

**Second International Feline Coronavirus & Infectious Peritonitis Symposium - a report by Jen Lacey**    **Intro** -----

The Second International Feline Coronavirus / Feline Infectious Peritonitis Symposium was held in Glasgow, Scotland, UK 4-7 August 2002. Like the hugely successful first FECV/FIP Workshop hosted by Prof. Niels Pedersen in UC Davis, the second welcomed scientists, Veterinary surgeons, cat breeders, cat rescue charities and industry. Prof. Niels Pedersen began the meeting by giving an overview of Feline Coronavirus and Feline Infectious Peritonitis. The conference co-ordinator was Dr Diane D. Addie. The proceedings will be published in the Journal of Feline Medicine and Surgery. Scientific committee: Prof. Niels Pedersen, Prof. Hans Lutz, Prof. Marian Horzinek, Prof. Oswald Jarrett, Dr Diane D. Addie. Local organising committee, Dr Diane D. Addie, Prof. Oswald Jarrett, Dr Margaret Hosie.

**The Beginning** ----- The Scottish welcome was very warm, with a ceilidh, haggis, kilts and pipers, plus the wee dram, of course, all contributing. Whilst most other parts of the UK seemed to be having torrential downpours or heavy mist, we were bathed in warm sunshine. There was the little matter of cryptosporidium in the water supply, but nothing to panic veterinary scientists! These had come from all parts of the world. Australia, Japan, Australia and South Africa were represented, as well as North America, many European countries and the UK. It was satisfying to put faces to some well known names, Dr Neils Pedersen, Dr Janet Wolf, and Dr Susan Little were there; and it was good to meet in person, Dr Diane Addie of Glasgow University who had co-ordinated the event, but mostly because she was taking a special interest in the FIP outbreak amongst my own cats and kittens. Over the 3 days the Symposium had 4 main sessions presenting papers on: Diagnosis & treatment of FIP, Epidemiology of FCoV Infection, Pathogenesis & Immunopathogenesis of FIP and Prevention of FCoV Infection/FIP. They were preceded by two speakers who gave a history of the study of the disease (Pedersen) and what it's like to actually live with an FCoV household (Sue Perry from Sleaford, whose tribe were all rescues of the sort nobody else would take on). On the final afternoon we broke for workshops, on 'Diagnosis', 'Minimising Disease Spread', or 'Recommendations for Future Research'. One of my reasons for being there was to learn all I could from the second and it was a stimulating afternoon. Taking the event as a whole though, I can't say there was much cause for celebration. That had absolutely nothing to do with the quality of the speakers or the presentations. I suppose the tone was set by Dr Pedersen in his introduction when he told us that the disease had been named in 1963 and fully described by scientists from Cornell in 1966. We also saw a slide of a photo taken in 1912 that showed a little cat with the typical swollen abdomen of the effusive form of FIP, so it's something that's known to have been around for a long time. He defined FIP as an important cause of death for young cat from catteries and shelters, but said that the years of study had not yet brought any easy way to prevent the disease and no way at all to cure it. He also admitted some blind alleys. The worst of which was the publication of a paper in the 70s which indicated FIP could be detected from an antibody titre test. Unfortunately, there was a weakness in the study as no comparison had been made with cats in multicat households (MCH). Within quite a short the data was available and corrections made, but still today probably more cats are euthanised because of a positive FCoV antibody titre than die of FIP. So prevention difficult, with the only available vaccine in no way helpful to those who most need it, kittens of 8+ weeks who have already been exposed to the virus in their MCH or shelter, and no cure. All the years had brought was a lot greater understanding. The research presented at the Symposium would add to that, and there were a couple of gleams of light from beyond the boundaries of feline medicine as both mouse

hepatitis and dengue fever (human) developed and progressed as FIP did in cats, so studies of these could contribute. He had hoped FIP would reduce as FeLV was effectively beaten, but it had made no significant difference. As yet then only a hard road ahead. I'll try tomorrow to give more detail of those studies I found most interesting, and then I'll describe the conclusions of the workshop on what we as breeders could do. I've pages of notes, but big lashings of info without the pictures and diagrams that went in to illustrate aren't that digestible.

### **Breeder Study**

----- Kinetics of FCoV Infection in Kittens Born in Catteries of High Risk for FIP Under Different Rearing Conditions - Lutz H. et al, University of Zurich. This was a significant paper for me as on the day it was given my litter born to a queen with a high titre (she was newly pregnant as FIP was diagnosed in my cattery) were three weeks old. Dr Addie's recommendation was that I should separate the kittens from their mother at five weeks (early weaning) in an attempt to prevent them becoming infected with FCoV. I had reservations, not because the actual weaning process would be difficult, but because the maternal bond in Korats is strong and queens continue to be protective and caring for their kittens at least twice as long as this, thus playing a significant role in their socialisation. However, I wanted to do all I could to protect them from FIP so I went to the Symposium really torn and hoped to get information to help me reach a decision. The purpose of the study was to determine the course and viral load of natural FCoV infection in conventionally and early weaned kittens and to consider the role of vaccination in those who were seronegative. 18 breeders took part. All were highly motivated as they had a history of FIP in the past and wanted to do all they could to prevent it. Their selection was on these 2 criteria. 226 kittens in 63 litters were studied, with half early weaning and the other raised with their mother and (later) other cats of the household in conventional fashion as a control group. FCoV shedding in the faeces of the kittens started as early as 2 weeks whether the queens were quarantined with their kittens or not. By week 4 20%, and by week 6 50% of kittens tested positive. At this point the conventionally raised kittens were shedding significantly more FCoV than the early weaned, but at the age of 9 weeks, and 12 weeks, the levels were the same for both groups. The two groups were followed for a total of 21 months. At this point 9 of the kittens had died from FIP. 5 were from the conventionally raised group and 4 from the early weaned. It was concluded that although the early weaning prevented a high viral load at a young age it was not found able to keep kittens free of FCoV infection under field conditions. The vaccination part of the trial was not followed through as no kittens in the study were FCoV negative. Of course Dr Lutz was asked if he could produce any reason for the different results in his trial to Dr Addie's. The size of the catteries in terms of numbers and space was considered. Dr Lutz wondered if we all had bigger homes in UK and were more able to separate cats effectively to prevent contamination of the isolation necessary for early weaning. Dr Janet Wolf said that in the trials she had conducted with breeders in USA none had been able to produce FCoV negative kittens by this method, and Dr Pedersen said that even under the strictest lab conditions it was difficult not to introduce FCoV to a clean area, he'd had it happen. Dr Gunn-Moore (Edinburgh) and one of the Europeans (who also added that she came from a small country confirmed success for the method. Considering again, Dr Lutz believed that the answer could well lie with the queens. They were all significant virus shedders, which correlated strongly with high antibody titres. Dr Addie's groups hadn't been selected on this basis, and it was agreed she had reported lack of success with some litters from high titre dams. This report made my own choice harder than ever. Dr Addie hoped very much that it hadn't put me off trying to early wean, and I had to admit

concern that I could be putting mother and kittens through a stressful situation for little gain. By the end of the conference I'd decided on a compromise. Yesterday I sent faeces and a blood sample from Shula (dam) and faecal swabs from the kittens off to Glasgow. I should then know whether Shula's titre has decreased significantly in her 11 week isolation period, and discover whether or not she's shedding virus at this point in time. I shall also know whether or not the kittens have already been infected from whether there is evidence of the virus in their samples. If it happens that their mother is positive and they are clear then I shall separate them in an effort to protect them.. However, I do it with the knowledge of the virulence of the virus that infected my cats, I'm not saying that it's a must for all, and indeed this particular paper shows that it's just about impossible to achieve the desired result when starting with cats at high risk of producing kittens, some of whom will go on to develop FIP (about 4%).

### Diagnosics

----- I think these papers deserve a report, but I must admit it was rather tough going. The most breeder relevant bit is in the final paragraph so skip to that if you're not wrestling with the is it/isn't it stage of FIP. I can't give those of you with specialist knowledge much detailed information on this subject as I'm not a scientist. I picked up on the fact that when effusion exists and fluid can be extracted it's not too difficult to come to a diagnosis of FIP, taking the other clinical signs into account. What would be useful for clinicians is a diagnostic to rule out FIP in its dry form so that further investigation could then go on to decide what the actual problem was. It was encouraging to find when chatting to other delegates socially that several of them were there from firms who had not yet worked on this to see if it was worth putting money into the development of diagnostic tests. I hope they returned home keen and eager. The first paper was AGP Measurement as an Aid to the Diagnosis of FIP given by S Duthie of Glasgow University. AGP is an acute phase protein produced by the liver in response to inflammation. It was monitored in cats with FIP and diseases with a similar clinical presentation. It was found that specific levels were of value in distinguishing field cases of FIP from look alike conditions. Indeed it was concluded that it was more efficient than the albumin:globulin measure used at present. It is able to give results within 36 hours. Further research to be done as this looked promising. The second study (K Hartmann) compared different diagnostic tests. In all cases FIP had been confirmed or not by necropsy and histology. The conclusion was that for cats with effusions diagnostic tools based on the analysis of the fluid have good predictive values, but this was impossible in many cases where there was no effusion. Therefore it was recommended that diagnosis should be made by the more invasive methods of laparotomy, laparoscopy and organ biopsy. Several of the vets there confirmed that these were now a preferred option to get a confirmed diagnosis to rule FIP in or out of the picture in cases with no effusion. To reinforce the last study research in Poland (P Kita) on RT-PCR to detect FCoV in blood was evaluated. The test was found to give false positives, with the inevitable conclusion that the detection of FCoV sequences in blood by RT-PCR has a limited value as a method of FIP diagnosis. However, research done in Utrecht was more upbeat on detection in blood. The RT-PCR was designed to detect mRNA a genetic element of most, if not all, field CV strains. The most significant result was that of a group of 49 cats, cats with pathologically proven FIP 94% were positive in the mRNA PCR, whereas the 12 proven to be non-FIP remained negative (100%). Finally, and perhaps of most interest to breeders, Dr Addie gave an evaluation of the Feline Coronavirus Antibody immunocomb. This could be used as an in-house test for vets. It scored well against the immunoflorescent antibody tests (84% & 85% for two different readers). From 110 samples 2 with a 0 titre and 3 with a titre of 1:10 scored higher indicating that it

could give false positives, and cats with a low positive score would need to be screened in the usual way. However, no false negatives were recorded, so it was concluded that it could be used with confidence in for entry into a FCoV stud or cattery.

### **Treating cats sick with FIP**

----- The outlook is very poor for cats diagnosed to have FIP (by effusion sample in the wet form, by biopsy in the dry). It's believed that any said to have recovered probably didn't have FIP in the first place, particularly as nothing claimed as effective has ever been able to be repeated in lab conditions. However, recently, since the advent of veterinary interferon, hopes have been raised that this could at least put the disease into remission so that cat and owner could enjoy extra months, if not years, together. The one paper on FIP treatment was from T Ishida of the Akasaka Animal Hospital, Japan. He reported on an evaluation of the therapeutic effects of a feline interferon currently commercially available in Japan, UK and EC. The cases considered were 6 males and 6 females, all FIP diagnosed on 5 counts (they didn't want to use any animals whose symptoms were vague). A treatment regime was initiated in which alpha interferon was used in conjunction with glucocorticoid treatment (dexamethasone & prednisalone). More detail of exactly what was given, with the specific amounts is detailed in the abstract, but I think that anyone wanting their vet to follow the same path would need to consult with the Japanese institute involved, rather than anything I copied out. The results were interesting. There was an age split. 4 of the cats responded to the therapy and have survived without illness for more than 2 years (though it must be said that full health and strength did not return). 2 showed a partial response and survived for 4 months and 5 months. All 6 had effusion initially and were over 5 years old. The other 6 were 3m-5y.o. or they had no effusion. On death these were shown to have had FIP by necropsy. So it was interesting that both age and form of FIP had significance for recovery. One criticism of this study that came from the floor after the paper was presented, was that there had been no control group receiving the glucocorticoids only. Other scientists were interested to know whether prednisalone alone, plus the general treatment, would have had the same effect. How vital was the interferon? Work for the future there.

### **Epidemiology**

This is the study of the prevalence of a disease, or put another way Corona Virus, where it's at. None of the papers presented in this section gave the slightest bit of comfort to me as a breeder. Without exception it was shown that there are two 'exposure factories' for FCoV: rescue shelters and pedigree breeders, with other MCHs also featuring. For instance, 'Operation Catnip' Gainesville, Florida was a typical, catch, neuter and release of ferals. (Ear tops were clipped to ensure the same cat didn't get 'done' twice over). Blood samples were taken from 250 of these to test for the prevalence of a variety of diseases. A measure of FIP antibodies was just one of a range. Those involved were surprised to find that only 18% of this group tested positive for FCoV, and of these 29 cats that did, only 6 had a titre greater than 1:320. Dr Addie had conducted a much wider study in Britain of 2,207 cats relinquished to cat rescue shelters. Where possible she had obtained information of the cat's background. Its sex didn't make any difference to whether it was sero-positive, the sick and the young had a slightly greater chance than the healthy and the adult. But with a 17% chance overall of being positive, and only an 11% chance for an adult feral, if the cat was designated as a pedigree or a pedigree x on reception it had a whopping 74% chance of being FCoV positive. The number of pedigrees taken at the shelters in her survey even skewed the statistics for the spread of FCoV after arrival and the subsequent FIP cases, with those taking the greatest numbers

having the worst record, despite husbandry practices being very much the same. Not feeling too bad yet? Then contrast the findings of Dr Pedersen in California, where he found of 50 kittens under age weeks of age of feral/outdoor owned origin coming into a shelter none was FCoV positive, against Dr Lutz's Swiss study, I detailed earlier, where 226 kittens from 18 catteries were 100% were positive by 8 weeks. OK, these were breeders who had asked for help because of FIP problems, but in a second study by Dr Lutz on 132 cats & kittens in 8 catteries 90% were positive and shedding virus for at least a portion of 24 week period. Of course we all breathe a sigh of relief as FeCV does not mutate to become FIP in the overwhelming majority of cases. We are not talking about an epidemic with cats dropping like flies After all it was only 4% of those in Dr Lutz's study. and in each case the cattery had had previous FIP cases. Still can't say I'm easy though with conclusions such as: These data are consistent with the belief that feline corona infection is primarily a disease of cats that live together in large groups. Feral cats are an unlikely to be a significant reservoir for infection with feline corona virus of owned outdoor cats." AM Legendre (University of Florida) "Since FCoV is transmitted faecal-orally, it was expected that life-styles which engender more contact of cats with the faeces of other cats would predispose to a higher prevalence of FCoV seropositivity. Feral cats were less likely to be SP than pets or strays. Pedigree cats were significantly more likely to be SP than domestic cats, associated with originating from an MCH." D Addie (University of Glasgow) "FCoV shedding in faeces is widespread in catteries and represents an important source of FCoV spreading." Lutz H (University of Zurich). Personally, I don't like being thought of as one of a group responsible for spreading infection, possible deaths and the ensuing misery each life lost brings. I shall do my best over the coming months to put into practice suggestions made at the workshop for prevention on the last afternoon (I've yet to write up the details, saving it as a conclusion) and aim to lose no more lives to this. 4 in every hundred is still too high a price by my reckoning.

### **Prevention**

----- I think I've just about reached the last chapter of my reports. I suppose those I've bombarded with just too much information have probably switched off by now, but the conference was just about the steepest learning curve I've been on for a good few years, and I felt I had to share as much as possible. If there's been a certain sour note to what I've had to say at times, please remember that my losses to FIP happened this year and are very fresh in my memory. Just by being there I rubbed a very sore spot, and some of what I heard had the same effect as adding vinegar to the wound. This was a self inflicted injury only. No one I spoke to directly had anything but sympathy for my situation, and the speakers referring to the high incidence of FCoV in breeding catteries were doing so to define situations where the MOST HELP was needed, rather than dishing out condemnation. Those following this most closely will have realised I've skipped the immunopathology and pathology papers. I was too way out my depth here to be able to summarise the reports, but I do know the papers gave important new research detailing how the disease progressed within the cats, which could help with early diagnosis, and prevention perhaps in the future. The cell mediated immune response (which is what prevents cats getting FIP, antibodies don't) is an exciting new area of study. In Utrecht University they are currently comparing the CMI in cats that either survived or succumbed to FIP, and when the difference has been understood that should be a major step forward. Dr Radford is pursuing an understanding of CMI at Liverpool too, to gain knowledge of specific genetic predisposition to cope with disease. I mention his study because DNA from a family of my cats (given when Korats were being screened for GM) has been used

in the study. I took comfort from the fact that in a very small way I'd contributed something positive. Before breaking for the workshops on Wednesday there were four papers on new vaccine approaches, 2 from Utrecht, one from Bristol and the other from Virbac (France). There were some promising leads that would be further explored, but Dr Pedersen's view given at the beginning of the 'Prevention' session was that we can't just sit around and wait for a vaccine, because anything new that will be effective for all is most probably years away. The efficacy, or not, of Primucell wasn't a discussion topic, so I won't comment either, as I know absolutely nothing about it (not licensed for use in UK). The only point of note is that to be of any great use a vaccine should be able to protect those already exposed to FCoV at an early age, as it's been frequently demonstrated that it's this group who are at most risk. Primucell makes no claim to do that. The workshop brief was, "Recommendations for Minimising Disease Spread in Breeding, Rescue and Boarding Catteries, In Veterinary Practices and at Cat Shows". The last three we dropped after a very brief discussion. That's not to say that FCoV cannot be transmitted from one cat to another at any of these places. Dr Addie's household study demonstrated that a new virus strain can be introduced without a known source, but situations where litter boxes are not shared, and some disinfection procedures are being used, can be considered low risk. (Incidentally, when Dr Pedersen learnt that our boarding catteries are inspected and licensed he was most impressed.) For shelters and rescue centres the key word was HOUSING. No two or more litters of kittens should share the same accommodation unit at any time during their stay. The same should also go for foster homes used by any rescue organisation. Unless separate facilities are available, one litter at each should be the rule for fostering, and any well-meaning person letting kittens mix should only get one warning (CP vet). Any available money for expansion, updates etc, then improving the husbandry facilities of the young should be a priority. As an aside Dr Pedersen believed that well-meaning people think they're doing abandoned kittens a favour by taking them to a shelter. If they could only do, as used to be the case, and find homes for them themselves, the kittens would have a greater chance of remaining healthy. For breeding catteries LITTER BOX HYGIENE and NUMBERS were prime considerations. Keeping litter faeces free, not sharing boxes between different groups of cats, keeping any scoops, brushes etc specific for each place; these measures have been discussed several times. As far as the number of cats for a household was concerned it was considered that FIVE was enough for any home that did not have facilities to house separate groups. Two or three in any one group would be ideal to prevent disease spread. Never had FIP in your cattery? Then you are either FCoV negative, by design or good luck, or your cattery strain of FCoV is a non-FIP causing FECV. There's enough evidence to indicate that there are differing strains, the goodies and baddies, and Dr Addie's household data showed that variation in a strain, as it was replicated and transmitted within a household, was little. It's just that as yet there's no way of knowing whether any strain will mutate and cause FIP until it actually does. Should you do anything other than practice good husbandry and not let numbers spiral? a) Don't visit studs or have queens to visit without antibody testing both parties. Obviously this is essential if you are maintaining a negative cattery, but otherwise consider 1:400 or below as the guide. Dr Lutz's study demonstrated that the higher the antibody titre, the greater the viral load and viral shedding, and you certainly can't tell a goodie from a baddie. (I'm 99.9% sure this is how I introduced my virulent virus, though no cat belonging to either owner, or their breeders, had cats with FIP as far as was known.) Even where there has been no FIP, you don't want to swap viruses if you can prevent it, so don't let the stud and queen share litter boxes. House them separately if you possibly

can. b) Before introducing new cats into your cattery, titre test, and again use the 1:400 as a guide. Isolate a newcomer for 3 weeks on arrival, and certainly don't let him/her mix with any kittens you have. Sporadic Incidence of FIP, or wanting to reduce/eradicate FCoV? As above. Also: a) Titre test all and isolate those with a high titre. Test and re-test these at 6 weekly intervals. Consider most strongly adoption to single cat homes for those that maintain a consistently high titre over 3 testings. There are 2 reasons for this. These are cats shedding great amounts of virus who are infecting and reinfecting other cats in your household. In spite of care to separate out mothers and kittens it is very difficult not to take virus from one part of a cattery to another when there is a high viral load (difficult to downright impossible according to the recent studies). Also these cats that do carry and shed greater amounts of virus are probably the least resistant to it. The aim should be to breed from cats that can cope with it effectively. Those whose antibody levels drop to 0, or at least below 1:400 are those who are dealing with it, and have the healthy immune system you want to pass on to the next generation. b) Use early weaning if you are happy to do this. It has been shown to be effective in eliminating FCoV from kittens and they go to new homes seronegative. If you're not comfortable with this because of stress to mother and kittens, or have difficulty weaning them at an early age, then at least keep each litter isolated with their mother away from all other cats in the household. Keep separate litter boxes for queen and kittens, and part them for periods so that mother uses her own, and ensure the kittens have no access to it. c) Studies (Pedersen at Davis, J Norris, who reported this year a disproportionately high incidence of FIP in the Australian Mist population) have shown there is a genetic link. Don't breed together cats that both have had kittens die of FIP. Consider removing from the breeding programme a male that sires kittens who succumb to FIP, with 2 or more females. (It's not that males carry genetic predisposition any more than females. It's that by the number of kittens they may produce they have a much greater genetic input to future generations than females). d) As stress is a factor in FIP developing, it's probably also useful to take into account the temperament of breeding cats. e) Don't have a constant throughput of cats in your cattery, buying in show and/or breeding stock frequently. It causes stress and adds to chances of importing fresh viral strains. Work with what you have. (That goes for all breeders not just those with a FIP problem). I think that's just about covers it. I don't think there's a lot that's actually new, other than testing for, and removing the high viral shedders, and recommendations of a titre score to go below. I should just add that testing should be done by the recommended Universities and Institutes rather than commercial labs.

**Jen Lacey Jenanca Korats at the Cottage Cattery**