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Photo: New York Zoological Society

Golden wagtail platys, a remarkable variety developed by Dr. Myron Gordon, who discusses inheritance in an article overpage

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Editorial

SEVERAL times have we tried to strip off the cloak of mystery and blow away the atmosphere of black magic in which the subject of fish breeding seems to be enveloped for so many people. But once again here before us is a pile of letters asking us to pass on "secrets" of the methods used by Continental breeders, demanding full details for breeding this and that species and woefully enquiring why fishes obviously made for each other will not get together and produce a family.

It may be disappointing for those who secretly hanker to use the magic incantation or herb potion, but the truth is that not only are there no well-defined methods or secret formulae but neither is there such a thing as fish-breeding *skill*. What passes for skill in this matter is a happy combination of qualities and circumstances which together form the successful fish breeder. Make no mistake—we do not deny that there are people who appear able, in the picturesque phrase of one aquarist, "to get spawn out of a plate of fish-cakes"; they are specially common among Continental aquarists, though not as common as some would have us believe, but what they have is acumen, not a special God-given skill.

Breeding is the fishes' business. Knowing something about his fishes' business is the nearest thing to skill the successful breeder develops. The qualities which aid him are patience, the ability to make observations and experiments and the capacity to recognise and learn from mistakes. Circumstances which provide the right background include an abundance of free time and sufficient space to house the multiplicity of tanks required. It is often found that the fish-breeder is also a specialist—his activities revolve around two or three, perhaps only one, species of fish. But the not-too-ambitious aquarist can easily become a breeder. The impatient, the indolent and the unimaginative, those who clamour for easy methods which do not and cannot exist, they can never hope to become breeders.

The Meaning of Inheritance in Aq

1. Origin of the Wagtail Platy

by Dr. MYRON GORDON

(*Geneticist, New York Zoological Society*)

Photographs by SAM DUNTON, N.Y.Z.S.

Wild Mexican platys. Upper fish shows one-spot and comet pattern. Lower fish has spotted body pattern and crescent pattern near the tail

TEN years ago the golden wagtail platyfish, with its sharp contrast of black fins on its golden body, was introduced to American aquarists. Its attractive colour pattern quickly attained great popularity. Yet comparatively few generations back, in 1939, one of the grandparents of the colourful wagtail platy was a wild, drab fish that lived among thousands of others in the arroyos and lagunas of southern Mexico. The other grandparent was the plain, undistinguished goldplaty common to aquaria all over the world.

The wagtail, an entirely new colour combination among aquarium fishes, was produced by applying well-known rules of genetics, the science of heredity. In the scientific beautification process the olive drab body of the wild platy-fish was transformed to golden. At the same time, its colourless and transparent fins were neatly darkened as if mascara were applied to the rays of the fins.

The wagtail was developed as a happy by-product of experiments conducted in the Genetics Laboratory of the New York Zoological Society for the purpose of studying the influences of heredity in the formation of pigmented tumours. The wagtails never develop abnormal growths or cancers. But their unique colour pattern was useful in illustrating a little known fact that the colour of the off-spring need not resemble the colour of their parents. This may seem to contradict the laws of inheritance. Actually it supports them, for it means that two parents may have characteristics which, when combined in their offspring, produce something new. There is a parallel in the physical sciences that is taught in every high school. Oxygen and hydrogen are gases. Yet when combined under special conditions they produce a liquid, water.

Development of the Wagtail

The wagtail story began in the Mexican pools and streams of the hot, mite-infested jungles of Veracruz and Oaxaca. I and my field associates caught over 8,000 platyfish, *Xiphophorus* (*Platypoecilus*) *maculatus*, from a tributary of the Rio Papaloapan. When I classified them according to their various colour patterns I found over 150 different black-marked types. Yet in none of these patterns was there anything that remotely resembled the wagtails of to-day.

Among the 150 odd types I noticed a variety which was distinguished from others by a strong black line on the upper and on the lower margin of the tail. The rest of the tail was transparent, as were all the other fins. I called this new colour type "the comet." A number of comet platy-fish, together with a larger assortment of other types, was transported 4,000 miles north to the New York Aquarium.

At the Genetics Laboratory of the Aquarium, I subjected the comet platy to a routine breeding test to see whether the pattern was inherited or whether it was just a chance variation that occasionally appears and then disappears without leaving any living representative to carry on the type. I used a simple test. The wild platy with the comet marking was mated to another platy without it. I soon found that all their offspring had the comet pattern. When the comet-marked offspring of the first generation reached maturity, I mated them together, brother to sister. They produced, in the second generation, three fish with the comet pattern to every one without the comet. This indicated to me, clearly, that the comet was inherited as a simple Mendelian character and that it was dominant over the plain type.

Then I mated a comet platy of our original wild stock to the plain, gold-platy, a strain that had been domesticated for a long time, the first of which appeared 30 years ago. When the young were born from the comet-goldplaty union, I could see readily that all the young were grey and

Natural Mexican waters from which platys are collected

arium Fishes

The first article of a series in which the subject of inheritance is discussed in detail by the world's foremost authority on the genetics of fishes. Aquarists have benefited greatly from Dr. Gordon's scientific work, which has given us several new and attractive varieties.

Grey wagtail platy male (left); golden wagtail female

that their tail fins were faintly outlined in black. This meant to me that, as before, the comet was dominant over the lack of the comet and also that the *grey* body colour of the wild platy was dominant over the *gold*.

As the grey comet-goldplaty hybrids grew in size, the colour of their tails became darker and darker. When they were about half an inch long, I noticed that the other fins were darkening, too. Eventually they developed into the first grey wagtails, and I so named them because of their fluttering black tails. The question that arose in my mind was, what caused the change of the comet into the wagtail? Many experiments were performed to solve this problem, as we shall see. Since the grey wagtail was now available, I conceived a plan to produce a golden wagtail. This plan simply involved the mating of grey wagtails to each other (that is, brother-sister mating), or mating grey wagtails back to the pure goldplatys. I did both.

In the first instance, I obtained the anticipated golden wagtails once in about every seven young, or to be exact, nine in every 64. In the second case, I obtained the predicted and desired golden wagtail once in every four offspring. Later, when these black-finned goldplatys were isolated and mated to each other, some bred true to type. Others produced a number of comets; these were throwbacks, indicating the wagtail's ancestral origin, the wild comet-marked platy.

The golden wagtails turned out to be so popular that fish breeders have used them to improve other varieties. Thus, golden wagtails mated to red platys produced red platys with black fins. Even the related swordtail has been dressed up in black "tails," "gloves" and "socks" by a series of matings with the wagtail. But the golden wagtail is the key type and the most popular. Besides its sharply contrasting colour scheme, there is another feature, the peculiar markings of its head, which enhances its attractiveness. The upper and lower margins of its jaws are outlined in black and the black trim runs along the lower lines of its gill covers. It looks like a golden harlequin wearing a black mask. The golden wagtail is an amusing fish to watch in the aquarium. It is just the kind of fish that aquarists are looking for these days.

Behind the Wagtail Story

That was the story, in short, of the golden wagtail platyfish as it appeared several years ago in the pages of New York Zoological Society's magazine *Animal Kingdom*. In response to this story, I received many inquiries from aquarists who wanted more information concerning the reasons for each step in the blueprint of the breeding programme which finally produced so striking a result. The pattern of the inquiry was much the same. What was the reason for the choice of certain mating partners? What was the breeding principle followed for the prediction of the number and kinds of young from chosen parents? Were certain special foods, water, temperature, aeration, plants required? These were a few of the many topics proposed for clarification.

In order to appreciate the circumstances which led to the discovery of the golden wagtail platyfish, an understanding of the nature of heredity, and its application, is vital. *Heredity*, as the word applies to man, usually has two meanings. A man may inherit a house or a sum of money; this is his social inheritance. A man may inherit such traits as blue eyes, brown hair, and a particular colouring of his skin; this is his biological inheritance. In a sense, neither the items of his social inheritance nor the traits of his biological inheritance are transmitted as such. For his house or sum of money man receives pieces of paper, the title to his house or bills representing money. For his inherited physical or mental traits man receives hereditary units of protoplasm or genes.

Inherited characteristics, such as blue eyes, brown hair, or a black skin colour are produced by genes (or the "factors" of Mendel) which are passed along unchanged from one generation to another. An individual inheriting genes for white skin may also inherit by the same genes the capacity of having his skin turn to a dark shade if he exposes it to the sun. After exposure his skin may match the colouring of a negro. The negro, on the other hand, inherits his skin colour through genes which act without the intermediate environmental requirements of the rays of the sun. The negro, or for that matter anybody having a highly pigmented skin, may become particularly sensitive mentally in a social environment in which his skin coloration subjects him to discrimination and restrictions. Thus, genes for black skin colour may effect not only a man's features but may also determine, in certain environments, his behaviour pattern.

Consider another example of colour inheritance in relation to environmental effects, this time in the corn plant. This plant has two distinct types of heritable effects which concern the sun-red colour of the leaves; one heritable effect will produce the sun-red colour only if the leaves are exposed to the sun; the other heritable effect will cause the leaves to become sun-red whether or not they are acted upon by the sun.

Genetics then is not just a study of heredity. The geneticist, like the chemist, records as accurately as possible the reacting agents involved and the conditions under which the reaction takes place. Often, when a chemical reaction

takes place under a very wide range of conditions, the chemist does not bother to specify those physical conditions every time he discusses that particular process. Similarly, the geneticist may not mention the environment necessary for a particular effect because in some cases the hereditary factors and the conditions for their performance are well known. When you ask a geneticist, "which is more important, heredity or environment?" he is likely to say, "what kind of heredity and what kind of environment do you mean?"

The modern method of study of heredity stems from the experiments of Gregor Mendel, although the terms *genes* and *genetics* were created long after his discoveries. Mendel announced his results to the scientific world in 1866 in a journal which was not widely circulated, so that it was not until 1900 that the principles Mendel clearly presented were read widely and appreciated. Great strides have been made in the science of genetics since 1900. New genetic experiments, employing improved methods of study and many kinds of plants and animals, have required an expansion and modification of the original principles. Nevertheless, Gregor Mendel's initial discoveries are as sound to-day as they were when they were first announced. Mendel's methods, his results and his explanations may well be reviewed for an appreciation of the basic principles of genetics.

Mendel's Experimental Method

In a little strip of land, hardly larger than a city back-yard, Mendel laboured painstakingly, over many years, whenever he could get time off from his duties as priest and teacher in the Augustinian Monastery at Brünn, in Moravia. He had studied physics and chemistry, as well as biology, in the high schools of his village. Later he travelled to Vienna where he continued his studies at the University.

Mendel knew that the physical scientists' methods of investigation were more precise than those of the biologists in the 1850s. What particularly appealed to Mendel was the way chemists and physicists used mathematics in the evaluation of their results. Appreciating this, he applied the more precise methods of the physical scientists to his biological experiments in heredity of plants. His discoveries were not the result of a sudden inspiration. He made many trial experiments and he made many errors. Out of his trials and errors he eventually worked out a scientific plan of action which he followed faithfully. His plan was good and his results led to great discoveries.

Mendel spent two years in testing his plants for purity. Like the chemist, he wanted to be sure of his reagents. Thus, when he was ready to cross the tall sweet pea plant with a short one, he knew by his own two-year test trials that each plant he used belonged to a race that bred true to type Mendel picked out easily recognisable characters in the sweet pea for his experiments; he chose those features which were opposed to each other like yellow pod-producing sweet peas in contrast to green-pod plants, or like tall sweet peas versus dwarf ones. In the beginning, Mendel treated each contrasting plant character separately, devoting a separate breeding experiment to it. Later, he combined two or more inherited characteristics and predicted the more complicated results accurately. In all, Mendel used seven contrasting features in the sweet pea.

The sweet pea was chosen deliberately by Mendel because, in addition to its many clear-cut characters of colour and size differences, the plant had a type of flower (which contains its reproductive system) that a skilled worker could manipulate. Ordinarily the sweet pea is self-pollinating and self-fertilising. Natural agents, such as wind and insects which effect cross pollination in other kinds of flowers, play no part in the sweet pea's system of reproduction, because its flowers are so constructed that foreign pollen has little or no chance of entering the plant.

When Mendel wished to cross a short-stemmed sweet pea with a long one, he delicately removed the undeveloped stamens from the short plant's flower. Thus, in effect, he emasculated it. Then, by an equally delicate operation, he placed the ripe pollen grains that he had removed from a tall plant's flower, upon the stigma of the short sweet pea's flower. This amounted to mating a "short" female with a "tall" male plant.

Mendel harvested the seeds of these artificially fertilised short sweet peas and planted them. He found that all the seeds developed into tall plants. This indicated that the tall plant's pollen had effectively suppressed the short plant's normally expressed characteristics. Mendel called these plants *tall hybrids*, even though they were indistinguishable from the ordinary true-breeding tall sweet peas. Mendel repeated the cross between the tall and short plants but the next time he used pollen from the short plant and placed it on the tall flower's stigma. This amounted to mating a "tall" female plant with a "short" male plant. This is called a reciprocal test. He found the results (from direct and reciprocal matings) were absolutely identical; that is, he obtained, again, all *tall hybrid* plants in the first generation.

Next, Mendel allowed the tall hybrid plants to reproduce in a normal way, by self-pollination, and harvested the seeds that were to produce the second generation crop of sweet peas. When these seeds were planted Mendel discovered that the tall hybrids yielded not only tall plants but short ones as well. Mendel said, "in this generation there reappear, together with the dominant characters, also the recessive ones with their full peculiarities, and this occurs in the definitely expressed average proportion of three to one, so that among each four plants of this generation three display the dominant character and one the recessive." Mendel found that each of the seven paired characters which he tested behaved in the same way. In each case the dominant character was represented in the second generation plants three times more frequently than the recessive.

Mendel continued his history-making experiments. The seeds of each second generation plant were harvested separately. The seeds sown from all the recessive dwarf hybrid plants retained their recessive dwarf character. They *bred true* just like their short-stemmed grandparental stock.

It was quite different with the tall hybrids. When the seeds were sown from the tall sweet peas possessing the dominant character, only one-third of them bred true to type. The remaining two-thirds of the tall hybrids yielded offspring some of which were tall and some of which were short, and the proportion of the tall to short was again three to one, showing exactly the same ratio as their immediate parents.

Mendel began to summarise and evaluate his results. He found that when he crossed the original true-breeding short plants with true-breeding tall ones, he obtained all tall hybrids in the first generation. The tall hybrids, after self-pollination, produced second generation plants consisting of one short to every three tall ones.

Mendel's Explanation of Results

On the basis of 100 sweet peas bred from tall hybrids, Mendel found that in the second generation 25 were short plants and these, when tested, bred true; 25 tall plants also bred true; while 50 tall plants, when tested, produced tall and short plants. Thus, Mendel showed that the apparent three tall to one short ratio in the second generation plants was actually one true-breeding tall plant to two non-true-breeding tall plants to one true-breeding short plant.

Mendel's scientific fame is not based entirely upon his invention of the proper method of conducting experiments

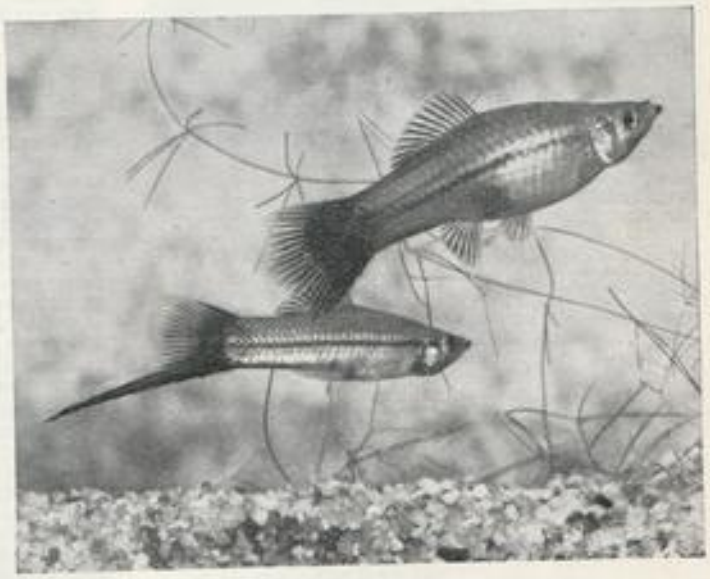
in heredity, but also upon his far-reaching theory of inheritence which he based upon the facts he obtained.

Recall Mendel's pure-bred stocks of tall and short sweet peas. The constant, true-breeding types can only be produced when the egg cell and fertilising pollen are of *like* character. Since the same hereditary elements are present, similar plants are produced when these types combine. Mendel thought of his plants in terms of the pollen and egg they produce. The true-breeding tall sweet pea produced pollen containing the tall hereditary factor which he called *T* (in a capital letter), and eggs containing the same factor, *T*. In the process of self-pollination the *T* factor of the pollen united with the *T* factor of the egg, producing *TT* or pure-breeding tall plants. That is why Mendel looked upon the plants as dual entities. Each received half (one *T*) of its inheritance from its father and half (the other *T*) from its mother. For this reason he used the formula of *TT* rather than *T* to represent each pure-breeding tall plant. By a similar line of reasoning, Mendel looked upon the short sweet pea as composed of two uniform hereditary elements which he called *tt* (small letters in contrast to capitals used previously).

When Mendel crossed the tall plant *TT* with the short *tt* and obtained all tall plants in the first generation, he visualised the process in terms of the pollen and the eggs and the hereditary factors which they carried. For example, when the tall plant furnished the pollen and the short plant the egg, Mendel suggested that the pollen-producing (male) parent contributed one *T* factor and the egg-producing (female) parent contributed another *t*. Thus, when a pollen granule carrying *T* fertilised an egg carrying *t*, the result of the mating was a *Tt* hybrid. Since the hybrid plant was tall, Mendel called the *T* factor dominant over the *t* factor. In appearance, the original *TT* tall parental plant was not distinguished from its tall hybrid *Tt* offspring plant.

To complete the picture Mendel found that when the short plant was the pollen (male) parent, *tt*, and the tall plant the egg (female) parent, *TT*, their hybrids were tall, *Tt* also. These plants, too, looked and behaved like the other *Tt* hybrid plants he had previously obtained. There was absolutely no difference in the results from direct and reciprocal matings.

When Mendel crossed the *Tt* tall hybrids of the first generation with each other (which may be written conveniently in the shorthand of genetics as *Tt* × *Tt*) he obtained *three* tall plants to every *one* short plant in the second generation. Again he explained these results in terms of the hereditary factors carried by the pollen and the eggs. As a dual entity, the tall male hybrid, *Tt*, could produce two kinds of pollen, one carrying the dominant *T* factor and one carrying the recessive *t* factor. Similarly, the tall female hybrid plant could produce two kinds of eggs, one carrying the dominant *T* factor and one carrying the recessive *t* factor. Thus, when thousands of dust-like pollen grains of two types, *T* and *t*, fell upon the many eggs also of two types, *T* and *t*, it was entirely up to chance which kind of pollen containing a *T* or *t* factor would fall on an egg containing a *T* or *t*. The chances are equal that *T* pollen falls upon and unites with an egg carrying *T* as with an egg carrying *t*. In the first case, a *TT* plant results, and in the second a *Tt* plant results. Similarly, pollen *t* will unite as frequently with eggs of the *T* type as with the *t* type. In the first case a *Tt* plant results and in the second a *tt* plant results. Adding the four possible combinations, there are the following: one combination of *TT*, two of *Tt*, and one of *tt*. The last represents the short plant, the other three are tall. But of the three tall plants only one is pure *TT*, while two are like the last generation hybrids, *Tt*. This may be summarised as follows: 1 *TT*: 2 *Tt*: 1 *tt*.



Among the attractive varieties developed by fish breeders following Dr. Gordon's introduction of the golden wagtail platy are wagtail swordtails like the handsome pair pictured here. Swordtails and platys are closely related, but it is the golden wagtail platy that is the "key" fish in the production of varieties

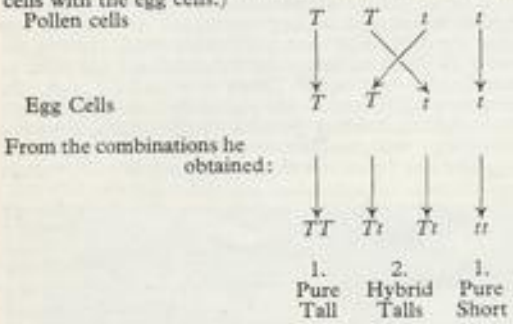
Mendel sought to prove his theory of the particulate nature of hereditary factors by planting the second generation sweet pea plants, both the tall and the short. If his theory was correct, he could expect the short plants, which he assumed to be *tt*, to breed true-to-type since only pollen of type *t* and eggs of type *t* could be produced. In this experiment his theory was entirely vindicated, for he obtained all short plants—exactly what he predicted.

In testing the tall plants of the second generation, Mendel expected that one out of three tall plants would breed true-to-type, while two-thirds would not. In order to be absolutely sure, he planted the seeds of each tall plant separately so that he could record all the offspring of each plant. He found that one-third of all the tall plants tested actually did produce tall plants only, and he ascribed this to the probability that the parents must have been of the *TT* type. Two-thirds of the second generation tall plants did not breed true; rather they produced *three* tall plants to every short *one*. This behaviour Mendel ascribed to the probability that the parents must have been of the hybrid *Tt* type.

Mendel designed a method by which he could predict the results of mating individuals whose heredity was previousy known. For example, if he mated *two hybrid tall plants* he said the pollen cells produced by the male, and the egg cells produced by the female would be as follows:

The pollen cells would be: *T*, *T*, *t*, *t*, etc.
The egg cells would be: *T*, *T*, *t*, *t*, etc.

He then arranged the hereditary factors for tallness (*T*) and shortness (*t*) as follows: (In the diagram the arrows indicate all the various possibilities of combination of the pollen cells with the egg cells.)



Another, a shorter method of working out this kind of problem, was designed by Punnett, an English geneticist. He suggested a series of squares be used in which the hereditary factors of both parents be arranged as follows:

	Male Pollen Cells *T*	*t*
Female Egg cells *T*		
t		

The squares may be filled in by combining one hereditary factor carried by the pollen and one carried by the egg. In other words, the completed chart would indicate the combinations that would result by the random fertilisation of the egg by the pollen. The result will be as follows:

	T	*t*
T	*TT*	*Tt*
t	*Tt*	*tt*

Note that when the recombinations in the squares are totalled that there are 1 *TT*; 2 *Tt*; 1 *tt*. Since *TT* and *Tt* represent tall plants, there are three tall to one short (*tt*). (If the reader intends to solve a similar problem, and the subject of inheritance in fishes or in other organisms, including man, is based upon the solution of a problem of this kind, it would be well not to pass this exercise without mastering it. The problems and their solution that are to follow are but variations of the present theme.)

Dominance and Recessiveness

Some of the terms which Mendel coined are still used. He called tallness a *dominant* trait and shortness a *recessive* one. He suggested these traits were represented by hereditary factors in the reproductive cells. While the term factor is sometimes used to-day, the word *gene* is used more often. They mean the same thing. When the hereditary factors or genes are alike in a given individual like the pure tall plant, *TT*, Mendel simply called it *pure*. This has been replaced by the term *homozygous*, meaning that the zygote or fertilising egg carries similar forms of the gene. Mendel called the *offspring* of two pure breeding types (*TT* and *tt*) the *hybrid* type (*Tt*). This is now referred to as the *heterozygous* type or one with unlike forms of the gene in question. The pure recessive *tt* is spoken of as the homozygous recessive and *TT* is called the homozygous dominant.

Neither the dominant nor the recessive genes lose their identity during their association in the bodies of the heterozygous individuals. The genes remain as separate units generation after generation. This fundamental peculiarity of genes has been found to be true in studies of inheritance of all sorts of characters in many kinds of plants and animals, including man.

We now know that the genes are distinctive parts of the chromosomes and, with respect to heredity, the chromosomes are the most important components of the nucleus of the reproductive cells. The pollen cell of the plant or the sperm of the animal is comprised of practically all nuclear material. That the new offspring inherits equally from the male and female parent is further evidence that the hereditary factors are carried in the nucleus.

The Chromosomes

In man the number of chromosomes, determined from microscopic study of actively growing cells, was found to be 48. Every cell in our body has this number: skin cells, liver cells, brain cells, muscle, and so on; except the ripe germ cells. The mature sperm cells in the testes produced by the male and the ripened ova in the ovaries produced by the female have half the usual number, that is, 24. A moment's thought will provide the explanation of why this is so. When the human sperm containing its 24 chromosomes penetrates and fertilises the egg cell with its 24 chromosomes, the newly fertilised egg contains all the chromosomes of each, or a total of 48 chromosomes. Thus, the newly conceived human organism has the typical number of chromosomes of its parents and it retains this number for the rest of its life, providing some abnormal condition like cancer does not develop.

Man is not the only organism that has 48 chromosomes. The great apes have this number, too, a further bit of evidence of their biological affinity. The common Mexican platyfish and the common swordtail have 48 chromosomes each but, of course, this is sheer coincidence.

Everything in biological inheritance that man may transmit to his child is contained within the nucleus of the sperm cell. The human sperm under a high-powered microscope looks superficially like a wiggling tadpole. An oval head piece flattened at the tip contains the nucleus which is composed chiefly of chromosomal materials. The sperm is propelled by an extension of its body in the form of a whip-like tail. The sperms are so tiny that it would take 2,500 of them to cover the dot at the end of this sentence. The human ovum is hundreds of times larger than the sperm, but 12 of them would fit neatly on a similar dot.

Within every human sperm, small as it is, there are the makings of 24 chromosomes and each chromosome may have a thousand genes. The nuclear material within the human ovum is approximately of the same mass as that of the human sperm, while the rest of its matter is essentially stored food in the form of yolk. The nucleus of the human ovum contains 24 chromosomes, too, the same number of genes that are carried by the sperm chromosomes. The union of the sperm nucleus, with its quota of 24 chromosomes, with the nucleus of the ovum with its 24 chromosomes, constitutes the last step in the fertilisation process. The resultant new individual with its complement of 48 chromosomes is equipped for further development.

(Next month Dr. Gordon will discuss the Mendelian principles involved in "making" the wagtail platy.)

Building Your Own Fish House

by

CUTHBERT L. NICHOLSON

First thoughts • Planning the work • Counting the Cost • Clearing the Site • Concrete Foundations.

THERE comes a time in the lives of most keepers of tropical fish when, taken by the forelock, their path leads out of a room full of tanks into a garden full of possibilities. We must sometime reach a point where expanding our hobby inside the house ceases to be safe or where wandering from room to room with dripping apparatus becomes unpopular, or even when we must have fish both in the house and in the garden. I reached that time and intend to tell you what I did about it so that you may follow, or avoid, my example, as you please.

Before telling you how I went on with the job I would like to say that after about two months of spare-time work, done during the evenings, often with the aid of electric light, my fish house is finished and I am busy wrestling with temperature problems. By the time I finish telling you how the place was built I shall have solved the problems now on hand and you will no doubt profit from the mistakes I am at present making. I should also mention that this is not a tale for the expert technician or master craftsman for they might find my verticals not vertical and my horizontals not horizontal. It is a simple story with pictures of how a fish house was put together by an average inexpert man.

Collecting a File

It is a good idea, after you have decided upon the fish house your garden and your pocket will stand, to set down the order in which you intend doing the jobs. Looking back at my file I see a rough sheet with a programme mapped out. I have mentioned the file—as a soft-handed clerk I am file-minded—and I recommend that you should keep your paper work on the job between folders and pop inside the cover all information you may read or hear upon the subject. All notes on proportions you use, or intend using in the mixing and laying of concrete, should go on paper. Do not rely upon your memory, even if you think you have a good one, for that is the sure way of making the same mistake twice. However, we must return to the programme I mentioned. This was mine:

> Procedure after concreting the whole area: Build outside walls; erect timber; shellac if railway sleepers; paint; glaze; build inside skin 2-ft. high—care over pipe spaces; dig out boiler hut space and put good soil into insulating sections; build brick or concrete boiler house walls—leave inlet for fuel; install boiler and test; build tank sides with shuttering either side of centre footpath; divide tanks; test tanks; waterproof if necessary; prepare tanks for plants and fish; dig out fuel storage space on left of boiler house and concrete base; fit doors and ventilators; continue water changing in concrete tanks; test pH; test response of plants in boxes and plants on floor of tanks; test response of "guinea pig" guppies; record temperature behaviour of tanks above ground and concrete tanks by night and day; instal fish.

The author's completed fish house, seen beyond a dry wall and trellis

Counting the Cost

The completed fish house which fits well into the garden scene is about 20 ft. by 13 ft.—I shall give you exact details later and, so that you may have an idea of the quantities needed for a larger or smaller place I am giving a list of materials which went into the job and, if only for the amusement of later years, the 1952 prices.

	£	s.	d.
Heating apparatus	27	12	6
Timber (wagon sides cut and delivered)	8	5	0
4 tons ¾ and ¼ stone chippings at 27s.	5	8	0
2½ tons of sand	3	2	6
23 cwt. of cement at 6s. per cwt.	6	13	0
2 cwt. of Aquacrete at 8s. 6d. per cwt.		17	0
21 lbs. Medusa Waterproofing agent at 1s. 9d.	1	16	9
1,000 common bricks	6	15	6
Nails, 2 lb. each of 4 in., 3 in., 2½ in. and 1½ in.		8	11
¼ lb. panel pins ¾ in. for holding glass			6
	£60	19	8

I have not mentioned paint, shellac, nor the fact that I faced the front brickwork with some stones in the garden to make it match the surroundings; the fuel house woodwork was that of a dismantled garden shed. Most people have some scrap material at hand to save spending.

I should say that although I did not need to use shellac to seal the timber, if I had used railway sleepers a coat of shellac before the paint would have sealed in the oiliness. The 1,000 bricks completed the outer skin and the walls of the boiler house and did part of the inner skin. The remainder of the inner skin was made by pouring concrete between shuttering and had an advantage in being cheaper, neater and completed in one operation with no need for facing. Indeed I believe the whole place could well be made of concrete at a smaller cost. If price is of no account and you like to use the imported hardwood that is available, you would perhaps quadruple the timber costs. I recommend well-seasoned railway sleepers or discarded wagon

Materials begin to arrive at the site, which is being cleared

sides. Now that you know the worst with regard to these quantities, let me get on with the story of the fish house.

Clearing the Site

The piece of garden chosen for building was occupied by a rickety garden shed under which lady and gentleman country rats had found comfortable quarters. I noticed them as I gazed at the spot one dark night when trying to visualise the completed fish house, and the first job was to remove the hut and the rats. These vermin made me decide that after the site was cleared and levelled the whole area should be concreted.

The site was pegged out 19 ft. 2 ins. by 12 ft. 10½ ins. and marked with string from peg to peg. The diagonals were measured to make sure the place was plotted as a rectangle. I found a spare length of catapult elastic useful when stretched across the diagonals, and with the use of a spirit level and a painter's board the surface was made level by digging in from the lowest level. Round the outside but within the marking strings was dug a trench 9 ins. by 9 ins. and this forms the foundation for the outer walls. The inner walls rest upon the floor of concrete which is first laid over the whole area.

Mixing the Concrete

You will need to mix your first lots of concrete on your path or on the concrete floor of your garage, remembering to hose it down after you have finished for the night. The proportions suitable for the mix are four of stone, two of sand and one of cement. If you use a proprietary brand of waterproof cement you will produce a waterproof wall or floor, provided your concrete-mixing technique is right. Mix the chippings and sand well together, then mix in the dry cement, then add the water and shovel well until you get a mix that will "tamp" down solidly with all the interstices filled. Don't start walking about on the concrete floor until it has set hard and you will then have a grand base on which to mix all the future concrete. If you can scratch anything from your concrete with your nail it has not set properly and if you walk on it too soon it will never set.

In case, right at the beginning of this story, you are rushing to start, let me mention something of which I have thought since my place was finished. It is this. If you build your fish house in warm weather do all the wall and fish tank building before you glaze, otherwise you may find carrying buckets of concrete in high temperatures very tiring. If you are starting now, as the cooler weather starts, or in the early part of the year, use the programme mentioned in the file and enjoy the final work inside a very pleasant shelter. I started my house on the 9th March, and working most week-ends and in the evenings, the job was done in two months. I am sorry I did not keep a record of man-hours for your guidance, but I do remember on one day's holiday I worked for 17 hours. It was fine to get back to work for a change!

(To be continued next month)

FRIENDS & FOES No. 7

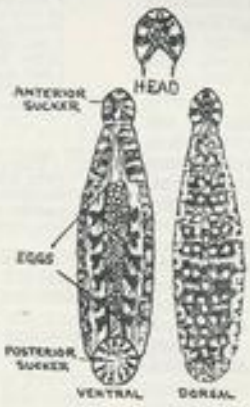
British Leeches

LEECHES—3

FISH-LEECH (*Hemiclepsis marginata*).

THIS leech is one of the prettiest of British leeches, and once found and examined cannot be mistaken for any other species. It grows to a maximum length of just over one inch. The basic body colour is greenish-brown. Round the outer edge of its body are a large number of small light coloured areas, each bisected with a patch of brown. This gives the creature an appearance of possessing a scalloped edge. On its dorsal surface are five distinct rows of cream spots, and numerous short, broken, transverse lines of the same shade. At the anterior end there appears to be an almost circular head, patterned in greenish brown, and at the fore end of it, in a lightish area, two pairs of eyes are situated.

The ventral surface is unmarked in any way, and completely transparent. Through it can be seen the very long, many branched gut, and also, in the late spring and summer months, a large number of small, brilliant green eggs. When the gut is distended with the blood of its prey, the leech is very dark brownish-red. Having fed, it can, like all leeches, live for several months without another meal.



Hemiclepsis marginata

It lurks among green weeds, where it is practically impossible to detect, and when hungry stretches itself to the utmost and waves its body up and down, from side to side, looking or feeling for a fish. Immediately it touches one it grips hard with its anterior sucker, and transfers its rear anchorage to the body of its victim. Until it is gorged with blood it will not release its hold unless the fish is removed from water. Tropical and coldwater fishes alike suffer from its attentions. Those over one and a half inches can survive an attack, but fry will always die.

C. E. C. Cole

A page for the beginner contributed by

A. BOARDER

NOW that the goldfish breeding season is over it is possible to make a thorough examination of all remaining youngsters to make sure that the best have as much room as possible. Then they may grow to the maximum size before the winter retards their development. I am often asked, how large should the season's youngsters be so that they have a good chance of going safely through the winter. I can say quite definitely that the size of the fry is not all important. Last winter I carried fry through the winter in outdoor tanks and they were not much more than an inch in overall length.

When it comes to how large the fry should be, the answer is that so much depends on the rate of growth. There is absolutely no comparison in the rates of growth of fry from the same hatching if they have been kept under different conditions. From the same spawning it is possible to grow fish up to three inches in length in three or four months, providing they have plenty of space and frequent feeds of the right type; others of the same batch can be less than an inch in length in the same time if they have been crowded and under-fed. Not that I think the feeding makes such a lot of difference—it is the space problem which is the more important.

If you have reared some good fish of up to two or three inches long in the season and wish to keep them growing as long as possible, I suggest that you keep not more than eight fish in a 24 ins. by 12 ins. by 12 ins. tank. Among several experiments made by me this season was one with fry from the same hatching being placed in different containers and all fed in a similar manner. One tank had only a few fry whilst another of the same size had three times as many. All were fed alike, yet in a week those with plenty of space had doubled the others in size. It is also a fact that where fry have plenty of room in which to develop they are not as subject to diseases as those in overcrowded conditions.

Future Feeding

If your fish are of a fancy type with deep bodies, such as veiltails, fantails, moors and orandas, it is good policy to add some starchy types of food to the usual mixture. I think that oatmeal is very good for this, and suggest one of the types of the quickly cooked class should be used. If the fry are still small it is necessary to strain the cooked oatmeal so that only the small is given to the fry. The older fish will clear up the larger particles. You should also continue with as much live food as possible, garden worms still being first favourites.

Towards the end of October it may be necessary to do a fair amount of clearing up in the pond. Many water-lily leaves will be dead by now and it is imperative that as many as possible be removed from the pond. An excess of these can mean a certain amount of water pollution and this must be avoided at all costs. There will be many leaves falling into the pond and you should do all you can to keep it clear; too many decaying leaves in the pond will spell trouble. You need not clean out the pond completely this month; November is plenty of time for this.

Adult fish in the pond require special treatment from now on. They must be fed as often as they will take food. If a little is offered each day and it is accepted, give some more so that all get a feed. This is most important; fish will go through the winter in a much more healthy condition if they have been well fed right up to the very cold weather. Many writers direct that no food whatever must be given to any type of goldfish during the winter months. I do not agree with this, as last winter I fed my fantails in the open pond as often as the weather appeared rather mild and found that they went through the cold season in much better condition than when they had been starved. I fed my fish on cooked oatmeal when there was over an inch of ice on the pond. I also fed on earthworms as often as the weather seemed a little milder.

Pond Molluscs

There appear to have been many new ponds made this year and many new pond-keepers have enquired about the need to put fresh-water mussels in the pond. Most newcomers to the hobby are quite certain in their minds that it is necessary to have plenty of mussels and snails in the pond to "keep it clear." The new pond is the last place in which to put mussels. That they can do a fair amount of good in a fair-sized, well-established pond I do not doubt, but they can only live and move about in mud or silt. As there is little or none of this in a new pond the mussels soon die. My advice is to leave mussels out of the new pond—you will save yourself a lot of trouble later on if you do.

Snails will live all right providing the water is pure. If it is polluted the snails may try to climb out or may die. Dead snails are often a sign of trouble in the pond and may be used as are canaries in a coal mine, to test for purity. The points in favour of snails are:—they eat some decaying vegetation, they provide food for the fishes in the shape of newly hatched young. Points against their use are:—many eat good plants as well as decaying ones; they eat and can pollute fish foods placed in the pond and their droppings cause trouble if in large quantities. Therefore I leave it to you to decide. I can add that it is quite possible to keep a pond or tank in a healthy condition without having any snails at all.

The indoor tanks will require some special attention now, to make sure that all dead leaves are removed from the water plants. During the weekly servicing the leaves can be easily pulled off when the depth of the water has been well lowered. Hold the plant secure in one hand whilst the leaves are pulled as otherwise the roots may be dislodged. Remove as much silt or mulm as you can from now on. Only a little is required for the plants will, to a certain extent, be resting and so will not be able to assimilate as much mulm as when in active growth.

Signs of Sleep in Aquarium Fishes

by

Dr. J. L. CLOUDSLEY-THOMPSON

WHEN I switch on the light at night, I like to watch my fishes struggle up from the sandy bottom of the aquaria where they have been resting. Within a few seconds they are all swimming about as actively as they do during the day. I wish I could wake up as easily! The crayfish, however, hurries back to his hole, for he shuns the light, and does not come out much during the hours of daylight.

Most aquarium fishes are diurnal in habit, or are arhythmic—nocturnal animals are less suitable as pets. Naturally too, there would be little advantage to an animal which finds its food by sight, in activity during the hours of darkness. On the other hand, catfish, gurnards, and other fishes that detect their food by touch or scent are frequently nocturnal.

Activity Rhythm

Animals whose periods of activity and rest are a direct response to the conditions of the environment (light and darkness, temperature, humidity, salinity, and so on) are said to have an *exogenous* rhythm of activity. Species in which 24-hour periodicity (12 hours of activity followed by 12 hours of rest, 16 hours of activity followed by eight of rest, and so on) persists for some days under constant environmental conditions, have an *endogenous* rhythm. Some have two peaks of activity during the 24 hours, for example at dawn and dusk. The majority however show a combination of both types—they have a *composite* rhythm.

Thus the goldfish is decidedly diurnal, and shows a rhythm of activity and rest which persists for several days in continuous light and running water. Gradually however, there is a decrease in total activity and a more even distribution of activity over the 24 hours, until the original diurnal rhythm is no longer perceptible. In alternating light and darkness the rhythm is quickly recovered.

Measurements of oxygen consumption indicate that goldfish in small groups (of three or four) are less active in the daytime than are single fishes, or fish in larger groups (16 or more). Over the entire 24 hours however, oxygen consumption per fish is the same, regardless of the size of the group to which it belongs. This is because in small groups the rhythm is less marked than it is in larger groups or in single individuals. In consequence the fish in smaller groups are more active during the night.

Young carp are nocturnal, but older individuals have been found to be arhythmic. Perhaps selection by predatory enemies has resulted in the evolution of a nocturnal habit among the defenceless young of this species. For it is a well-known fact that among terrestrial animals many of the weaker or more primitive species avoid their enemies by coming out only at night.

Pigment Rhythm

The pigment which shades the rods in the retina of the eye in fishes is under nervous control, and shows a rhythm of migration correlated with the normal cycle of light and darkness. At the same time in many species the melanophores (black pigment cells) expand by day and contract at night. In minnows these changes apparently represent an exogenous rhythm, since under continuous light stimulation the melanophores remain in a continuous medium dark state.

That the endogenicity of the diurnal rhythm of the catfish *Ameiurus* is poorly developed is shown by the fact that although here again the rods and cones in the eyes are lengthened at night so that they expose a greater surface to the diminished light, under conditions of continuous darkness, constant temperature and running water, the rhythm of rod and cone extension and contraction is maintained for only two days. By the third day it is hardly perceptible.

On the whole it is surprising how little is known of the physiology of diurnal rhythms in fishes, more particularly when the economic aspect of the subject is considered. For not only are their times of feeding affected by these rhythms, but some species migrate from shallow to deeper water and back again, and diurnal migrations from one depth to another also occur. Or the fishes may follow the diurnal migrations of the plankton on which they feed. But this, like most ecological problems, is extremely complex and a vast amount of detailed research has yet to be undertaken.

Aquarium in the Picture

An attractive example of the sparing use of water plant species, this tropical aquarium containing a mixed community of barbs won the Irene Perpetual Challenge Cup at the N.A.S. Show this year. Mr. D. M. Pullen of Nottingham was its designer. Plants used are Cryptocoryne species and Ambulia. Rock strata are arranged in a natural fashion and the main plant stems lean in the same general direction as if growing in flowing water. The plant-free region just off centre is the funnel-opening of an artistic but natural rock channel between the plants, creating the illusion of great distance in the aquarium

Photo: Valerie Litley

Decorative Underwater Tropical Plants

by JACK HEMS

A GREAT deal of the charm of a decorative aquarium is due to the plants, which add distinction to the underwater scene and help to enhance the beauty of the fish. To-day there is a galaxy of lovely plants to be had from the larger dealers. Most of them are quite easy to grow if you take the trouble to find out their requirements in the way of compost, light, depth of water and heat.

The small spatterdocks (*Nuphar*) from America will thrive in most aquariums, deep or shallow, temperate or tropical, and are delightfully green and good to look upon at any time of the year. The best specimens are grown in small pots of loam topped with coarse sand or fine gravel. In a sunny situation spatterdocks will flower and produce seed. But the quickest way to add to one's stock is to divide the rhizomatous root and plant each piece afresh.

The African blue lily (*Nymphaea* species) has daintier foliage than the spatterdocks and needs plenty of bright

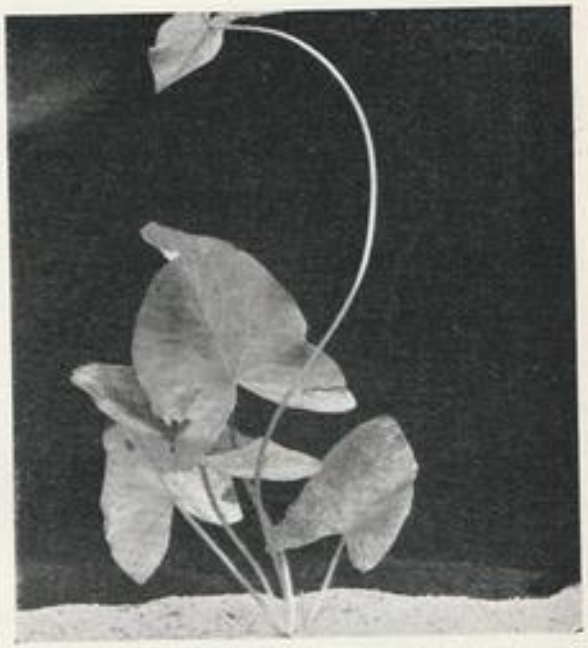
Photos : G. Timmerman

Echinodorus muncates in an aquarium

light and a temperature in the seventies. Although it will flourish in sand alone, it is more likely to send up its pretty blue flowers when it is potted in a mixture of loam, sand and a tiny pinch of bonemeal. Flowering time for this attractive aquarium lily is about the middle of June.

Given the average amount of daylight, or its equal in electric light, *Heteranthera zosteraefolia* will shoot to the surface with express speed and quickly mat the water with grassy foliage. During the summer, it will produce lots of pale blue aubretia-like flowers. *H. zosteraefolia* is a good subject to mass along one side of the aquarium, or to soften the appearance of unweathered rockwork. Besides its decorative value, *H. zosteraefolia* is a good oxygenator.

The several species of *Echinodorus* and *Aponogeton* suited to aquarium culture make stately and lasting centrepieces, but they need plenty of head room. In other words, do not be tempted to buy an Amazon sword plant (*E. intermedius*) or less common Texas mud baby (*E. radicans*) unless the tank it is to live in is at least 12 inches deep, for



Tropical water lily Nymphaea lotus

Echinodorus species attain a large size. Of the two species, *E. radicans* is the most ornamental. Its six inches or so long leaves are shaped like elongated hearts and are held at right angles to the stems. A young plant, however, shows no promise of this glory to come. It is a poor little thing, with thin grassy leaves borne on flattened stems.

Although *Echinodorus* species are suited only to the deep aquarium, baby plants often die in deep water; so it is best

(*Continued overpage*)

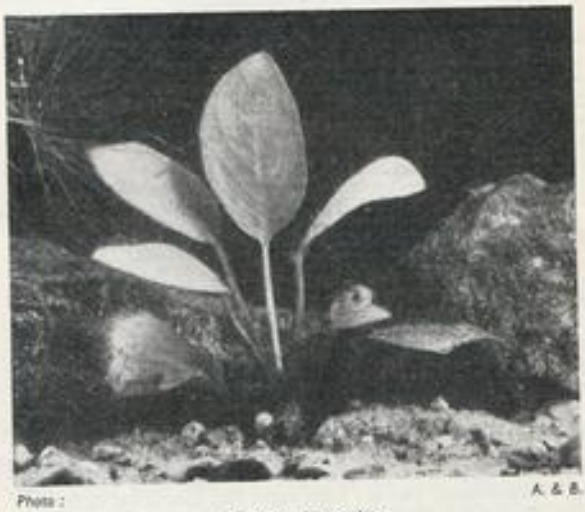


Photo : A. & B.

Anubias lanceolata

IN THE Water Garden — *by* Dr. W. E. SHEWELL-COOPER

I AM tempted to include in this month's selection a number of plants which shouldn't really come under the heading water plants, but which I so often use in the paving that surrounds the pool. Take for instance, the New Zealand bur. This is a low-growing carpeting plant with inconspicuous flowers, but having attractive foliage in various shades. It's quite suitable for paving and for steps, too, for that matter, because the plants will stand up to a certain amount of traffic.

I like them because they will thrive in sun or shade and they are easily increased by division. They quickly cover a large area. Their scientific name is *Acaena*; there is *A. buchananii*, which has pale silvery green leaves and which produces an inconspicuous flower in July and August. *A. microphylla* must be included because of its very decorative bronze leaves and colourful seed heads covered with bright red spikes; *A. microphylla inermis* has bronze leaves, too, but slightly larger than its "cousin," and the little dull flower heads are borne on stems four inches high. This is an inch taller than *microphylla* and two inches higher than *buchananii*. Another prostrate little plant is *Anthyllis montana rubra*, which grows like a mat of grey-green leaves, producing crimson flowers in June on stems three inches tall. Give it a sunny position and it will spread into quite large plants.

However, let's get back to our true water plants for a moment, and still sticking to the A's let us think of the water plantain (*Alisma*). This bears whorls of pinky-white flowers and plaintain-like leaves, and as a rule grows to a height of about three feet. I always like to grow the plants by the margins of the pool, and if they have a fault it is that they reproduce themselves very easily from seed; it is most important to remove all the dead flower heads. There are a large number of species which flower in the summer. *Alisma natans* bears small three-petal flowers which grow in the pool and always float on the surface. The tip in this case is to plant in shallow water. *A. lanceolatum* grows 18 inches high and has slender spear-like leaves with rather delicate blossoms, pinky-white in colour. *A. ranunculoides* grows in bogs, or even water up to a foot deep; it blooms (small mauvish flowers) any time from May to September and is quite a dwarf member of the family.

Last month we were talking about scent and I said how important I thought the fragrant plants were. It is for this reason that I want to consider the *Aponogeton*, which grows masses of sweet-scented flowers emerging on tallish spikes from among the flat, sloping leaves. It is at its best in April and October; *A. distachyon* has v-shaped white flowers with black anthers and oval leaves. It has quite large racemes; the scent is just like May blossom and that's why I love it. There's another improvement, or so it is claimed, with a very long name *A. distachyon* var *aldenhamis*. This certainly has longer, larger and stouter flowers, and the foliage is more interesting because it is flushed with bronzy purple.

Would you like a little plant to give a close carpet of little green leaves that would clothe a bare rock face? You could have it if you plant *Arenaria balearica* in a moist position in semi-shade. This wonderful little plant is covered with tiny white flowers in May and June, and it never grows more than about an inch high. Gardeners call it "spilt milk" because of the little white flowers which are dotted about all over the place. Another little carpeter that will not swamp small plants is *Bellium minutum*; this has white, daisy-like flowers which fade to pink-red; they are produced all the summer on stems an inch high. This is the mother of the tiny little specimens I want you to have in the cracks of your paving.

Most people know the *Poa annua*, an annual grass which crops up in lawns and other parts of the garden. There is another, *Poa aquatica*, commonly known as the reed poa, an ornamental grass which can grow in any moist spot around the pool or pond and quite likes shallow water. I grow it because the flower stems are very useful for indoor decoration. Another taller grass which is related to the sugar cane is *Miscanthus*; it likes growing in a sunny position in very rich, deep compost, and if you are going to grow the variegated species you will have to give the plants some protection in winter.

There is the hardy sugar cane, *M. sacchariferi*, which is really a vigorous Japanese species which will grow about eight feet high and therefore should only be propagated in the bigger gardens. *M. Sinensis* var *variegatus* is less tall and its leaves are striped longitudinally with white, the stems being green and white suffused with pink. I think it is well worth having this variety even though you do have to remember to place a cloche over the plants about the middle of October. There is a variegated variety of the hardy sugar cane but I don't like it half as much as the one I have just described.

Decorative Underwater Tropical Plants

(*Continued from the previous page*)

to start them in pans raised close to the surface, where the pressure is not great and the fish will be prevented from burying them beneath a storm of churned-up sand or clinging sediment. *Echinodorus* species need a bright light, with some sun, when it shines.

Like *Echinodorus* species, *Aponogeton* species are not for growing in the small aquarium. They need room to expand their stems and attractive foliage. The finger-wide, crinkled-edged leaves of *A. crispum* often measure more than nine inches long, and are held erect like lances on stems as long or longer than the foliage. The wider and more diaphanous leaves of *A. ulvaceum* grow outwards from the crown, and at a quick glance, look somewhat like those of a sagging hart's-tongue fern.

Plants to grow in really shady places are few in number. At the present time we have only the *Cryptocoryne* species and the rare water aspidistra (*Anubias lanceolata*) from French Guinea. This plant resembles the window plant beloved by the Victorians. The leaves, however, stand more erect than those of the window plant, and are very leathery to the touch. *A. lanceolata* needs old, acid water and a pot of peaty soil in which to thrust its thick roots. It may be propagated by division, but this operation should be delayed until the plant has been established for more than a year and has produced several new leaves.

A Shy Dwarf Cichlid—

Nannacara anomala

Many queries from readers of "The Aquarist" are answered by post each month, all aspects of fish-keeping being covered. Not all queries and answers can be published, and a stamped self-addressed envelope should be sent so that a direct reply can be given.

I have just bought a pair of "Nannacara anomala." They seem very shy and hide away in the plant life all day. I wonder whether you could give me some information on the species?

Like many other dwarf cichlids, *Nannacara anomala* is a shy little fish, and will keep out of sight until it gets used to its owner and surroundings. Regular feeding with live food will help to cure its fears. A well-planted tank and a temperature of about 80° F. suits it best. The male attains a length of about two-and-a-half inches; the female does not grow so large. The species likes to spawn inside a flower pot turned on its side. After spawning is over, the female guards them, though sometimes the male seems quite concerned about the safety of the eggs. The eggs hatch out in about two days and the fry become free swimming soon after. For the first few days, the fry can be fed with large Infusoria, after which they need brine shrimps, screened *Daphnia* or tiny whiteworms.

Recently two of my fish died of what seemed to be a kind of swim-bladder trouble, but instead of assuming a head-down position, they hopped over the floor of the aquarium on their tails. Sometimes they would fall over on one side. Could you tell me how to cure this condition?

The symptoms you describe point to a chill. The effects of a chill do not always become apparent until some days have passed, then the fish act the same as you mention in your letter. Some fish succumb to a drop in the temperature more quickly than others. Mild cases of swim-bladder trouble usually get better if the temperature is kept a few degrees above normal and the fish are fed with scraped raw meat or live food. Dried food helps to prolong and sometimes worsen the condition. Shallow water helps the fish to recover.

Twice during this summer I have lost practically the whole of two successive spawnings of fighting fish. The fry suddenly start to swim with fins pressed tight against the side of the body. The few that survive this condition grow into healthy young fish. I have tried isolating the afflicted fish and giving them various treatments such as salt,quinine and so on, but nothing seems to save them. Feeding has followed the usual lines, the water has been clear or slightly green, and the top of the aquarium has been covered with a sheet of glass. What do you think is the trouble?

It is possible that your fry have been subjected to draught or a sudden drop in the temperature of the water. Cold air striking the aquarium can soon lower the temperature of the water. Although a slight drop will have no effect on adult fish, its effects soon become apparent among a batch of fry. We suggest you protect your aquarium from draughts from an open window and make sure your heating arrangements are in good order. It would be as well to look for a scum on the top of the water. Young labyrinth fish often die in large numbers when they cannot break the film that often covers the surface of water. It is a good idea to draw a sheet of clean paper across the surface every day. Treating fry with chemicals in the water is always a risky business and usually results in hastening their death.

Please could you give me some advice? I am having a lot of trouble trying to breed red wagtail platys. I manage to keep them for about two weeks, then they die.

Platys are not the easiest of livebearers to breed, but we think your fry are dying of starvation or too low a temperature. Baby platys need a temperature above 72° F.; 75° is better. For food they must have dust-fine dried food or minute live food such as micro worms, tiny *Daphnia* or large Infusoria. You do not say anything about the parent fish. Do they live in the same aquarium? If they do, and they look in good health, we think you can rule out the idea of unhealthy conditions.

I am setting up a small tank of tropicals and would appreciate your advice on the following problems. I will not be able to keep the tank close to a window. Our fire often smokes. Will this harm the fish? I have a large tank outdoors which fills with rainwater drained from the roof. Will this water be all right for the fish?

You will need to burn a 60-watt electric lamp over the aquarium for at least six hours every day. Unless you do this, the plant life will die down and the fish will suffer and soon die. The usual glass cover will prevent an excess of smoke from polluting the water. If rainwater is taken from a wooden or lead vessel it is usually quite suitable for fish. But it might be safer to fill the aquarium with water from the tap, boiled to remove the effects of chlorination, and then allowed to cool down.

About a month after introducing a pair of fighting fish into my aquarium, the male lost all sense of equilibrium and just rolled about on the bottom. A gourami has also started to behave in a similar fashion, but in its case it keeps to the top of the water instead of the bottom. It also blows bubbles through its gills with a loud clapping sound. What is wrong?

Your fish have swim-bladder trouble. The cause of this might be cold, or too much starchy dried food. Swim-bladder trouble can often be cured in its early stages by keeping the temperature of the water slightly above normal, and leaving all dried food out of the diet. The fact that the gourami expels bubbles through its gills is nothing to worry about. Gouramies and fighting fish are air-breathers and after they have taken a mouthful of air from the surface of the water, they expel some through the gills. The warmer the water, the more often will they replenish their supply of oxygen from the surface.

COLDWATER FISHKEEPING QUERIES *answered by* A. BOARDER

My fishpond is badly infested with fish-louse. What treatment should I give the fish and can I clear the pond and plants of the pest?

You will have to catch all the fish and give them a bath in a Dettol solution. Use one teaspoonful to the gallon of water and immerse each fish. Any argulids will drop from the fish almost immediately and there should be no need to keep the fish in the solution for more than about five minutes. If there are any wounds on the fish the bath will do them good. As for clearing the pond, this is a more difficult matter. You will have to empty it and give it a thorough scrubbing with a fairly strong solution of Dettol. The majority of the lice will be on the fish, although they can swim quite well on their own.

A specimen of the fish louse (Argulus)—seen under the microscope. Natural size is about one-eighth of an inch.

Photo: Ray Palmer

If you refill the pond and see that all water plants have a wash in the disinfectant it will be fairly safe to return the fish. After about a fortnight it would be advisable to catch the fish and if any lice are seen, give another bath. It has been suggested that minnows in the pond will clear the pests up, and although it is quite possible that they would eat the free swimming ones I feel sure that they would be quite unable to pick them from the fish. I had a bad attack of this pest in my pond years ago and since ridding the fish of them by the above treatment I have had no further trouble. I know of nothing which you could put into the pond to kill the pests which would not be likely to do some harm to the fish.

We have commenced to sell live fish in our shop (a fishmonger's). How much food should we give a tank of 100 to 150 goldfish daily, also what plants are necessary to "balance" it?

For your large selling tanks I recommend that you install running water. It will be quite impossible to keep the above number of fish in a tank without some form of strong aeration. It should be fairly easy to fix up a hose or other pipe to supply tap water, with a suitable overflow; a trickle will be sufficient. All the water plants you could get in the tank would not give off enough oxygen to supply all the fish, and after all, plants only give off this gas during fairly strong daylight. I find that almost invariably dealers over-stock their tanks and appear to imagine that they can keep hundreds of fish in a tank which should only hold a few dozen. A few healthy fish in a tank present a much better picture and are, I am sure, a better incentive for people to buy them.

The amount of food which you should give will depend on the size and number of the fish in the tank. When feeding give just a pinch, sprinkled on the surface of the water. If the fish take no notice of it do not give any more food then. If the food is taken fairly eagerly you can give a little more. There should never be any uneaten food lying about on the bottom of the tank. You will find that most fish will eat small pieces of other fish if chopped up into small pieces. By the way, do not use a copper pipe for running the water to the tank as this is poisonous to fish; don't overcrowd and don't over-feed.

If fish lie listless on the bottom of the tank, can anything be done to save them?

From the rest of your letter I take it that you are referring to goldfish. When they lie on the bottom listless there is usually something sadly amiss with them. They are probably suffering from some wasting disease and may appear emaciated. The trouble may be caused by any one of several complaints, and without knowing all the history of the case, the surroundings and treatment, it would be most difficult to say with any degree of certainty from what complaint the fish was suffering.

The first step would be to remove the fish and other occupants from the tank. Place it under running water for a time to see if it improves. Then try it with a little live food such as small pieces of earth worm or water fleas. If it recovers sufficiently to swim about place it in a tank of green water if you can, as this often has a beneficial effect on ailing fish. If the fish is under-nourished you could try feeding it from a pen-filler with the top of the milk. Should the fish be suffering from a wasting disease such as tuberculosis you have little chance of curing it. Newly imported goldfish often show these signs and often fail to respond to any treatment.

If a fish has been kept in rather warm water and is then suddenly placed in colder water it can drop to the bottom and become very distressed. This may give it a bad chill from which it may not recover, but if the water is slightly warmed the fish may soon get all right again. The fish which I have seen lying listlessly on the bottom usually have the dorsal fin down and are hollow bellied. This is not a sudden condition and has most probably been brought about by continued wrong treatment.

I have a tank, 18 ins. by 9 ins., in a living room heated by a gas fire. The goldfish I had in the tank died. Was it due to the gas?

The fish may have been affected by the gas, for the tank is on the small side. I cannot emphasise the point too strongly that whilst it is fairly simple to keep a few fish healthy in a large tank, it is almost impossible to keep fish healthy in a very small tank. Personally, I would not dream of trying to keep goldfish for long in a tank less than 24 ins. by 12 ins. by 12 ins. If a damp cloth were placed over the tank whilst the fire was on it might stop some of the fumes from reaching the water. It is also a fact that continued smoking in a room can harm fish; the nicotine deposit can be quite large if the concentration of smoke is heavy.

You say that you are now going to try to keep some guppies. These are fairly cheap fish with which to experiment and as a rule tropical fish can be kept with a smaller surface area than coldwater ones. I consider that the ideal fish for the beginner with tropicals is the handsome paradise fish. These can often live in foul water, for they can come to the surface to take in a quantity of air. In your case, however, the gas may even effect them more than some other types.

I have recently started an aquarium and obtained two veiltails, two fantails, two golden orfe, and six goldfish. I set my tank up as advised in books but have had a number of setbacks. I have already lost four of the fish and can't understand why. I have used an aerator: should this be kept running day and night or just by day?

You have left out the most impoetant point which may have helped me to discover your trouble and that is the size of the tank and that of the fish. You may have been overcrowding. If your tank was no larger than 24 ins. by 12 ins. by 12 ins., then you had too many fish. It should not be necessary to keep an aerator running all the time in a tank. As water plants only give off oxygen in fairly strong light it seems that it would be better to run the aerator at night only, as this is when the plants may be giving off carbon dioxide.

You say that you have been feeding with a different type of dried food each day. If your fish were overcrowded in the tank, and I suspect that they were, they would not be very keen to eat at all. The uneaten food would then only tend to upset matters more than ever. My advice to all who are starting with their first tank is to set the tank up for a week with compost, rocks and water plants and not add any fish until it appears that the plants are growing. Then add one or two small fish only and try to keep them healthy. If later on they are doing well you can add one or two more. The placing of too many fish in the tank in the first place is usually where most beginners go wrong.

I have been a successful tropical fish breeder for many years. I have just tried to rear a batch of coldwater fantails and have failed utterly. I consider that the rearing of tropicals is child's play compared with coldwater fish. Where did I fail ?

Ssssh! I have been saying the same thing for years but tropical fishkeepers will never believe me! I am inclined to think that you lost most of the fish because being used to keeping tropicals you were inclined to try to keep too many fish in a small tank. I have known it possible to be able to keep three times as many tropicals in a tank as the number of coldwater fish it would have held. I think that one of the reasons is that in a tropical tank there is generally a heater on at the base of the tank. This causes a good circulation of water and moves the fouler parts usually at the bottom.

You say you started feeding the fry with plenty of Infusoria from a culture. This may have polluted the water. Most of the Infusoria I use for the early feeds I take from the open pond. The water is in a healthier condition than that from a small jar in which Infusoria has been cultured. If this stinking water is emptied into a tank in fairly large quantities some pollution is bound to occur. If the Infusoria is fed with a drip feed this is generally much better, as the drip of water causes a good circulation of the water.

I have made a concrete tank to use as winter quarters for my pond fish whilst I leave the pond empty during the winter to get rid of the blanket weed. Can I transfer a water lily in a pot and a clump of iris into the tank and will it harm them to cut the leaves down?

I think that it would have been quite possible to get rid of most of the blanket weed from the pond without leaving it empty all the winter. You have probably had too little cover from other water plants. These cut out a great deal of the sunlight which encourages the growth of algae or blanket weed. As for your intention to put the water lily in the concrete tank with the fish for the winter, I can foresee plenty of trouble for you if you do. The roots and root stock of a lily usually collect a large amount of black, evil-smelling mulm around them, and you will find that in the small confines of a tank the water will become foul in a short time. At the beginning of the winter, say at the end of October, the lily leaves will mostly have died down and you could safely cut the rest without doing any harm. I suggest that you keep the lily and iris in a separate container; unless your concrete tank is very large you will not winter many fish therein.

Can you recommend me a good, winter-growing plant (preferably oxygenating) for a large tank?

Coldwater plants do not grow in the winter as a rule. It would be possible to get some types to grow with the aid of artificial light and heat. Without these it would be almost impossible. This oxygenating of the water by the plants is not anywhere near the life saver of fish that some people would have us believe. It is quite possible to keep fish healthy in a tank without any plants at all. If a drip of water was supplied and all the waste matter and mulm siphoned out of the tank each day, the fish would remain in good health despite the absence of water plants. Growing plants will use up some of the waste matter from the fishes, and this is, in my opinion, their most important use in the tank.

I wish to paint the inside of a concrete tank green or blue. What do you consider the most suitable type of paint and is an undercoat necessary?

I would not try to paint the inside of such a tank. You say the tank has a glass front to it, and if the tank is placed in strong light the sides of the tank will soon become green with algae. This will have a more natural appearance than any paint. Most paints do not take to concrete very well. You can get Snowcem in various colours and this may be the best for you to use. When you constructed the tank it would have been possible to have added some powder colouring matter to the cement which would have done the job for you in one go. My advice is, don't paint the inside but plant a good screen of water plants around the sides instead.

I read in the August issue of "The Aquarist" about fish spawning when the barometer is rising. Do you think there is any truth in this?

The article described the spawning of tropicals, but as far as coldwater fishes are concerned I think that there is a great deal of truth in the statement. Over very many years of breeding coldwater fish I have found that the fish have spawned repeatedly at the commencement of a warm spell. I have so many records of this happening that I am quite convinced that the fishes know when a fine spell is starting, and what could be a surer indication of this than the atmospheric pressure ?

My first spawning in the open pond this year was on 15th May. We had had unsettled weather and the morning in question was very misty. The sun came out later and we had a continued hot spell for days; records for the 17th May showed that it was the hottest May day for 81 years. The second spawning was on 26th June, the commencement of another hot spell which lasted several days. The third one was on 20th July, which started another fine spell after very indifferent weather for many days. The fourth spawning took place on 17th August, the first warm settled day for over a week of severe thunderstorms and heavy rains. Although I do not suggest for one moment that fish *only* spawn when the barometer is rising, I have sufficient evidence over the past 15 years to prove that fish are more inclined to spawn at the beginning of a fine spell than at other times.

AQUARIST AT HOME:

Mr. F. R. Wait

(HEMSBY, NORFOLK)

Interviewed and photographed by JAS. STOTT

AFTER an active business life a Leicester manufacturer decided to retire and do something which had been an ambition for several years—to start a small, private zoo. Prior to retirement he had been an enthusiastic breeder and exhibitor of budgerigars, with considerable success since 1935. During the last two or three years of business life he had also become a keen aquarist and had acquired, during that period, several tanks. Here then was a beginning around which to start the zoo; so in 1946, birds and aviaries, fish and aquariums were transported to the village of Hemsby, Norfolk, which is situated near Great Yarmouth, and were installed in the grounds of an extremely attractive house. Mr. F. R. Wait had made a start towards achieving his great ambition.

In July this year, I called on Mr. Wait and spent a most pleasant afternoon with him at his Bridge House private zoo, and as I wandered through his beautifully laid out grounds I enjoyed the realisation of his ambitions as many other people have done in the last three or four years. Here is to be seen one of the largest budgerigar establishments in the fancy, with every colour and type represented, and a grand display of foreign birds, monkeys and several other forms of life, but I was naturally interested mainly in the aquatic section. This consisted of three formal ponds constructed in such a manner as to provide an ornamental set-out in keeping with the surroundings, and a large conservatory converted into an attractive aquiary. This was, however, in the process of re-decoration at the time of my visit and, of course, partially dismantled with plenty of paint cans around. I shall, therefore, only mention the size of this and the number of tanks, also giving some idea of the new plans which Mr. Wait has in mind for this department of his zoo.

The ponds were to be seen at their best, with fountains playing a fine spray of water over the surface where the blooms of water lilies provided a pleasing variety of colours, and their leaves gave shade for the fishes. Marginal plants and underwater foliage looked healthy and strong in growth, offering a delightful picture. Coloured electric bulbs are concealed among the planted surrounds to provide illumination after sundown when desired. The ponds were stocked with shubunkins, common goldfish and veiltails, all of which could easily be seen moving about among the plants in the cool depths of the clear water. The fishes are kept in the ponds right through the year; even the veiltails are wintered in the ponds, and so far Mr. Wait has experienced no trouble. As far as I could see they all looked in a fine and healthy condition.

Shallows are provided, as part of the design, for breeding purposes and these are heavily planted with suitable plants to receive the spawn. These shallows may be divided from the main part of the ponds so that eggs or fry are protected from the adults. Breeding this year with shubunkins and common goldfish has proved very successful.

I was interested in the construction of these ponds so Mr. Wait gave me details of this. The soil was excavated to a depth of three feet, the base levelled and tamped down hard to provide firmness. Single-width brick walls were

One of the ponds at Bridge House, in which veiltail goldfishes are wintered

built up to the required height, which in the case of Mr. Wait's ponds is eighteen inches above ground level, and the top edge faced with brick tiles. A three-quarter-inch thickness of concrete facing was applied to the inside of the walls and then a concrete base four inches thick put down. Pockets for marginals and bog sections were formed by constructing inner brick walls to the required design and a thin concrete facing applied. A final dressing of water-glass solution was brushed over the entire internal surfaces after the concrete had firmly set. In my opinion, for a formal, ornamental layout, the result of this method was remarkably attractive.

With a length of sixteen feet and eight feet wide the lean-to conservatory has been converted into a useful fish house. The strong staging will hold quite a number of tanks—actually there are 24 in all, ranging from 10 ins. by 6 ins. by 6 ins., up to 36 ins. by 12 ins. by 12 ins., most of them of the larger size. This department will look quite well when the decorations are completed. Mr. Wait plans to re-stock it with an interesting collection of tropicals and a coldwater section devoted to sunfishes and bass. He intends to make a speciality of breeding angels and fighters.

"Velvet" and Neon Disease

I USED to have considerable trouble with "velvet disease" on labyrinth fishes, and began to look upon this trouble as a disease which could not be avoided. However, one day I decided that prevention was better than cure and put old copper pennies in each tank in the proportion of one penny to every five gallons of water. Since adopting this method I have had complete freedom from this disease. It should be noted that this is not a cure, but merely a very inexpensive preventative.

AQUARISTS sometimes imagine that their neon fishes have contracted this unpleasant disease when the trouble is actually of little consequence. Some male neons adopt almost a swordtail aggressiveness towards other male neons in the tank. They always attack the other fish in the same place—where the tail joins the body. Repeated attacks result in a fungoid growth appearing which certainly resembles the onset of neon tetra disease but all that is necessary for cure is to put the affected fish into a saline solution for a few days. Unfortunately, many aquarists rush to try more drastic cures when there is really no cause for alarm.

Raymond Yates

OUR READERS

Write—

Readers are invited to express their views and opinions on subjects of interest to aquarists. The Editor reserves the right to shorten letters when considered necessary and is not responsible for the opinions expressed by correspondents.

International Federation

TWO items in your August issue interest me very much. The first is the International Federation, suggested by Mr. A. Fraser-Brunner. This can do a lot of good, for apart from assisting aquarists visiting other countries, ideas can be pooled and fishes, etc., exchanged along with experiences of their breeding. But I am not quite in favour of the control suggested—the "right fishes for the right people." Just who would be the "right people"?

Would this mean that the lesser-known yet equally enthusiastic and skilled aquarist would not get the chance of buying the "right fishes"? No! Mr. Brunner—that can almost be compared with the old "jobs for the boys" angle. Apart from that I wish all the luck in the world to the Federation.

The second item of interest is the aquarists' badge, proposed by Mrs. V. Watkins. This would do a lot to promote friendship between aquarists everywhere, and we should be able to recognise each other wherever we go. It would be an asset to travellers and servicemen like myself (there are many servicemen interested in our hobby, believe me!). Let us have a badge, I say!

In a past issue of *The Aquarist* an Editorial mentioned the visit of Mr. Churchill to the Kremlin and the goldfish there. A query was raised as to whether there are aquarists' societies in Russia. Well, there are. I have just returned from Finland, where I visited a leading aquarist of that country who told me that Finnish societies had written to societies in Moscow and Leningrad, but without acknowledgement or reply from them. I wonder if there exists a preference for red as a fish colour there? Maybe if we breed an angel showing hammer and sickle markings we shall succeed in breaking the curtain!

LDG. SEAMAN J. W. DAVIES,
H.M.S. *Swiftsure.*

The Editor thanks the numerous readers who have sent letters on the subject of the aquarists' badge. As the response has been so favourable a neat and attractive metal badge has been specially designed and made and this will be available at a small cost next month. The design will be pictured, and details for obtaining the badge will be given, in our November issue.

Aquarium Rhythm

IN his article "Design for a home-made base-heated aquarium" (*The Aquarist*, August), Mr. W. Newman raises what I believe to be a fundamental and most important point. He suggests that fishes and water plants in his aquaria are particularly healthy on account of the daily rise and fall of temperature which has not been eliminated by thermostatically-controlled heating methods.

For several years I have been investigating diurnal rhythms in arthropods and my experimental results, published in the *Proceedings of the Zoological Society* and the *Journal of Experimental Biology* clearly demonstrate the importance of fluctuating temperature in maintaining the health of the animals I have been studying. Temperature fluctuations may be of far greater ecological importance than is at present realised, and, as I suggested at the 9th International Congress of Entomology in Amsterdam last year, the ability of an insect species to thrive in the comparatively constant conditions of many stored products, may determine whether or not it is a potential pest.

As far as the cold-blooded vertebrates are concerned, constant temperatures certainly have a deleterious effect. In the case of fishes, however, no information is available; but, as I have indicated, this point may turn out to be of considerable significance. It would be interesting to know whether your readers have made any observations on the subject.

DR. J. L. CLOUDSLEY-THOMPSON,
Esher, Surrey.

Dr. Cloudsley-Thompson has contributed an article bearing on this subject on page 142 of this issue—Editor.

Tubing Tip

IN the August issue of *The Aquarist*, J. C. Allen suggested that rigid bends in tubing should be made by inserting "resin-cored solder" into rubber tubing.

An alternative method is to use glass tubing of similar size as frequently used in chemical apparatus. This can be obtained from most chemists at about the same price as rubber tubing. The glass is very easily bent and joined by heating gently over any household gas ring. In being transparent, glass tubing is ideal for use inside the aquarium in place of rubber.

J. H. EDMONDS,
Chiswick, W.4.

The Trade

I AM a little perturbed about the position in the wholesale tropical fish trade. As a small dealer I have to buy my fish from a wholesaler, and, of course, it is well-known in the trade that in order to make any profit one must double the price in order to allow for severe losses by death and disease. Anyone at all connected with the trade will know very well that this is not an exorbitant margin. Competition is keen amongst traders, and this is as it should be, but I do not think this competition should be extended to the whole-

saler setting up a retail shop a few doors away from his wholesale premises, and undercutting his own customers.

Let us take the case of a fish sold by the wholesaler at 1s. 6d. to the retailer. We would normally charge 3s. for this, yet our customer can walk into the wholesaler's retail shop and purchase this fish for 2s. The wholesaler, therefore, not only makes his wholesale profit, but on top of this he makes 6d. extra as a retailer.

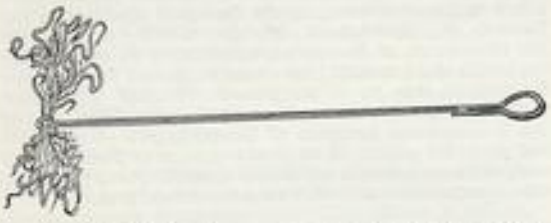
However, the most serious thing of all is this, that by this means he is gradually going to completely eliminate the small retailer. In addition, we have the wholesaler who is advertising as a retailer in our magazines at prices very little above the wholesale price. I definitely consider this whole problem needs some attention, and I propose the question: "*Should a Wholesaler also be a Retailer?*"

J. H. Eserin,
Highfield Road Fisheries,
London, N.21.

Gadgets

WITH reference to your Editorial and gadgets (*The Aquarist*, August), try the enclosed for removing algae from the leaves of plants. I find it successful.

It is made of stainless steel and could be manufactured



Mr. E. S. Walker's algae-remover is a stainless steel holder gripping a tight mass of metal turnings. The turnings are not dangerous to handle in this form but their serrated edges effectively catch and remove thread algae

quite cheaply. I find the blanket weed leaves the gadget quite easily, but if it does get choked with algae, passing through a flame will remove weed without damaging the gadget.

E. S. Walker,
Aquatic Developments,
Birmingham, 25.

Aquarium Sticklebacks

AS I have kept both 10 and three-spined sticklebacks over a number of years I was somewhat surprised to read in an answer to a query that there are few coldwater fish which are easy to get which will not grow to more than 2½ ins. in length. If they were more popular the two sticklebacks would be ideal for aquaria.

While male sticklebacks are aggressive when breeding I have never seen my specimens or pond sticklebacks use their spines against other fish. They will, if attacking, hold their spines away from the body but the mouth is the weapon used. In most ponds, near Liverpool at least, these fishes are found in a half-starved condition, but if given a period of isolation and much live food they will not be likely to develop disease.

I have seen some three-spined sticklebacks as brightly coloured as many tropicals, but the 10-spined males are as sober in colour as the others are bright. I have yet to see a black male but I have seen them a uniform brown, or black and silver.

W. Roughsedge,
Liverpool, 17.

Show Publicity

I AM writing on behalf of the committee and members of the Romford Aquarists' Society to thank you very much for the publicity which you gave our Open Show during the past few months. I know from enquiries received that this did much good and your help is much appreciated.

R. Alley (*Show Secretary*),
Romford Aquarists' Society.

The Editor is always pleased to receive advance information of events of interest to readers for inclusion in our feature "Aquarists' Calendar."

Flowering Aquarium Plants

I WAS interested in the letter from Mr. F. Metcalfe in the September issue of *The Aquarist*. My *Cabomba* plants maintained a succession of blooms throughout the month of August. I gave them no special treatment and they are rooted in sand only; like Topsy, they "just growed."

They are now showing signs of fading and I can see no more buds so I conclude that their flowering for this season at any rate is now drawing to a close. I shall be interested to see what happens next year.

Margaret Thomas,
Hampstead, N.W.3.

Gudgeon Breeding

IN the September instalment of "Stepping Stones," Mr. Boarder remarked that it would be a very interesting performance to be able to breed gudgeon in a pond as there is not a great deal known about the young stages of these fish.

On 15th June, 1950, I introduced six four-inch gudgeon into my 14 ft. by 8 ft. community pond, and at the end of July of that year the first young fish appeared. A month later a shoal of about four dozen was seen, from which I assumed that the gudgeon was an easy fish to breed.

It was observed that the shoal remained in one part of the pond, in the vicinity of some *Myriophyllum* and *Elodea*, into which the fish swam for refuge if disturbed. About the middle of October the young fish disappeared from view and reappeared at the end of the following March in the same spot. After a few weeks, however, they moved to the opposite side of the pond where they clung with their bodies in a vertical position, against that part of the wall which receives the direct rays of the sun for the greater part of the day, browsing on the algae growing there. This practice was maintained until the fish reached about two inches in length, after which they swam about normally in all parts of the pond.

C. A. Rose,
Hendon, N.W.4.

White Spot Treatment

FOR the second time this year I have completely cured a severe outbreak of white spot disease in tropicals by using mercurochrome, two drops to a gallon of water.

During treatment I raised the temperature of the aquarium water to 85° F. and the spots disappeared on the fourth day. On the following day I changed about half of the aquarium water, and continued to do this daily until the visible signs of mercurochrome had gone. During this period one wagtail platy died, and that was my only loss in a total of 30 fishes.

The only plants to suffer were two Indian ferns which lost their roots, but are now recovering, and one *Aponogeton undularum* which shed most of its leaves. This plant is also recovering, although very slowly. Amazon swords, *Cryptocoryne* and *Ambulia* were not affected by the mercurochrome.

J. H. Medhurst,
Bethnal Green, E.2.

READER'S RECORD:

A Minnow that Strayed

AT the beginning of May I put two pairs of white cloud mountain minnows in a tank 24 ins. by 12 ins. by 8 ins. Both pairs were separated by a partition, and within a few days one pair had spawned, so they were removed, the other pair being left to continue the good work for a few days longer. There appeared to be no egg-laying activity, so they too were removed, the idea being to put in another pair, but for one reason or another this was not done.

Then about a week later, when the fry were free swimming, I noticed that one of them had somehow managed to move into the unoccupied side of the tank; there it was moving about in splendid isolation. I poured a little Infusoria into this side, but on the next day the isolationist had vanished, and close inspection at various times during the following day seemed to indicate that it was no more, because no sign of it could be found. I then put in another pair of adult fish, and was again unlucky with this side of the tank, no spawning taking place that week. However, while watching the pair one night, I noticed something moving at the top of the water, and lo and behold it was the small minnow, come to life as it were.

When compared with its brothers and sisters it had not made the same growth, but this was not surprising in view of the fact that no Infusoria had been put into this water for over a week. So to find out just what it had been living on I prepared a number of slides for microscopic examination of the water, and was quite amazed at the deficiency of Infusoria present in the samples taken, it being much less than other samples taken from established tanks in the room. The minnows being in a new tank containing water only a fortnight old no doubt accounted for the lack of small life. As I had found and sealed the small gap in the partition, through which the small fry originally passed, the strong Infusoria content in the one half of the tank could not diffuse into the other.

Another point that surprised me was, although this little fish lived in a space of 12 ins. by 12 ins. by 8 ins. with two full size fishes, no attempt was made to make a meal of it by either of them, and yet small white worm and the few *Daphnia* that were fed to them were snapped up quite greedily. I know clouds are not supposed to exhibit cannibalistic tendences, but I think this state of affairs was provocation in the extreme!

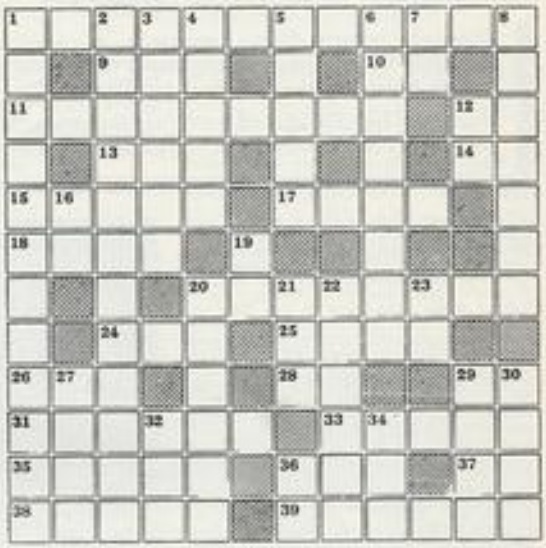
However, as soon as the youngster was big enough I transferred it back with the original spawning, where it soon grew (fed on brine shrimps etc.) to be the same size as the others, and from then onwards I lost track of it. But I do think that this example proves that given enough space, a fish will continue to live (and to do so, it must find food) in water which appears very deficient in organisms; therefore the idea that is current amongst aquarists, that if you want size you must provide space, is due in no small measure to the ability of the very young fish to find the requisite amount of food in a larger area of water, thus giving them the all important good start in life. Of course, the last statement may appear very obvious, but I think the point is overlooked by a lot of people.

A. Price-Canning

One guinea will be paid for each **tropical fish breeding experience** published under "Reader's Record." Send your detailed record, written in diary form or how you like, to Reader's Record, *The Aquarist*, Half Acre, Brentford, Middlesex.

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

1 *Stratiotes aloides* (5-7)
9 Girl from the natterjacks (3)
10 You begin to yearn (2)
11 One kind of stickleback (9)
12 Denoting presence in a tank (2)
13 Scarcely a ripple to tear (3)
14 and 36 Carp variety (2-3)
15 *Rutilus* (5)
17 Famous English river for anglers but may be trying (4)
18 Animal existence (4)
20 The egg passages from ovaries (8)
24 Centre board for a man's fin (3)
25 Sucker of the octopus (4)
26 The barbel may be a coarse fish; but note the family tree (3)
28 Some tank frames are this (1, 1)
29 Part of the royal style of the goldfish (1, 1)
31 Fly-fishing, for instance (6)
33 Is the Portugese man-o-war this? (5)
35 I laid for Homer's poem (5)
36 See 14
37 Half carp for the auditor (1, 1)
38 Also a fish (5)
39 More and less than rill (6)

CLUES DOWN

1 British aquatic plant (5, 7)
2 Treat roof rim (anagram) (5, 4, 3)
3 Ice net to do 31 across (6)
4 R and the sacred river, but the pH finishes the boy (5)
5 Way of the starfish? Aerator bit end! (5)
6 Water beetle (6)
7 That is in guppies (1, 1)
8 Roach (7)
12 The head of a herring (2)
16 Vulgar hail of 36 across (2)
19 Pious proviso in brief (1, 1)
20 Goldfish variety (6)
21 Orfe (3)
22 Lung-fishes (6)
23 Cubic capacity (1, 1)
27 Calm (4)
29 *Leuciscus* (4)
30 These fish sound rather boring (4)
32 Myself in that role end the *Asterias* (1, 2)
34 Sicken (3)
36 Water-soldiers from the reserve tank? (1, 1)

PICK YOUR ANSWER

1. "He eats no fish" is an expression used to denote that a person is: (a) Dishonest. (b) Honest. (c) Poor. (d) Rich.
2. *Rivulus ocellatus* (the ocellated rivulus) is native to: (a) North-east Brazil. (b) North-west Brazil. (c) South-east Brazil. (d) South-west Brazil.
3. The saddle cichlid is the popular name of: (a) *Aequidens curviceps*. (b) *Aequidens maronii*. (c) *Aequidens portalegrensis*. (d) *Aequidens tetramerus*.
4. *Cobitis taenia* (the spined loach) will stand a temperature range of: (a) 30° to 65°. (b) 35° to 75°. (c) 40° to 80°. (d) 45° to 85°.
5. *Selenotoca papuensis* was named by: (a) Ahl. (b) Fraser-Brunner. (c) Meinken. (d) Myers.
6. The genus *Fontinalis* (willow moss) is represented by: (a) 2 species. (b) 4 species. (c) 6 species. (d) 8 species.

G. F. H.

(Solutions on page 152)

News from AQUARISTS' SOCIETIES

Monthly reports from Secretaries of aquarists' societies for inclusion on this page should reach the Editor by the 5th of the month preceding the month of publication.

A copy of *The Aquarist's Directory of Aquarium Societies* will be sent free to any reader on receipt of a stamped, self-addressed envelope.

THE three-day open show of tropical fishes organised by the **Romford Aquarists' Society** was opened by the Mayor of Romford. Over 200 entries were made in the 21 classes and there was strong competition in the Egg-layer Breeder's Class. Mr. H. G. Rundle's six red fighting fishes gained first in this class with Australian lyretails, entered by Messrs. Gibbons and Satt, coming a close second. Best fish in the show was judged by Messrs. M. Barnes-Oake and C. J. Saunders to be a red fighter belonging to Mr. L. E. Baker. The best junior entry was Mr. C. Speller's dwarf gourami, and the Salmons Cup for the best furnished aquarium was awarded to Mr. T. Ahrens.

The Mayor of Hendon at the opening of the Hendon A.S. Show, which was visited by 40,000 people. All 155 furnished aquaria were displayed at eye level and masked all round

Secretary Changes

CHANGES of secretaries and addresses have been reported from the following societies: **Brighton and Hove Aquarist Society** (Mr. F. N. Leaver, St. Claire, Leconfield Road, Lancing, Sussex); **East London Aquarists' and Pondkeepers' Association** (Mr. A. J. Holloway, 37, Garfield Road, Plaistow, London, E.13); **Federation of British Aquatic Societies** (Mr. R. O. B. List, 1, Coronation Court, Willesden Lane, London, N.W.6); **Merseyside Aquarists' Society** (Mr. R. H. Atkin, 2, Mersey View, Garston, Liverpool, 19); **Oldham and District Aquarist Society** (Mrs. V. Tripp, 187, King Street, Oldham, Lancs.); **Ryde Aquarist Society** (Mr. G. H. Seedman, 159, High Street, Ryde, I.o.W.); **Slough and District Aquarist Society** (Mr. R. P. Ray, 3, The Spur, Slough, Bucks.); **Wombwell and District Aquarists' Society** (Mr. P. Fawcett, 51, Barnsley Road, Darfield, near Barnsley, Yorks).

New Societies

Coates Brothers Aquarist Society: *Secretary:* S. R. Crampton, Coates Brothers & Co., Ltd., Cray Avenue, St. Mary Cray, Kent.

AQUARISTS interested in the formation of a new society at **Epsom,** Surrey, are invited to attend a meeting on Wednesday, 22nd October, 8 p.m., at 55, Lower Hill Road, Epsom, Surrey.

Friends' Aquarist Club: *Secretary:* P. B. Salter, 28, Kestrel Avenue, Herne Hill, London, S.E.24. *Meetings:* Every Thursday, 7.30 p.m., at 315, Milkwood Road, Herne Hill, London, S.E.24.

London Transport Central Road Services Sports Association (*Aquaria*): *Secretary:* R. L. Genley, 11, Arundel Road, Croydon, Surrey.

Newtownards Aquarium Society: *Secretary:* J. P. Gaw, 11, Craiglee Way, Newtownards, Co. Down, N. Ireland. *Meetings:* Fortnightly on Tuesdays, 8 p.m. at the Devonshire Hotel, Newtownards.

Prestwich and District Aquarists' Society: *Secretary:* N. G. Richardson, 20, Lime Avenue, Whitefield, Lancs. *Meetings:* Alternate Fridays.

Aquarist's Calendar

1st-4th October: **Oldham and District Aquarists' Society** Second Annual Show in the Regent Street Schoolroom, Oldham, Lancs.

3rd-4th October: **Bristol Aquarists' Society's** Annual Open show in the Y.M.C.A. Hall, Bristol.

11th-18th October: **British Aquarists' Festival, 1952.** Large scale show of aquaria and fishes in the Exhibition Hall, Belle Vue Zoological Gardens, Manchester.

14th-18th October: **Bradford and District Aquarists' Society.** Annual Show in the Mechanics' Institute, Bradford.

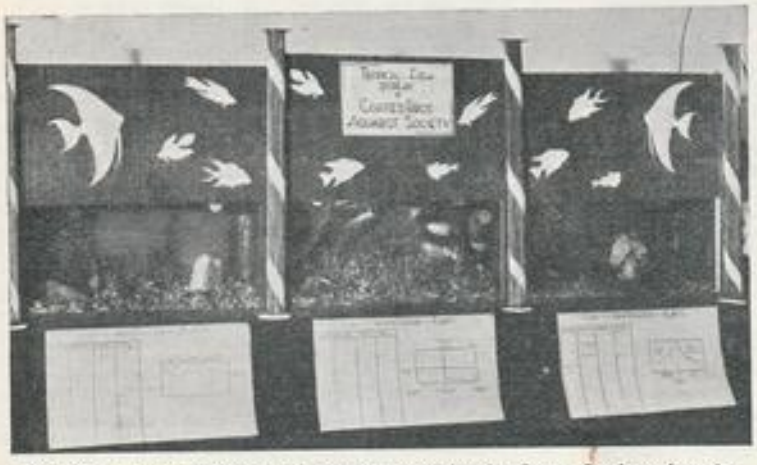
20th October: **British Herpetological Society** (London Group) meeting, "Crocodiles and Alligators (Loricata)," 7 p.m., at the Linnaean Society's Rooms, Burlington House, Piccadilly, London, W.1.

25th October: **Lambeth Aquarist Society** Annual Show, 1 p.m. to 9 p.m., at St. Luke's Hall, West Norwood, London, S.E.27.

25th October-1st November: **Huddersfield and District Aquarists' Society** Annual Show. Details from Mr. M. E. Pearson, 44, Wasp Nest Road, Fartown, Huddersfield.

31st October-1st November: **Leicester Aquarist Society** Annual Show and the National Guppy Show at the Co-operative Hall, Belgrave Gate, Leicester.

21st-22nd November: **Scottish Aquarium Society** 18th Annual Show at the Kelvin Hall, Glasgow.



Part of an attractive display of aquaria staged by the Coates Brothers Aquarist Society this year

Crossword Solution

W	A	T	E	R	S	O	L	D	I	E	R			
A		E	N	A		R		Y	E		U			
T	I	T	T	L	E	B	A	T			A	T		
E		R	I	P		I		I			H	I		
R	O	A	C	H		T	E	S	T		L			
L	I	F	E		D			C			U			
O		R		O	V	I	D	U	C	T	S			
B		O	A	R		D	I	S	C					
E	L	M		A		E	P			D	F			
L	U	R	I	N	G		N	A	V	A	L			
I	L	I	A	D		G	O	I		C	A			
A	L	O	S	A		R	I	L	L	E	T			

PICK YOUR ANSWER (Solution)
1 (b). 2 (c). 3 (d). 4 (c). 5 (b). 6 (b).

BRITISH AQUARISTS' FESTIVAL 1952

News of this year's B.A.F., organised by the F.N.A.S. in co-operation with The Aquarist, to be staged in Manchester this month

ENTRIES for this year's British Aquarists' Festival, which will be open from 11th-18th October at the Exhibition Hall, Belle Vue, Manchester, have exceeded last year's record figure, and it is estimated that there will be 3,000 fishes on show. Fishes are being sent from as far south as Torquay and from Scotland in the north.

* * *

MANY aquarists' societies all over Britain have organised parties to visit the B.A.F., and admission to the Exhibition Hall, includes entry to the famous Zoological Gardens. There are full catering facilities at the Festival and a large attendance of aquarists and their families making a day's outing to this spectacular display is expected.

THE assembly of the Federation of Northern Aquarium Societies will be held on Sunday, 12th October, and the main event will be a "Brains Trust" with Messrs. A. Boarder, J. Carnell, C. Creed, R. Mealand and W. Phillips (F.B.A.S. judges) as its members, and Mr. G. T. Iles as question-master. Members of the F.N.A.S. affiliated societies and their families will make this their special day.

* * *

TRADERS' stands at the B.A.F. are expected to have a fine display of stock and apparatus for sale, and at the stand of *The Aquarist*, Mr. A. Boarder will be present to meet aquarists and sign copies of his new book *Coldwater Fish-keeping*.

SPECIAL printed sheets giving names, popular and scientific, and countries of origin of aquarium fishes for tank labelling will be used at the B.A.F., and these will be on sale to visitors at *The Aquarist*'s stand. Society show secretaries especially will find them invaluable.

* * *

EDUCATIONAL authorities in the north have arranged for parties of school-children to visit the Festival during the week, encouraged by the tremendous enthusiasm which last year's B.A.F. fostered. One visitor to the B.A.F. will be Mr. S. McKnight, who will be flying to Britain by jet airliner "Comet" from Nairobi.

* * *

BREEDERS' tropical entries have doubled last year's figure and many of the rarer species of fishes will be displayed. Over 600 fishes make up two of the classes alone. St. Martin's Aquaria of London have donated a Challenge Trophy to be awarded this year, another splendid addition to the galaxy of cups, shields, prizes and *The Aquarist*'s greatly coveted award cards.

World Union of Aquarists Formed

DELEGATES from nine countries met at Amsterdam on 23rd and 24th August to form the nucleus of a world organisation of aquarists. This conference arose from the suggestions circulated last year by Mr. A. Fraser-Brunner, and the subsequent efforts of his wife and Mr. Veldhuizen of Holland, during his absence in Africa. Correspondence had made it clear that Holland would be the most convenient venue for most of the delegates, and it therefore fell to the lot of the Nederlandse Bond (the Dutch Federation) to arrange accommodation for the assembly. The chair was taken by Dr. Lodewyks, President of the Nederlandse Bond.

Dr. Lodewyks then made an introductory speech, in which he remembered that Holland had frequently been the scene of international gatherings because of her situation and her numerous contacts. Moreover, fish-keeping was extensive and highly organised in Holland, perhaps because of the international interests which are an inherent part of the hobby. Holland, in fact, was internationally minded, and it was, therefore, not inappropriate that the World Union should be born there. As long ago as 1948 the Nederlandse Bond had begun preparations for an international organisation, but at that time it would have been premature, and it was fortunate that it did not materialise. Now, however, the time was ripe, as proved not only by the people present, but also by the enthusiastic letters from those not able to attend. It could truly be said that round the table there were more countries than people. Aquarium-keeping taught a great lesson in harmony and balance; in inter-dependence and an ordered economy; that rules must be obeyed if we are to avoid disaster.

Mr. P. S. Campkin, Chairman of the Federation of British Aquatic Societies, replied on behalf of the delegates; in his speech he said: "I bring fraternal greetings from my fellow aquarists in Great Britain to our brother and sister fish-keepers in Europe.

"The ideal aimed at is the formation of a World Union of Aquarists, and the F.B.A.S. believe that it will be built strongly, surely and wisely. Therefore we hope that as a first step towards this end, the existing Federations and Societies will join together without delay." Mr. Campkin gave thanks to the Dutch Federation for organising the gathering and pledged the support of the F.B.A.S. for the venture.

After various delegates had made supplementary speeches in their own languages, which were ably translated by Mr. Veldhuizen, the latter, who was acting as secretary, read letters of support from those countries which had not been able to send delegates. These included Denmark, Switzerland, Spain and India. A telegram wishing the congress every success was received from Mr. Gene Wolfersheimer of California, who has been interested in the formation of an international body for some time. Mr. Fraser-Brunner then outlined the scheme which he had proposed. He outlined the tasks which a World Union could perform, and the methods by which they could be achieved. It should be possible to negotiate at high level for the international exchange of stock, in order to smooth out the difficulties of transport, customs barriers and currency regulations. There was no question of interfering with normal trade arrangements, but rather the co-operation of reputable dealers would be sought. A certain independent exchange between federations, however, would result in a general improvement in the quality of stock, and the elimination of diseases.

Delegates to the inaugural meeting of the World Union in Amsterdam

A long discussion on the various points raised resulted in agreement with most parts of the scheme, and many additional suggestions were made and incorporated. The most important modification to the plan was the proposal to allow individuals to join the organisation on the condition that they should not be entitled to vote in congress.

The first act of the delegates upon the second day was to vote unanimously for the formation of the World Union, having the following objects as its foundation:—

1. To promote friendship, co-operation and goodwill among aquarists in all countries.
2. To stimulate and promote aquarium-keeping among all nations and all sections of the people.
3. To further these aims by
   (a) the exchange of information and the extension of knowledge relating to the aquarium.
   (b) the exchange of livestock and materials connected with aquarium-keeping.

To these aims were added the following footnotes: The World Union would consider the extension of its activities to cover terraria should this appear to be desirable. The World Union considers a flourishing and bona fide trade in aquarium-fishes, plants and equipment desirable, and undertakes not to infringe on the rights of such trade. The same principles apply also to journals and publications.

After a considerable discussion a set of rules was agreed upon provisionally.

There followed elections for Council and Executive Committee, and the election of Mr. W. Veldhuizen as Secretary determined that the residence of the World Union would be in Holland for the time being. It was decided, however, that as far as possible the full Congress should be held in a different country each year, and that the Federation in that country should provide the president for the meeting. Dr. J. M. Lodewyks was therefore nominated as the first President of the World Union.

The financial basis for the organisation was next discussed, and a number of proposals were put forward for delegates to take back to their committees. Closely connected with this was the decision to publish a periodical Bulletin, in three languages, giving abstracts of important items in the aquarium journals of the world, together with news and information not usually to be found in those periodicals. In the late afternoon the delegates paid a brief visit to the aquariums at the Amsterdam Zoo, where they were received and escorted by the Director, Dr. A. J. L. Sunier. Notes and photographs of the proceedings were taken by repeesentatives of several press agencies, and an account of the meeting was broadcast by the Dutch radio in 17 languages.

An event not to be missed!

British Aquarists' Festival

1952

(Organised by the Federation of Northern Aquarium Societies in collaboration with "The Aquarist")

at

Exhibition Hall
Belle Vue, Manchester
11th—18th October, 1952

Hours of opening

Saturday, 11th October 2 p.m. - 9 p.m.

Other days - - - 11 a.m. - 9 p.m.

Prices of Admission are Adults 2/- Children 1/-

Car-parking facilities at Belle Vue are excellent for B.A.F. visitors coming by road. Buses from Manchester's stations run right to the entrance of Belle Vue.

Adequate catering facilities are available with several fully licensed restaurants.

Admission tickets to the B.A.F. include entrance to all the attractions of Belle Vue—the gardens, the Zoo, with its own aquarium and the amusement park.

Special Souvenir Catalogue will be on sale, with a large amount of aquatic information and illustrations.