MERCURY FILLINGS AND ANTIBIOTIC RESISTANCE

Bio-Probe has previously reported on an abstract published in the "Physiologists" journal in August of 1990 (BPNL. Vol. 6 No. 5. Sept 1990) and reported at the Annual Meeting of the American Physiology Society in October of 1990. The investigators inserted amalgam fillings into the teeth of 2 monkeys and followed them for 3 months. Within 2 weeks, mercury released from the amalgam fillings caused a large proportion of the common mouth and intestinal bacteria to become resistant to mercury and to antibiotics.

The research team has now duplicated these results on 2 additional monkeys which were followed for 5 months, including removal of the amalgam fillings and comparison of findings. The results were reported at the 1991 Annual Meeting of the American Society for Microbiology on 7 May 1991. The abstract follows:

Summers, AO; Wireman, J; Totis, PA; Blankenship, J; Vimy, MF; Lorschieder, FL.

Mercury Released from Dental "Silver" Fillings Increases the Incidence of Multiply Resistant Bacteria in the Oral and Intestinal Normal Flora.


Mercury (Hg) released from dental amalgam ("silver") fillings is a commonly ingested toxic substance. However, the question of the bioavailability (and, thus, the toxicological relevance) of dental amalgam Hg has been disputed. We asked whether the incidence of Hg resistance in gingival and fecal bacteria is altered by installing dental amalgams. Sixteen small occlusal surface amalgam fillings (total mass 1500 mg Hg) were inserted under general anesthesia into wild-caught adult monkeys using standard dental procedures (2 monkeys each in 2 experiments). Monkeys were individually housed and fed an antibiotic-free diet. Duplicate fecal and gingival samples taken from each monkey during 10 days prior and 30 days after amalgam installation were cultured for enterobacteriaceae and enterococci, and for oral streptococci and staphylococci, respectively. In 3 of the 4 monkeys Hg resistance in all bacterial populations was low or undetectable prior to amalgam insertion and for 7-10 days post-insertion; one monkey had detectable Hg resistant enterococci prior to amalgam installation. From 10 days post-amalgam insertion until termination, the levels of Hg resistance in the gingival and fecal bacteria in all monkeys averaged 30% (range 1-100%). Hg resistant isolates were typically also resistant to at least one and often several antibiotics (e.g. tetracycline, ampicillin, streptomycin, chloramphenicol, or sulfadiazine). All Hg resistant enterobacterial isolates examined thus far are capable of reducing Hg(II) to Hg(O), as expected. Thus, constant exposure to Hg arising from dental amalgams (ca. 3.5
ppm in feces and 4 ppm in gingiva in these experiments) constitutes continuous selective pressure for the maintenance of multiply resistant bacteria in both oral and fecal normal flora of primates. The number and types of plasmids in these strains is being assessed.

AUTHORS’ COMMENTS: Oral and intestinal bacterial populations are very complex and may differ considerably between individual animals. Since bacterial samples were obtained during the 10 days before and for at least one month after the installation of amalgam fillings, each animal served as its own longitudinal control. In the 5 month study, the amalgam fillings were replaced by composite resin fillings after two months and the proportion of resistant bacteria declined during the subsequent two months.

The authors further noted that since dental amalgam is a greater source of mercury exposure for humans than any other non-occupational source (including food), it is likely that dental amalgam mercury is a selective agent which increases the prevalence of plasmid-associated mercury and antibiotic resistances in the oral and intestinal bacteria of humans. It has been fully documented that such resistance plasmids can compromise the effectiveness of antibiotics used in the treatment of bacterial infections. Plasmids are movable genetic agents that transfer genes between strains of organisms.

BIO-PROBE COMMENT: It is clear that the findings of this research team is of the utmost importance to the medical community and to patient health. Antibiotic resistance is a rapidly increasing threat to patient therapy. The implications of this research, therefore, are dramatic. The lead author of these studies, Dr. Anne O. Summers, is a widely respected microbiologist and one of the world leaders in her field. The American Society of Microbiology and the American Physiology Society are certainly valid authorities.

These findings do not even depend on the transfer of dental amalgam mercury into body tissues or calculation of body burdens. The harmful effect occurs before the mercury enters the body. Further, the finding that these mercury resistant bacteria convert ionic mercury to the lipid soluble non-valent form of mercury means that more of the mercury is potentially able to enter the body of the host.

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NEW RESEARCH ON DENTAL AMALGAM FROM SWEDEN

Pro-mercury dental spokesmen have recently made reference to new research by M. Molin demonstrating the harmlessness of mercury amalgam dental fillings. Their reference is the following:
Molin, Margareta.
Mercury Release From Dental Amalgam in Man
Swedish Dental J. Suppl. 71. 1990.

This report is actually a compilation of four published studies by M. Molin and others in various dental journals. Before discussing the design and execution of the individual studies, it is interesting to note Dr. Molin’s own conclusions:

- The significant positive correlations between the plasma-mercury level and the number of amalgam surfaces as well as the total amalgam surface area respectively, and the fifty per cent reduction in plasma-mercury after amalgam removal shows that dental amalgam contributes to the mercury concentration in plasma.

- The significantly increased urine mercury level after amalgam placement and the seventy-five per cent reduction in urine mercury level after amalgam removal shows that dental amalgam contributes to a major part of the mercury concentration in urine.

- The results indicate that mercury release from dental amalgam does not influence the selenium status in man.

- Supplementary blood and urine analyses were carried out in order to evaluate any possible effect of mercury released from dental amalgam on blood cells and erythrocyte components, electrolyte balance, liver function, inflammatory activity, immune stimulation, tissue damage and kidney function. The results for the components chosen for analysis did not indicate any changes in organ functions.
Dr. Molin's findings clearly confirm the transfer of mercury from dental amalgam fillings into the host bodies. Since she has concluded that there were no harmful effects found in her studies, the foundation for this conclusion should be examined.

As previously stated, her study was conducted in four parts, with the supplementary blood and urine analyses for evaluation of organ function conducted in each part.

I. "Plasma-selenium, glutathione peroxidase in erythrocytes and mercury in plasma in patients allegedly subject to oral galvanism.": Twelve subjects with a mean number of amalgam surfaces of 34.6 were compared to twelve controls (Faculty of Odontology) with a mean number of amalgam surfaces of 30.5. All of the "controls" had amalgam fillings. One of the subject group had no amalgam fillings. The variable in this part was the symptoms expressed by the twelve "subjects". The author stated that the symptoms stated by the subject group could not be specifically related to mercury from amalgam fillings.

II. "Mercury, selenium, and glutathione peroxidase in dental personnel.": A high urinary mercury group (HUM) of 18 dental personnel were compared to 13 dental personnel from the same clinics in the low urinary mercury group (LUM). The HUM group mean urinary value was 6.5 mcg/g creatinine and had a mean number of amalgam surfaces of 39.9. The LUM group mean urinary value was 2.0 mcg/g creatinine and had a mean number of amalgam surfaces of 31.5. There was no indication that any of the subjects in either group had no amalgam fillings. Urine protein levels, an indicator of kidney dysfunction, were statistically significantly higher in the LUM group but all individual values were within the "reference interval".

III. "The influence of dental amalgam placement on mercury, selenium, and glutathione peroxidase in man.": This study consisted of 8 amalgam-free subjects that received a mean number of 8.9 amalgam fillings (16.1 mean surfaces). After amalgam placement, the erythrocyte glutathione peroxidase level in the study’s only female elevated to twice the level of the other 7. She was dropped from the study. This study had to be limited to 3 months for patient cooperative reasons (subjects were recent immigrants from countries other than Sweden). In all of these subjects, the plasma and urine mercury levels following amalgam placement failed to reach the levels found in amalgam-bearing subjects in the other three studies. Moreover, these were the only subjects in all of the studies to exhibit a significant increase in plasma selenium. The author attributed this to a change in the diet of subjects. This group also had a statistically significant increase in urine beta2-microglobulin, an indicator of kidney dysfunction. The author stated that the increases were within the "reference interval".

IV. "Mercury, selenium and glutathione peroxidases before and after amalgam removal in man.": All amalgam fillings were removed on one treatment occasion in 10 healthy subjects with a mean number of a 19.9 amalgam surfaces. Parameters were compared to 10 age and sex matched controls with a mean number of 24.7 amalgam surfaces. Twelve months following amalgam removal the plasma mercury levels were reduced by 50% and the urine mercury levels by 75% in the subjects. The subject group exhibited a statistically significant higher mean urine albumin level (an indicator of kidney dysfunction) twelve months after amalgam removal. The values fell within the "reference interval" and no other significant differences were found between the groups.

**BIO-PROBE COMMENT:** Parts I and II of this report contain no valid information for the evaluation of adverse health effects of amalgam fillings. All of the controls possessed amalgam fillings in roughly the same amounts as did the subjects. The author herself questions the validity of findings in Part III as, during the short duration of the study, the plasma and urine mercury levels of the 7 subjects did not reach levels found in amalgam bearers in the other three parts.

The author's conclusion that mercury exposure from dental amalgam fillings causes no changes in organ functions rests solely on findings on the 10 subjects in Part IV who had the amalgam fillings removed and were followed for twelve months. The question now arises as to the credibility of the tests selected to arrive at that conclusion. Consider, for example, the choice of laboratory indicators for mercury-induced kidney
dysfunction, which were; urine albumin, urine protein, urine beta2-microglobulin, urine osmolality, and plasma creatinine (page 28).

There are many references available that document indicators of adverse physiologic effects of mercury, the most recent being the 1991 update by the World Health Organization (Environmental Health Criteria 118: Inorganic Mercury. World Health Organization. Geneva. 1991). This group of medical experts on mercury toxicology said the following about mercury-induced kidney damage: "Here it can be summarized that two types of renal injury have been observed. The first is a glomerular injury caused by an auto-immune reaction induced by mercury and resulting in antibody formation against the glomerular tissue, deposition of immune complex, glomerular nephritis, proteinuria, and nephrotic syndrome. Alternatively, immune complexes containing other mercury-induced antibodies may be deposited in the glomeruli. The second is a renal tubular damage affecting the proximal tubules and developing in parallel with the accumulation of mercury in the renal tubular cells. This damage results in a loss of renal tubular enzymes, such as gamma-glutamyl transferase, and lysosome enzymes, such as beta-galactosidase, beta-glucuronidase and N-acetyl-beta-glucosaminidase and in decreased reabsorption leading to an increased secretion of endogenous trace elements such as zinc and copper. An early effect is an inhibition of protein synthesis. A swelling of the endoplasmic reticulum with disaggregation of polyribosomes is observed in electron microscopy. Eventually, renal tubular necrosis and renal failure develop." The research cited by the WHO committee dates from 1962 through 1988 and was, therefore, readily available.

It is obvious that the kidney function parameters selected by Dr. Molin do not totally reflect documented mercury-induced kidney dysfunction indicators and, therefore, her findings do not allow conclusion that amalgam derived mercury does not cause kidney damage. Further, none of the other indicators selected by Dr. Molin (page 28) can be found in the WHO document as established indicators of mercury damage.

There is an obvious lack of agreement between Dr. Molin and the W.H.O. mercury toxicology experts as to what testing indicators are valid for the determination of adverse effects to mercury. Further research is necessary to fully investigate the potential adverse effects of mercury exposure from dental amalgam. In the meanwhile, prudence and responsibility to the public health dictates that the dental profession involve, and rely upon, qualified medical scientists for the evaluation of potential systemic adverse effects on the various organs and systems.

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ETHICS AND DENTAL AMALGAM REMOVAL

The Journal of the American Dental Association recently presented an article on the ethics of dental amalgam removal by John G. Odom, Ph.D., an associate professor of Community Dentistry at the Ohio State University College of Dentistry (JADA. 122:69-71. 1991). Mr. Odom concludes: "The recent controversy regarding dental amalgam restorations illustrates the impact of societal forces on professional conduct and decision making. Technology, consumerism and the media are having significant impact on the way professionals provide service. Dentistry's response to the media's allegations regarding mercury amalgams has been admirable. The response has been based on scientific evidence and ethical principles and has provided the opportunity to reaffirm and define dentistry's commitment to professionalism and ethical behavior."

Mr. Odom addressed the lofty ethical principles of "beneficence", "nonmaleficence", and "autonomy". Interestingly, the opening of these subjects could provide stronger arguments to oppose the use of dental amalgam than for its removal. Bio-Probe is grateful to Laurence I. Barsh, D.M.D. for his permission to present his response to Mr. Odom in its entirety.

To the Editor [of JADA]:

In his article "Ethics and Dental Amalgam Removal" published in JADA, Volume 122, June 1991, Mr. Odom introduces a broader concept of ethics than his title implies. Rather than being limited to merely the ethics of amalgam removal, the article introduces ethical concerns involved with resolving medical
controversies which could affect the health of a large population. Controversy among medical professionals has existed since the history of medicine and dentistry has been recorded. The worm theory of dental decay, the efficacy of bleeding to relieve the humors, the germ theory of infection, and the use of ether anesthesia to relieve the pain of surgery are all examples of controversy where the medical establishment thought one way and a dissident thought the other.

Historical perspective has proven which "side" of the controversy was correct and which theories were fallacious. We now look back and amuse ourselves with the naiveté of those whom history has proven incorrect.

The difference between these controversies and the one involving dental amalgam is that the mercury issue exists within our professional lifetimes and, therefore, must be resolved without the benefit of historical perspective. Despite the fact that we are in an enlightened era of medicine and dentistry we still resort to name-calling, innuendo and revocation of the right to practice as a means of quelling responsible disagreement with the medical/dental establishments.

Mr. Odum attempts to rationalize away some dentists' genuine belief, supported by responsible researchers, that mercury containing amalgams are dangerous by quoting from the American Dental Association's "Principles of Ethics" which state that "... the removal of amalgam restorations from the non-allergic patient for the alleged purpose of removing toxic substances from the body, when such treatment is performed solely at the recommendation of the dentist is improper and unethical." Mr. Odum states that "without supporting scientific evidence to justify amalgam removal, a dentist who initiates amalgam removal violates the ethical principle of beneficence." Yet his statement "scientific evidence simply does not support amalgam removal" remains unreferenced. Ethical behavior would dictate that this statement be documented by references in the bibliography. As there are articles published in peer adjudicated journals (1, 2, 3, 4) which question the safety of dental amalgam, the principle of beneficence has yet to be decided.

There are, to be sure, two or more sides to every issue which continue to exist until there is overwhelming, conclusive proof which establishes the "correct" position. If an ethical practitioner, after reading and evaluating both sides of an issue, is constrained from acting upon his/her beliefs, is that practitioner truly being allowed to practice ethically? [Note: See Bio-Probe Comment] Further, if research points out even the suggestion of a risk to a specific group, is it not the obligation of an ethical professional organization to point out the potential of risk to the public and to vigorously pursue research to prove or disprove that presumed risk?

If any risk exists in the choice of a medical treatment, the public has a right to know of that risk. Choice of treatment is currently being offered to women in the case of breast cancer where the "ideal" therapy has yet to be determined by the medical community. The patient is offered the choice of lumpectomy vs. mastectomy, with and without chemotherapy and with and without radiation. As long as the patient is given full access to all accumulated knowledge, it must be the patient who ultimately decides the course of therapy. It is unethical for a professional organization to deny the patient this choice by constraining responsible professionals! It is rather the obligation of a professional organization to guide and advise but not restrict the activities of those who responsibly seek the truth.

Mr. Odum argues against amalgam removal stating "Furthermore, the dentist should present the potential harms associated with amalgam removal. For example, the high degree of concentrated vapor that occurs during removal may be more dangerous than leaving dental amalgam in place..." While I totally agree that the vapor generated during amalgam removal can be dangerous, the statement is obfuscatory in light of the American Dental Association's statements that the mercury used in dental amalgams is safe "because the mercury is made virtually harmless when it combines with other metals to produce amalgam. (5)" If Mr. Odum's statement is indeed incorrect since the mercury has been rendered "harmless" than his entire article is suspect. If Mr. Odum's statement is correct and a potentially toxic vapor is generated during amalgam
removal, why is it that this fact has never been presented as a warning to dentists and their patients when removing carious amalgams to place a new restoration, such as new amalgams?

The purpose of this letter was not to resolve a scientific issue but rather to point out that errors in logic exist both in the ethical statements promulgated and the practical statements used as corroboration. I would ask that the Journal of the American Dental Association provide an unbiased forum for both sides of the dental amalgam controversy with equal access for both case reports and scientifically conducted experiments. Research on this essential part of our practices should not need to be published in physiology journals, they should be where all dentists can find and read them. It is our patients' health and welfare with which we should be concerned, not who "wins" or "loses" this battle in the "amalgam war."


**BIO-PROBE COMMENT:** In December of 1990 the widely known Dr. Gordon Christensen of Clinical Research Associates reported his results in surveying close to 10,000 dentists (CRA Newsletter. Vol 14, Issue 12. December 1990). Although only 6% of the dentists surveyed did not use mercury amalgam, fully 39% where "concerned" or "highly concerned" about the safety of the material. The newsletter stated: "This indication of unrest should signal researchers & politicians that controversy is more than just rhetoric & valid research on this subject is needed."

The obvious question that will soon be faced is "what is the ethical status of a health profession where one third of its practitioners routinely implant into their patients a material for which they have concerns over potential adverse health effects?" More to the point, what role has organized dentistry had in forcing these practitioners into this obvious ethical dilemma, along with its potential medico-legal implications?

The following definitions [Webster's New Collegiate Dictionary] illustrate the significance of the ethical considerations revealed by Mr. Odum. The principle of "autonomy", for both patients and practitioners, is already being violated by the actions of the pro-amalgam faction of dentistry. In the absence of conclusive scientific proof that mercury amalgam fillings are not harmful to patients, revelation of the principles of "beneficence" and "nonmaleficence" could very well backfire on the position taken by Mr. Odum.

Beneficence: 1. The quality or state of being beneficent. 2. Benefaction. [Beneficent: 1. Doing or producing good; esp. performing acts of kindness or charity. 2. Beneficial.]

Maleficence: 1a. The act of committing harm or evil. 1b. A harmful or evil act. 2. The quality or state of being maleficent [Working or productive of harm or evil].


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SCIENTIFIC REVIEW

Wataha, JC; Craig, RG; Hanks, CT.
The Release of Elements of Dental Casting Alloys into Cell-culture Medium.

ABSTRACT: Ten dental casting alloys were tested for alloy-element release into cell-culture medium, and this release was related to alloy composition, alloy microstructure, and alloy cytotoxicity (previously determined). Cell-culture medium was analyzed for alloy elements by flame atomic absorption. Concentrations of elements in the medium were normalized by dividing them by their atomic abundance in the alloy, giving element medium-alloy ratios (EMA ratios). Results showed that Au, In, and Pd generally did not dissolve into the medium, but that Ag, Cd, Cu, Ga, Ni, and Zn frequently dissolved. Comparison of EMA ratios for Ag, Cu, and Zn showed that each element retained a behavioral identity in diverse metallurgical environments, but that these environments influenced the release behavior to some degree. Some EMA ratios in multiphase alloys were greater than those in solid solutions, and EMA ratios showed great diversity within all the alloys. Nominal composition seemed to be of little value in the prediction of metal release unless the composition supported multiple-phase formation. In addition, release of alloy elements did not, in itself, completely predict alloy cytotoxicity measured previously. However, cytotoxicity was associated with metal release in each case. The commercial alloys used in this study exhibited more complex and less predictable release behavior than did the simpler ternary alloy systems used by previous investigators. It is believed that the use of commercial preparations is necessary for their in vivo behavior to be modeled.

Livardjani, F; Ledig, M; Kopp, P; Dahlet, M; Leroy, M; Jaeger, A.

ABSTRACT: Rats were exposed to mercury vapors (30 mg/m3) for either 1 or 2 hours. Histological lesions like alveolar edema, hyaline membranes and sometimes fibrosis were observed. The lesions were more significant after 2 hours of exposure, with about 50% of the animals dying within 2 weeks. The mercury level and the superoxide dismutase activity in the blood and the lungs demonstrated differences according to the time of exposure. In the animals exposed for 2 hours to mercury vapors, N-acetylcysteine treatment increased survival time and the percentage of living animals. The lung superoxide dismutase was lower than in the non-treated animals indicating an antioxidant effect. Mercury levels were decreased in blood and lung, suggesting some chelating effect of N-acetylcysteine. The exact mechanism of its action must be further elucidated.

Vinay, SD; Raghu, KG; Sood, PP.
Dose and Duration Related Methylmercury Deposition, Glycosidases Inhibition, Myelin Degeneration and Chelation Therapy.

ABSTRACT: Methylmercury accumulation in different parts of the CNS (olfactory bulbs, cerebral hemispheres, cerebellum, medulla oblongata and spinal cord) in relation to the cytoarchitectural changes in myelin sheath as well as in glycosidases levels have been reported. Male albino rats were treated with low and high doses of methylmercury chloride (1 mg/kg and 10 mg/kg), N-acetyl-DL-homocysteine thiolactone (40 mg/kg and 80 mg/kg), and glutathione (100 mg/kg and 150 mg/kg) for varied time periods. The study shows a dose and duration dependent accumulation of mercury in all the CNS areas coinciding with a progressive myelin degeneration and inhibition of the glycosidases. A casual relationship between the amount of mercury accumulation and the extent of enzymes inhibition, in any particular area of CNS, could not be established. Similarly none of the antagonists is able to bring an absolute control value in any group, though this has been successful in recovering the enzymes and lessening the mercury burden in a few isolated cases.
FORUM

EXPOSING TO MERCURY DECLARED "ASSAULT WITH A DEADLY WEAPON"

On 28 May 1991 a judge sentenced the two owners of a mercury thermometer company to prison for "assault with a deadly weapon" for "knowingly endangering employees by exposing them to toxic mercury." (The Boston Globe. Business:69-70. Wednesday, 29 May 1991.) The two owners of the company (now defunct) received 26 weekends in jail, $10,000 each in fines, and 5 years probation for the criminal charges.

The case, which has gone all the way up to the U.S. Supreme Court, set an important legal precedent. It is absolutely essential that organized dentistry inform its practitioners of the implications of this case on mercury hygiene in the dental office. Are those dental offices that still require manual preparation of the amalgam "knowingly endangering their employees"?

Further, although the case was for occupational exposure to mercury, the legal precedent of conviction on criminal charges for "knowingly" exposing workers to mercury could have future implications in the use of mercury amalgam fillings on patients. The mercury exposure patients receive from amalgam fillings is scientifically undeniable.

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IAOMT ANNUAL SCIENTIFIC SESSION

The Annual Scientific Session of the International Academy of Oral Medicine and Toxicology will be held at the Sheraton Inn in Seattle, Washington on 13-15 September 1991. Meeting chairman is Paul G. Rubin, D.D.S. Phone (206) 328-0221 or write P.O. Box 20039, Seattle, WA. 98102 for registration. Special room rates are available by specifying "IAOMT", and may be obtained by phoning (206) 621-9000.

Scientific presentations on friday and saturday include: "New Research on Dental Amalgam Safety"- Dr. Murray J. Vimy; "Current Considerations on the Use of Dental Amalgam"- Dr. Michael F. Ziff; "Bioconversion of Mercury by the Oral and Fecal Microbial Flora"- Dr. Anne O. Summers; "Alternative Techniques to Amalgam"-Dr. David Kennedy; "Effective Detoxification Procedures for the Mercury Toxic Patient"- Dr. Sandra Denton; "Porphyrin Profile as an Indicator or Mercury Toxicity"- Dr. James Woods; "Electrochemistry of Dental Amalgam"-Dr. James V. Masi; "The Effect of Mercury Amalgam on Health"- Dr. Robert Siblerud; "A Critical Look at Evidence Supporting the Safety of Amalgam"- Dr. Paul Rubin; "Questions on the Safety of Fluoride"- Dr. John Yiannouyiannis; "A Study of Toxic Materials in Dental Office Wastestream"- Cynthia Welland.

The 1991 Annual Meeting of the IAOMT will be held on sunday morning and a public forum will be presented friday evening.

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IAOMT WINTER REGIONAL MEETING

The winter regional meeting of the IAOMT will be held in Orlando, Florida on 1-2 February 1992. Special rates of $89.00/night have been arranged at the Travelodge Resort Hotel, which is directly on Walt Disney World property and within walking distance of the Disney Village Market Place. Free transportation is available to all Disney functions. Room rates will hold for three additional nights before or after the meeting, but room availability is limited. Make reservations as soon as possible by phoning (407) 828-2424 or FAX (407) 828-8933. Be sure to specify IAOMT when making reservations. For further information contact Peggy Ziff; 5025 Bermuda Circle; Orlando, FL 32808.