FHS FISH HEALTH SECTION—AMERICAN FISHERIES SOCIETY

NEWSLETTER

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Characterization of the "Mystery Agent" Found in Ovarian Fluids of Fall Chinook Salmon in Washington State

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Viral-like cytopathic effect (CPE) was observed during the fall of 1989 in CHSE-214 tissue culture cells inoculated with ovarian fluid from fall chinook salmon from six Columbia River and eight Puget Sound WDF hatcheries. The CPE consistently appeared between 7-14 days after inoculation of fall chinook salmon ovarian fluid onto CHSE-214 cells only (not EPC cells). The CPE was originally thought to be due to infectious hematopoietic necrosis virus (IHNV) infections in these fish, based on the characteristic plaques which formed on the cell sheet. However, attempts to pass the CPE onto fresh monolayers of EPC or CHSE-214 cells was not successful, yet CPE could again be induced if samples from the original tubes were inoculated onto a fresh monolayer of CHSE-214 cells.

The CPE was not inhibited when samples from the original tubes of ovarian fluid were treated for 1 hour with polyclonal anti-IHNV or anti-IPNV antisera prior to inoculation onto CHSE-214 cells. Monoclonal antibody assays conducted by Dr. Jim Winton (USFW Sandpoint Research Lab) and Dr. Sandra Ristow (WSU Dept. of Animal Sciences) also suggested the CPE was not due to IHNV.

At this point it was determined that whatever was causing the CPE was not IHNV, or any other virus we had seen before. The CPE was not thought to be due to sample toxicity since identical samples caused the CPE in CHSE-214 but not in EPC cells. In addition, toxicity-associated CPE usually occurs within several days after inoculation, but the CPE observed in CHSE-214 cells did not appear until at least 1 week following inoculation and appeared as focal plaques, not diffuse regions of dead cells typically seen in cases of toxicity. If toxicity was the cause, then an undiluted sample from a plate of cells expressing CPE should have caused CPE on a fresh monolayer of cells, however, we could not pass the CPE a second time.

The CPE was not thought to be a lab-associated contaminant in our CHSE-214 tissue culture cell line because it did not show up in every well of a 24-well plate, or flask, containing

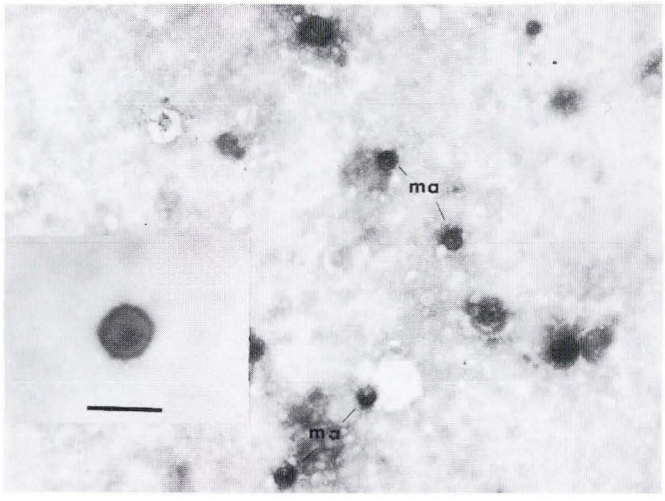

Fig. 1. Particles observed in CHSE-214 cells infected with the "mystery agent" from chinook salmon ovarian fluid (particles are labeled as ma). Inset is a higher magnification of an individual particle (bar = 100 nm).

cells from the same passage of cells. If the cells were infected with *Mycoplasma sp.* or some other contaminant, all wells or flasks containing that same passage of cells would have exhibited the CPE. This did not occur. Also, the CPE occurred only in cells inoculated with ovarian fluid from fall chinook salmon. It did not appear in the same passage of cells (on the same plate) inoculated with kidney/spleen samples from fall chinook salmon or from spring or summer chinook or coho salmon ovarian fluid or kidney/spleen samples.

Thus, it appeared that the CPE was not associated with any microbe we had ever observed nor was it due to toxicity or a contaminant in our cell line. After discussions with other pathologists from California, Oregon, and Washington, it appears that they too have observed this similar phenonmenon in the past: IHNV-like CPE from ovarian fluid samples only, with CPE being expressed only in CHSE-214 cells, and an inability to pass the CPE. These pathologists were concerned enough so that they destroyed fish or prohibited the importation of fish as a result of this CPE, only to find that they could not pass it a second time.

In our attempts to determine if the CPE was temperature dependent we inoculated ovarian fluid samples from six remaining original samples onto CHSE-214 cells and incubated them at 14°C. After CPE was evident, the supernatant was removed and inoculated onto two sets of CHSE-214 cells. One set was incubated at 14°C and one at 7°C. None of the cells incubated at the warmer temperature exhibited CPE, however, five of the six samples inoculated onto the CHSE-214 cells and incubated at 7° C induced the IHNV-like CPE previously observed in the primary culturing of the ovarian fluid samples. We have now successfully passed the CPE from the five different samples six times in CHSE-214 cells incubated at 7-8°C. Transmission studies conducted in water at 6° C showed that injections of supernatant from cells expressing CPE into 1.5 g chinook and 3.5 g rainbow trout did not cause any disease signs after one month.

Electron micrographs of pellets resulting from Corning T-150 tissue culture flasks of CHSE-214 cells expressing the CPE have revealed the presence of a small (about 80 nm diameter), round particle. It is not clear at this time if the particle represents a virus or not. However, the CPE did pass through a 0.22 μm filter, was associated with the presence of RNA as the CPE was not inhibited by IudR or BudR, and the particle may have an outer shell and an inner core region (Figure 1).

Despite the fact that we know the agent is not IHNV or any other pathogen we routinely screen for, it unfortunately causes rhabdovirus-like CPE. Since there is IHNV and VHSV in Washington, the CPE associated with the "Mystery Agent" can't be ignored when seen. Thus, to distinguish "Mystery Agent" CPE from any rhabdovirus-induced CPE attempts to passage or neutralize it at 14°C must be tried.

Examination of Mucus and Coelomic Fluid throughout the Spawning of Adult Chinook Salmon for Infectious Hematopoietic Necrosis Virus

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Mucus collected from the external surface of adult salmonids could be used as a simple non-lethal virus monitoring technique to indicate if a population is infected with infectious hematopoietic necrosis virus (IHNV). However, it is not known if detection of IHNV in mucus from adult salmonids is an indicator of viral presence in their reproductive fluids. The objective of this study was to 1) compare the prevalence of IHNV in mucus and coelomic fluid (CF) obtained from adult chinook salmon (*Oncorhynchus tshawytscha*) throughout the spawning run, 2) determine if IHNV could be detected first in the mucus, and 3) correlate this to the prevalence of the virus in reproductive fluids from the population.

Elk River Hatchery located on the south coast of Oregon has an annually returning historic stock of IHNV carrier adult fall chinook salmon. The fish become sexually mature in late November and are spawned by hatchery personnel. In this study, each time the fish were spawned mucus was collected from the external surface of each female by using a sterile cotton swab that was placed in an antibiotic solution (AFS Fish Health Blue Book) and kept cold. The fish were then sprayed with a dilute iodophore solution for surface disinfection prior to egg removal and a CF sample from the same fish was obtained. Prior to plaque assays on EPC cells, swabs from the mucus samples were discarded and the supernatant was used for virus detection and compared to CF.

Mucus and CF samples from 261 adult female fish were collected on eleven occasions over a 49 day period. Infectious hematopoietic necrosis virus was detected on the fourth day of collection in both CF and mucus samples Table 1). The virus was detected in all subsequent examinations of mucus but not CF. Both samples showed a trend toward increased prevalence of IHNV in the later spawning fish.

Overall a 22% (57/261) prevalence of IHNV was detected in mucus and 7% (17/261) in CF. The total carrier rate in the population by examination of individual reproductive fluids collected from all fish that were spawned was 10% (51/490).

Table 1. Virus monitoring results for Elk River Hatchery fall chinook salmon (*Oncorhynchus tshawytscha*). Prevalence of infectious hematopoietic necrosis virus (IHNV) in coelomic fluid and mucus from female fish at each spawn.

Date Spawned	Total Adults	Total Female	Proportion CF	IHNV-Positive Mucus
11-28-89	25	12	0/12	0/12
12- 5-89	54	26	0/26	0/26
12- 8-89	42	21	0/21	0/21
12-15-89	93	47	1/47 (2%)	2/47 (4%)
12-20-89	37	19	1/19 (5%)	4/19 (21%)
12-22-89	31	16	0/16	4/16 (25%)
12-30-89	12	6	0/6	1/6 (17%)
1- 3-90	55	34	4/34 (12%)	4/34 (12%)
1-10-90	50	31	3/31 (10%)	17/31 (55%)
1-12-90	50	25	3/25 (12%)	8/25 (32%)
1-16-90	41	24	5/24 (21%)	17/24 (71%)
Total:	**490**	**261**	**17/261 (7%)**	**57/261 (22%)**

Artificial IHNV infection experiments with juvenile salmonids have shown that virus can be detected in external mucus as early as 24 hours post-exposure and that the integument may be a site of virus replication and a possible portal of entry. Mucus collected from the external surface of adult salmonids may also serve as a source of IHNV and can be used for fish health monitoring (LaPatra 1989, FHS Newsletter 17(1):3; LaPatra et al. 1989, Fish Pathology 24(4):197-202). In this study nine fish had virus present in both CF and mucus, eight in CF only, and 48 in mucus only at spawning. Examination of mucus at each spawn did show a trend of an increased IHNV prevalence in later spawning fish. The same trend of IHNV prevalence was subsequently observed in CF. This suggests that the presence IHNV in mucus could indicate recent exposure to virus. Possibly testing of mucus samples for IHNV as the fish are approaching sexual maturation could give an indication of the viral status of the population. This strategy could be used to allow fisheries managers to prepare in advance modification of fish culture plans as deemed necessary.

Portable Carbon Filters Remove Malachite Green From Hatchery Effluent

The U.S. Food and Drug Administration granted the Fish and Wildlife Service and Investigational New Animal Drug permit to allow the use of malachite green at specified Federal and State fish hatcheries provided that the malachite green is removed from treated water prior to its release. Permission was also granted to use malachite green at certain hatcheries without removal if the concentration in the hatchery effluent is 50 ppb or less. Since most hatcheries cannot conform to the dilution requirements, removal is mandatory. Carbon filter units are commonly used to remove specific organic or complexed inorganic chemicals from water.

Filtration Equipment and Procedure

We tested two sizes of DISPOSORB filters, portable units manufactured by Calgon Carbon Corporation, at the Edenton National Fish Hatchery, Edenton, North Carolina. The small unit contained 165 lb of carbon and a 55-gal vessel and the large unit contained 1,000 lb of carbon in a 350-gal vessel. Both units contained Filtrasorb 300, an activated carbon of 8 x 30 mesh size. The floor drain trench was blocked to collect the effluent from treated tanks. The effluent was first pumped through a sand prefilter to remove debris and then through the carbon filters. Samples of treated water were taken from the floor trench before the water entered the prefilter system and from the carbon-filter effluent every 10 min during the first hour and every 20 min the second hour. Four 100-gal fish-holding tanks were treated with 6.8 g of malachite green oxalate to simulate actual treatments of malachite green. For testing the large filter unit, six tanks were treated and a water flow of 5 gpm continued through each tank. For the small filter unit, a single tank was treated with malachite green and a water flow of 10 gpm continued through the tank. Tests were repeated three times in each filter system to provide replication. Concentrations of malachite green in all samples were determined by High Performance Liquid Chromatography.

Efficiency for Removal of Malachite Green

Treated water from the tanks were collected in the drain trench that contained untreated water initially. Concentrations of malachite green in treated water that entered the filter system peaked at 1.81 mg/L after 20 min of operation of the large filter and at 1.00 mg/L after 20 min of operation of the smaller filter. The lower rate of flow (5 gpm) through the six tanks used with the large filter resulted in a slower rate of dilution of malachite green than for the small filter system. After 2 hours of operation, the residual malachite green in treated water before it entered the filters was 0.52 in the large unit and 0.14 mg/L. The color in the treated water was a brilliant green; in filtered water, no color was recognizable even when viewed through 12 inches of water in clean white pails. Removal efficiency was 99.5% or better. In previous simulation studies, Filtrasorb 300 activated carbon removed 69 mg of malachite green per gram of carbon. *Information Bulletin, U.S. Fish and Wildlife Service, submitted by Doug Anderson.*

Increasing Importance of *Citrobacter freundii* as a Fish Pathogen

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Until now only *Yersinia ruckeri*, *Edwardsiella tarda*, and *E. ictaluri* have been considered as substantiated fish pathogens in the family Enterobacteriaceae. However, the real role in fish diseases of other members of this family such as *Proteus*, *Citrobacter*, and *Serratia* remains to be determined.

During the last two years, the number of isolations of *Citrobacter fruendii* from diseased fish has increased in both the USA and Spain. The strains are isolated in pure culture or in mixed infections from rainbow trout (*Oncorhynchus mykiss*) and Atlantic salmon (*Salmo salar*) reared in fresh water and are usually associated with high levels of pollution. The isolates can be easily identified using the AP1-20E system because, regardless of their origin, all of the strains gave the same biochemical patterns. They are positive in 9 tests (ONPG, H_2S, GLU, MAN, SOR, RHA, MEL, AMY, and ARA) and negative in 9 other reactions (ADH, LDH, ODH, URE, TDA, VP, GEL, INO and OXI). The only variable test results among the isolates occurred in tests for citrate utilization, indole production, and sucrose fermentation.

A great proportion of the *C. freundii* strains are resistant to oxytetracycline, chloramphenicol, and potentiated sulfonamides. In addition, the isolates proved to be pathogenic for rainbow trout by intraperitoneal inoculation with LD_{50} values ranging between 10^5 and 10^6.

The main aim of this note is to alert fish health workers to the potential importance of *C. freundii* as an agent causing disease problems in cultured salmonids which can be difficult to control with the usual therapy. These increased isolations of *C. freundii* may reflect the impact of pollution on aquaculture activities.

Experimental Transmission of the myxosporean *Myxobolus arcticus* to Sockeye Salmon Using an Aquatic Oligochaete, *Eclipidrilus sp.* (Lumbriculidae)

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CANADA

The mode of transmission of myxosporean parasites has long been an enigma, and most experimental attempts to transmit infections directly with spores recovered from infected fish have been unsuccessful. Wolf and Markiw (1984. Science 225:1449-1452) provided experimental evidence that the life cycle of *Myxobolus cerebralis*, the cause of whirling disease, includes development within a tubificid oligochaete. They proposed that the myxosporean spore develops into a triactinomyxon stage, which is then infectious to fish. This life cycle contradicts the classical view on myxosporean life cycles, which held that spores released from the fish are infective to other fish after "aging" in the aquatic environment. Therefore, Wolf and Markiw's results were not readily accepted by many parasitologists. However, Hedrick et al. (1989. 4th Europ. Assoc. Fish Pathol. Conf., Santiago de Compostela, p. 38) reproduced the results of Wolf and Markiw with the same parasite, and El-Matbouli and Hoffmann (1989. Parasitol. Res. 75: 461-464) also achieved identical results with *M. cerebralis* and another myxosporean, *M. cotti*.

In our laboratory, we are investigating the life cycles of myxosporeans using *M. articus* (previously identified as *M. neurobius*) as a model. This parasite infects the brains of sockeye salmon, *Onchorhynchus nerka*, in British Columbia. We have selected this parasite for our studies because infected and uninfected salmon are readily available, and large numbers of spores are easily obtained from the brain of infected sockeye from certain watersheds in British Columbia. Furthermore, the parasite is non-pathogenic to infected fish and, compared to some other myxosporeans, it develops into spores in a relatively short time. We have also selected this parasite because of its importance as a biological tag for salmon stock identification (Quinn et. al. 1987. Can J. Fish Aquat. Sci. 44:1963-1967). Knowledge of the mode of transmission of M. arcticus could help explain its discontinuous distribution among sockeye salmon stocks in North America. Although Dana (1982. M.Sc. Thesis, Simon Fraser University, British Columbia) reported direct transmission of *M. articus* (under the name *M. neurobius*) in a few fish, our attempts at direct transmission of this parasite have been unsuccessful. Our experiments have involved feeding fish fresh spores and aged spores that had been subjected to various temperature regimes, and exposing fish to sterile mud containing aged spores.

We have recently achieved experimental infection of underyearling sockeye salmon held in the laboratory using lumbriculid worms, *Eclipidrilus* sp., collected from Sproat Lake, Vancouver Island. The prevalence of infection of *M. arcticus* in sockeye salmon from this lake is almost 100%. Worms were washed, and placed in a plastic tray containing sterile aquarium gravel. Dechlorinated tap water (13-15° C) was run through the tray and the effluent was discharged into an aquarium containing 15 *Myxobolus*-free, laboratory-reared sockeye salmon. Examination of 6 surviving sockeye after 135 days continual exposure revealed 100% infection of *M. articus* in the brain. The other 9 fish died early in the experiment and were not examined. Fifteen fish from the same stock were used as controls. These fish, which were fed fresh spores and maintained on the same dechlorinated water supply for 135 days, were uninfected.

Our results represent the fourth study that has implicated aquatic oligochaetes in the transmission of *Myxobolus* species. This is also the first report of transmission of a myxobolid parasite using an oligochaete of the family Lumbriculidae. To our knowledge, the previous studies have successfully used only *Tubifex tubifex* (family Tubificidae).

Although we achieved transmission of *M. arcticus* in the laboratory, the precise role of *Eclipidrilus sp.* in the life cycle of this parasite remains to be elucidated. Current research in our laboratory is being directed towards this question.

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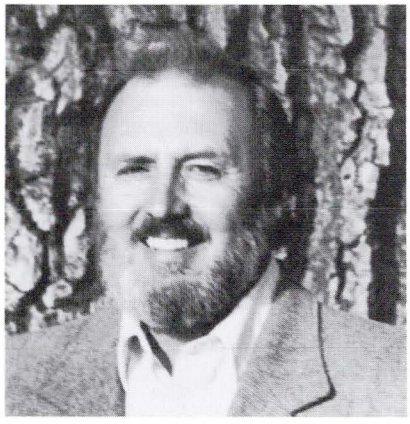

It has concerned me for quite some time now, that most, if not all current Fish Health policies require killing substantial numbers of fish for disease inspection regardless of the size of the population or management purposes.

Such policies have been established and regarded as necessary to prevent the introduction and/or spread of fish diseases, and to control fish pathogens already established so that serious losses in fish hatcheries and wild fish populations do not occur.

Generally, the number of fish required for lethal sampling during disease inspections does not have adverse economic or biological affects upon large groups of small fish. However, the value of some fish, such as rare, endangered and threatened species, genetically limited broodstock, small populations of wild and domestic broodstocks and some market-sized fish is so high that lethal sampling techniques, currently required by Fish Health policies, are unacceptable.

I recently received a letter from Mr. Angelo Incerpi, Chairman of the New England Salmonid Health Committee, a subcommittee of the N.E. Atlantic Salmon Committee. He shared a major concern expressed by commercial fish growers in the North East, related to the large number of fish that must be sacrificed for fish health inspections. This concern resulted in the committee approving a resolution encouraging fish health research to become more involved in the development of non-lethal sampling methods.

In the current issue of Journal of Aquatic Animal Health, (Vol. 2:151-153, 1990) T.A. Bell, D.V. Lightner and J.A. Brock outlined a biopsy procedure for the non-destructive determination of IHHNV of shrimp. Animals tested via this non-destructive new technique need not be sacrificed and are thus still available for use as a broodstock.

It seems quite reasonable to me that similar non-lethal sampling methods, some of which we already have, that will achieve acceptable levels of risk need to be and can be developed to detect diseases of concern in finfish, as well.

I feel we have been somewhat remiss in not concentrating more efforts in this area. I'm sure most people recognize the need to develop such techniques, yet we continue to develop more sensitive methods for isolating and identifying fish pathogens, but continue to rely on lethal sampling.

As President of the FHS, I have written the Director of Fishery Research, U.S. Fish & Wildlife Service, to encourage that some research be directed to developing non-lethal sampling techniques.

State Fish Health laboratories, universities and private fish health labs should also be encouraged to work on developing and adopting non-lethal sampling techniques appropriate for use in fish health inspections.

Acceptance of non-lethal sampling methods, once developed, will take some change in attitude of user groups to be fully implemented.

I solicit input from the Fish Health Section membership. I've expressed my opinion and that of a few others. I would really appreciate hearing yours.

Charlie E. Smith
President, FHS

Awards

Ron Goede, Director of the Fisheries Experiment Station, Utah Division of Wildlife Resources, was recently singled out for a special award. The Western Division of the American Fisheries Society bestowed Ron with their most prestigious recognition- the Award of Excellence. This award, which is made very rarely, was given to Ron to recognize both his pioneering efforts in fish disease control and the development of the Fish Health/Condition Assessment System. *Congratulations Ron.*

Awards Committee

The awards committee is soliciting nominations from the FHS membership for the newly recognized Special Achievement/meritorious service award. The new award is in addition to the S.F. Snieszko award and is designed to 1) identify outstanding candidates who have made a unique contribution to the fish health field, or 2) provided a significant research accomplishment, or 3) provided outstanding leadership in resolving a major fish health problem. The purpose of the award is to provide timely recognition for one-time accomplishments that have a significant impact on the management or control of fish health problems. The achievement must meet high standards of science and survive peer review. Anyone, not just the researcher, is eligible to receive such an award.

For further information contact:

Dr. Fred Meyer, Chair
Awards Committee, FHS
518 North First Street
La Crescent, MN 55947

Scholarships Available

The J. Frances Allen Scholorship was established in 1986 in honor of Dr. Allen who pioneered women's involvement in the field of fisheries. Female PhD students in any area of fisheries science including but not limited to genetics, engineering, aquaculture, aquatic animal health, limnology and technology are eligible to apply. The applicant must be a member of AFS. For complete application information and instructions write to:

J. Frances Allen Scholarship
c/o Dr. G. Joan Holt
American Fisheries Society
5410 Grosvenor Lane
Bethesda, MD 20814-2199

Letters to the Editor

Dr. Randy MacMillan
Editor
FHS/AFS Newsletter

I was entering the bibliographic citation for Herman Jarboe's article (about the use of oxolinic acid on goldfish) into the on-line database, FISHDRUG Index (on the Aquatic Data Center), when I noticed that the chemical name synonym was printed incorrectly.

Generally, the use of chemical synonyms is of no value unless they're correct. I respectfully suggest that when reviewing submissions with chemical names, that the latest copy of the Merck Index be consulted for the accepted chemical synonym(s).

For the record, the correct chemical name for oxolinic acid is, 5-ethyl-5,8-dihydro-8-oxo-1,3-dioxolo [4,5,-g]quinoline-7-carboxylic acid. One can always be suspicious (as to the correctness) of chemical names when any of the following conditions exist:

1) The placement of numbers inside parentheses (i.e. "(4,5-6)").

2) The name ends in a prefix (i.e. "-oxo").

3) A number is separated from a word with a comma instead of a hyphen (i.e. "5,ethyl").

4. When numbers in a list (i.e. "2,3,4,5") are separated by a hyphen instead of a comma (i.e. "4,5-6"); this usually means a lower-case letter has been erroneously read or typed as a number (i.e. a "6" instead of a "g").

I am not trying to [have a] pedantic [attention to detail] on these points, but as a chemist it is distressing to see chemical nomenclature bastardized to the extent it is in the fish drug literature. I have been the compiler of the FISHDRUG Index (formerly called FISHDRUG/TXT) since 1979, and I have thoroughly documented the extent to which chemical nomenclature is erroneously recorded in the fish disease literature.

If I can be of any assistance with drug and chemical names please do not hesitate to call (816-842-5936) or FAX (816-474-5597) or post a message to me on FISHNET (76702,447).

John Farrell Kuhns
Manager, Aquatic Data Center
Editor, Journal of Aquariculture & Aquatic Sciences, CODEX of Fishery Chemicals, and Drum & Croaker
Research Director, AquaScience Research Group, Inc.

Request for Specimens

I would like to obtain specimens of eggs from *Neoechinorhynchus venustus* for comparison with another species of *Neoechinorhynchus*. *N. venustus* was first described by Lynch (1936) from *Catostomus macrocheilus* in Lake Washington (State of Washington) and tributaries for the Lake. We have specimens of *Neoechinorhynchus* eggs from another catostomid which we wish to compare using SEM.

If you have fixed (10% formalin, 75% ETOH, etc.) specimens of gravid females that we may use for SEM, please send them to:

Dr. Richard Heckmann
109 WIDB
Department of Zoology
Brigham Young University
Provo, UT 84602

Thank you.

Positions Available

Aquatic Biologist. Requires B.S., advanced diving certifications, four years husbandry experience. Strong background in diagnosis and treatment of marine and freshwater fish diseases, and familiarity with standard lab techniques is essential. Send resume and references to Roger Klocek, John G. Shedd Aquarium, 1200 S. Lake Shore Drive, Chicago, Illinois 60605

NOTICE: MEMBERSHIP DIRECTORY UPDATE

To date less than 150 responses have been received from 606 FHS members for the new directory. Does that mean there are only 150 "interested" FHS members? We realize considerable confusion resulted from the newsletter mailing after the return date on the directory form. The new directory will contain updated information on the FHS members we have heard from. Names and addresses only of the remaining FHS members will be included as listed on the most current membership list from AFS. We would still like to hear from you....send your name, business/agency, address, phone, fax, professional licenses or certification, job description/expertise (35 word max.), and primary function(s) of lab (e.g. virology) to Kathy Hopper, 3420 Fishtrap Loop NE, Olympia, WA 98506 USA....within one month after you receive this newsletter. Any questions call Kathy Hopper (206)586-2075 or Beth MacConnell (406)587-9265.

Passages

Dr. Jerri Bartholomew has left the National Fisheries Research Center-Seattle to accept a research position at Oregon State University in the Department of Microbiology. Her new address is Department of Microbiology, Oregon State University, Corvallis, OR 97331.

Dr. Ron Hedrick, University of California, Davis is on sabbatical leave until June 30, 1991. His current address is: INRA, Virologie et Immunologie Moleculaire, Laboratoire d'ichtyopathologie, Domaine de Vilvert 78350, Jouy en Josas, France.

Short Course Announcement

This is to announce the short course, "Diagnosis and Treatment of Diseases of Warm Water Fish" (FAS 5225) will be taught at the University of Florida, July 22 - August 2, 1991.

This short course is designed to provide instruction in the methodology of diagnosis and treatment of parasitic, bacterial, viral, nutritional, and environmental diseases of warm water food fish, as well as aquarium species. Four hours of college credit are available to graduate and undergraduate students. The short course is also available to veterinary students as an elective clerkship. Tuition for Florida residents is $70.70* per credit hour. For non-residents tuition is $205.65* per credit hour. Those wishing to receive continuing education credit in lieu of college credit are invited to participate by paying a $250.00 registration fee in place of tuition.

This course is open to students, veterinarians, fisheries biologists, and aquaculturists, but is limited to 24 participants. Prospective students should apply in writing to Dr. Ruth Francis-Floyd at the address below. The deadline for receipt of a letter of application is April 15, 1991. All applicants will be advised whether or not they have been accepted to attend before May 15, 1991.

Students will be expected to provide their own compound microscope and dissecting kit for use in the laboratory. A limited number of microscopes will be available for those people who do not have access to one.

Instructors for the course will be Dr. Ruth Francis-Floyd, Extension Veterinarian for Aquaculture, Department of Large Animal Clinical Sciences and Department of Fisheries and Aquaculture; and Dr. Thomas L. Wellborn, Jr., Professor Emeritus, Department of Fisheries and Aquaculture, University of Florida.

Inquiries should be addressed to:

Dr. Ruth Francis-Floyd
IFAS Extension Veterinarian for Aquaculture
7922 NW 71st Street
Gainesville, Florida 32606

*1990 Tuition figures. May be slight increase for 1991.

Meetings

International Conference on Problems of Chemotherapy in Aquaculture: Theory and Reality. March 12-15, 1991. Paris, France. Contact Office International des Epizooties, 12 rue de Prony, 75017 Paris, France.

World Fisheries Conference. 14-19 April, 1991. Athens, Greece. Contact World Fisheries Congress, 5410 Grosvenor Lane, Suite 110, Bethesda, Maryland 20814. Tel: 301-897-8616, Fax 310-897-8096.

Regional Aquatics Workshop. April 26, 1991. Milwaukee, Wisconsin. Contact Rich Sajdak (414) 771-3040.

14 th Annual AFS/FHS Annual Meeting. Mark O. Hatfield Marine Science Center, Oregon State University, Newport, Oregon. Contact Paul Reno at HMSC 2030 S. Marine Science Dr., Newport, OR 97365; phone 503-867-0147, FAX 503-867-0105.

Second International Symposium on Viruses of Lower Vertebrates. July 29-31, 1991. LaSells Stewart Center, Oregon State University, Corvallis, Oregon, USA. Contact J.L. Fryer, Department of Microbiology, Oregon State University, Corvallis, Oregon 97331-3804. Telephone 503-737-4441. Fax 503-737-0496.

European Association for Veterinary Pharmacology and Toxicology, 5th Congress. August 18-22, 1991. Copenhagen, Denmark. Contact Folke Rasmussen, Chairman of the Congress, Karlegogard, 91 Karlegovej, DK-3400 Hillerod, Denmark.

3rd International Congress of Comparative Physiology and Biochemistry. August 25-30, 1991. Tokyo, Japan. Contact Congress Secretariat, 3rd International Congress of Comparative Physiology and Biochemistry, Zoological Institute, Faculty of Science, University of Tokyo, Hongo, Tokyo 113, Japan. FAX 81-3-816-1965.

European Association of Fish Pathologists Fifth International Conference: Diseases of Fish and Shellfish. August 25-29, 1991. University for Horticulture, Budapest, Hungary. Contact EAFP Meeting Secretary, Institute for Veterinary Medicine, Federal Health Office, Alt-Marienfelde 17-21, D-1000 Berlin 48, Germany.

Special Meeting Announcements

REGIONAL AQUATICS WORKSHOP (R.A.W.) ESTABLISHED

In 1989 representatives from a number of aquarium facilities in the Great Lakes region and nearby states began meeting informally twice a year to discuss topics relating to the captive husbandry of fishes, marine invertebrates and other aquatic organisms.

R.A.W. is unusual in that there are no officers, dues, etc. Participating institutions take turns hosting the meetings which provide a relaxed atmosphere where aquarium personnel and professionals from related fields can exchange information and present updates on current projects at their facilities.

Institutions represented at the recent meeting at the Saint Louis Zoo included: The John G. Shedd Aquarium, Toledo Zoo, Sea World of Ohio, Pittsburgh Zoo, Columbus Zoo, Milwaukee County Zoo, Belle Isle Aquarium, Cleveland Metropark Zoo and Fort Wayne Children's Zoo.

The next meeting is schedule for April 26, 1991 in Milwaukee. Contact Rich Sajdak (414) 771-3040 for more information. Involvement by aquatic biologists from outside of the Great Lakes region is both welcomed and encouraged.

14th ANNUAL AFS/FHS MEETING

August 1 - 3, 1991

MARK O. HATFIELD MARINE SCIENCE CENTER
OF
OREGON STATE UNIVERSITY
NEWPORT, OREGON

The fourteenth annual American Fisheries Society/Fish Health Section Meeting will be held in Newport, Oregon from August 1 through August 3, inclusive. It will be held in conjunction with two other relevant meetings: the Second International Symposium on Viruses of Lower Vertebrates at Oregon State University in Corvallis, Oregon on July 28-31, 1991 and the International Congress for the Society of Developmental and Comparative Immunology at Reed College in Portland, Oregon from August 5-9, 1991. For further information please contact Paul Reno at HMSC 2030 S. Marine Science Dr., Newport, OR 97365; phone 503-867-0147, fax 503-867-0105.

SECOND INTERNATIONAL SYMPOSIUM ON VIRUSES OF LOWER VERTEBRATES

July 29 - July 31, 1991

LaSells Stewart Center
Oregon State University
Corvallis, Oregon, USA

The Second International Symposium on Viruses of Lower Vertebrates will be held July 29-July 31, 1991 at the LaSells Stewart Center on the campus of Oregon State University in Corvallis, Oregon. There will be formal presentations as well as poster sessions. The major scientific sessions will include:

Session I:	Viruses of Amphibia and Reptilia
Session II:	Viruses of Cyclostomata and Chondrichthyes
Session III:	Viruses of Osteichthyes
Session IV:	Immunology and Defense Mechanisms
Session V:	Evolution and Taxonomy
Session VI:	Diagnosis of Viral Diseases

The Symposium has been scheduled in conjunction with the Annual Meeting of the American Fisheries Society, Fish Health Section, which will be held at the Mark O. Hatfield Marine Science Center in Newport, Oregon from August 1-3, 1991 and the Fifth International Congress for the Society of Developmental and Comparative Immunology which will be held at Reed College in Portland, Oregon from August 5-9, 1991.

Abstract and registration forms may be requested from: J. L. Fryer, Department of Microbiology, Oregon State University, Corvallis, Oregon 97331-3804 USA.
Telephone: (503) 737-4441. **FAX:** (503) 737-0496.

AD HOC COMMITTEES

Program (1991 Meeting)

Paul Reno, Chair (503) 867-0100
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Bob Olson
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International Standards

Chair to be named
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Pierre de Kinkelin
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(*Streptococcus, Lactobacillis*)
*John Hawke (*Edwardsiella ictaluri*)
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Ron Hedrick
*Diane Elliott (*Aeromonas salmonicida*)
Robert Durborow (Warmwater parasites)
*Roselynn Stevenson (*Yersinia ruckeri*)
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*Russ Kelly (*IPNV*)

Blue Book Field Advisory

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(717) 726-6611
*Jack Frimeth
(Coldwater parasites)
Diane Elliott
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Jack Ganzhorn (*Vibrio*)
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Bill Rogers, Chair
John Plumb
John Grizzle

Sequelae

Heckman in Russia

Hedrick et al. on Microsporidium and Iridovirus

Roberts et al. on Picorna virus

Elston on Asian Fish Health

Deadline for the Spring Edition of the FHS Newsletter is Feb. 15, 1991.

Address contributions to Dr. Randy MacMillan, Director of Research, Clear Springs Trout Co., P.O. Box 712, Buhl, Idaho 83313 or any member of the Newsletter Committee.

Contributions submitted on 3.4 or 5.25 inch floppy disks in Word Perfect are appreciated.

Fish Health Newsletter

The Fish Health Newsletter is a quarterly publication of the Fish Health Section of the American Fisheries Society. Submissions of any length on a topic of interest to fish health specialists are encouraged with the understanding that material is not peer reviewed. Submissions should be addressed to the editor or to a member of the publication committee.

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