allowing light to enter the skin and be reflected back from tissue deep inside this dermis layer. This tissue gives a metallic shine to the scales, and so the common goldfish is part of the 'Metallic Group'. If the reflective layer is missing (by selective breeding) the even deeper coloured layers overlying the adipose tissue (equivalent to our fatty layer) can reflect through, giving coloured varieties (such as Shubunkins). These are called the 'Nacreous Group'. If every trace of reflective tissue is bred from the fish, the colour takes on a matt appearance, i.e. no shine at all (such as the Black Moor) and these are known as the 'Matt Group'.



A section through the skin of a goldfish along its lateral line. Scale count from head to tail in domesticated examples varies from 22 to 28.

Now the actual colours inside these layers are chemicals of two distinct types — the schemachromes, where the structure of the chemical gives reflection of white light in its composite colours (like oil on water) or the biochromes, which are true pigments (like the dyes in your clothes).



Pigment cells (chromatophores) in the dermis beneath a goldfish's scales. Their distribution and colour combination determines the hue of the fish.

The biochromes include carotenoids, giving yellow, reds and orange; these are present in goldfish. There are also melanins, giving black and brown colours or the purines, that are white or silver. These pigments, including others such as flavins, porphyrins and pterins, occur in other fishy parts, giving the characteristic colour of the eye, the liver, kidney, fish eggs etc.

Among schemachromes are the iridocytes. These are plates with reflective qualities, but pigments are also embedded in them. If the scales are transparent, showing plenty of iridocytes rich in erythrophores (red pigment), you get a red-gold metallic hue (and *that's* why goldfish are gold). If the iridocytes contain xanthophores (yellow pigment) you get a paler golden fish as seen in the Italian and Asian breeds. If the pigment is melanophores (black) you get black spots, or even patches.

Hand-sorting goldfish on a Far Eastern fish farm. Yes, we know he should use a net, but at least the process is swift.

Colour is not a Disease

The black pigmet melanin is the main component of melanophores. It is a breakdown product of amino-acids, the food elements that make up protein. Feed goldfish a protein-rich diet and the fish may develop melanin as part of the digestive process. Black areas can appear (and disappear) and often hobbyists write to me about a new disease — Black Spot — that is afflicting their once golden fish. Actually there is a Black Spot disease — but this isn't it.

This effect is also why we use the White Carbohydrate Flake in 'Aquarian' Goldfish Food — it lowers the protein content of other recipes used in the blend, and so controls the melanin output. Ageing occurs in fish, and melanin can form in older specimens, the black spots or patches just revealing the passing years. If the goldfish is not pure bred but there is a history of nacreous or matt ancestry, colour changes can also develop with age that are genetic and thus permanent.

Diet or water quality changes will not affect the fish's new colouring. It is analagous to dog breeds. A pure-bred Labrador may win prizes at Crufts, but a mongrel will not even get pedigree registration.

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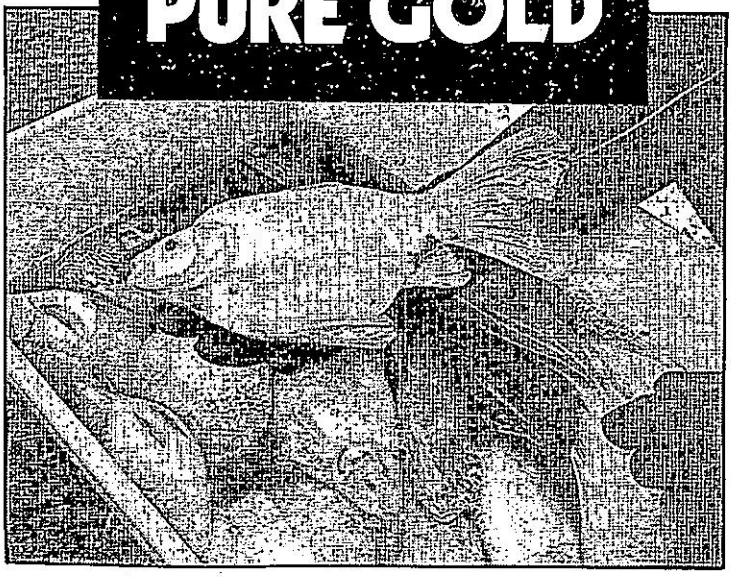
There are so many varieties of goldfish around today that it is no wonder cross-bred 'mongrels' occur.

The fading of goldfish is where in-breeding or poor selection has given transient erythrophores — or a preponderance of purines that develop with age. There's nothing wrong with such fish, just that the skin is pale where the owner expected a gold or red colour. Again, people write to me with worries that the fading colour means illness or the start of Fungus.

If the goldfish is from good, pure-bred stock with plenty of carotinoid colour, feeding food rich in such compounds can enhance the colour to its maximum genetic level. A food compound that is very effective for this colouring is canthaxanthin (the 'x' is pronounced like a 'z'). It is found in crabs, shrimps and prawns, where boiling releases the compound, hence they turn red when cooked. The compound is also found in 'Aquarian' Colour Food, which should be fed for about a week to a fish before it is entered in a show to maximise its colour potential.



Unselective breeding (you can't get much more unselective than in a farmer's pond) has thrown up this not unattractive, pale goldfish. The picture also shows the impressive size which these fish can attain in unrestricted space.

Wild is Olive-green

The goldfish, whatever variety it grows to become, is born a natural olive-green colour, where all the pigments are present to help camouflage the fry. Genetic engineering takes over as the fish grows, and the common goldfish turns gold after about four months.

This change is temperature related. It is no coincidence that the sunnier climes produce the best goldfish. Pond-bred fish in Britain, especially in cool summers, often never change from olive to gold because the critical temperature has not been reached at the critical time in the fry's development. Commercial breeders know about this effect, and will bring developing fish indoors to heated pools when the weather stays cold.

It is claimed by some authorities that the effect is viral. A virus within the fish's dermis changes the chromatophores and they need a temperature over 60°F, preferably near 80°F, to activate the virus. Without more evidence I do not accept this view, believing the effect to be chemical — but still temperature-related.

Buyer Beware

Do not condemn your goldfish if it does not stay as golden as the day you bought it. It's still the same, friendly goldfish. However, if you want a rich golden hue, perhaps for club showing, you must buy pedigree stock.

If the imported fish at your local aquarium shop are not good enough (some are . . . you get what you pay for) then contact the specialist breeders such as members of the Goldfish Society of Great Britain or the Northern Pondkeeper and Goldfish Society (addresses are sometimes published in Practical Fishkeeping). These and similar societies hold annual open shows (see the magazine for dates and venues) and it is worth visiting to see what a really good goldfish looks like . . . it's pure gold!