

The History Of Zoo Nutrition¹

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Providing an appropriate diet to the wide array of animal taxa in zoos remains challenging, despite the tremendous expansion in the science of zoo nutrition and diet management in the past 20 years. Significant advances have been possible because of a number of interested scientists.

Zoo nutrition was initiated in 1918 by Dr. Ellen Corsen-White, a pathologist at the University of Pennsylvania Medical School. Dr. Corsen-White investigated primate bone disease at the Philadelphia Zoological Garden and continued to publish papers in the early 1920s on this topic. She introduced the recipe for what later would be called the "Zoo Cake," which was designed to be augmented with commercially available produce. In 1935, Dr. Herbert Ratcliffe, a Philadelphia Zoological Garden pathologist outlined the use of Zoo Cake in 1936 and in 1937 presented the results of new feeding methods. A series of reports out of Europe in the late 1950s and in 1966 by H.F. Matthysen (Rotterdam, The Netherlands) and by Wackernagel (Zoologischer Garten Basel, Switzerland) updated the method of feeding Zoo Cake and promoted the use of browse with supplements. They published a paper on zoo feeding methods together in 1966 [Nijboer, 2001; Oftedal, 2001; Ratcliffe and Wackernagel, 1966; Toddes, 2001]. From about 1970 to 1988, the Institute of Zoology of the Zoological Society of London performed nutritional studies, including fatty acid metabolism work. This program performed by scientists including veterinarians interested in nutrition developed into the society's Comparative Nutrition Group [Fidgett, 2001].

In 1974, at the new Metro Toronto Zoo (Ontario, Canada), Sergio Oyarzun was the first professional hired as "Commissary Supervisor" and developed his position into nutritionist over the years. Dr. Olav Oftedal held the first official Zoo Nutritionist position at Smithsonian's National Zoological Park (Washington, DC) in 1978 [Oftedal, 2001]. Next to follow was the Chicago Zoological Society's Brookfield Zoo in Illinois, which began its zoo nutrition program in 1980. In 1982 the Royal Rotterdam Zoological and Botanical Gardens (Rotterdam Zoo) in The Netherlands presented the report "Efficiency in the Diets of Rotterdam Zoo," at

the IUDZG meeting, which illustrated its interest in the subject [Nijboer, 2001]. Although a pioneer in zoo nutrition, the Philadelphia Zoological Garden did not hire its first zoo nutritionist until 1984 [Toddes, 2001]. The Wildlife Conservation Society (WCS) began its program in 1986 [Dierenfeld, 2001]. Over the next ten years, these few programs developed both in scope and depth.

The Toronto program moved forward under Dr. Eduardo Valdes, who became director of the program upon Oyarzun's retirement in 1994. The program has since begun to commercialize its diets, and has been instrumental in the development of raw meat diets for cats [Valdes, 2001]. Oftedal established the first zoo laboratory dedicated solely to nutrition research in 1981 at the National Zoo. From modest beginnings, the laboratory advanced to a state-of-the-art facility. It continues to function with the continued work of laboratory technician Michael Jacobasz, and a myriad of interns, graduate students, and post-doctoral students. Oftedal concentrated much research on the investigation of mammalian lactation and milk composition [Oftedal, 2001].

Dr. Mary Allen, Commissary Manager/Nutritionist at Smithsonian's National Zoological Park in 1991, became Clinical Nutritionist in 2000. Allen concentrated her research efforts on reptile nutrition, ultraviolet light and vitamin D. Allen's work helped develop feeding high-calcium diets to insects destined to be reptile food to ensure provision of calcium to these (and other) animals [Allen, 2001]

Brookfield Zoo's nutrition program began with diet formulation by Mary Allen. Dr. Bruce Watkins developed the first diet analysis computer software program available for general zoo use in 1985 during his short tenure as nutritionist there. Dr. Sue Crissey, hired in early 1987, advanced the outreach concept with the first Zoo Nutrition Residency, begun in 1990. Additionally, Zoo Nutrition Network™ was formed to provide at-cost nutrition services to institutions that cannot afford a full-time nutritionist. The department later added two full-time staff nutritionists, Barbara Lintzenich and Kerri Slifka.

In 1989, Joeke Nijboer, who since 1977 had worked with the veterinary laboratory and animal commissary at Rotterdam Zoo, studied nutrition under Dr. E. Voute. In 1998, his work focused completely on nutrition. The Rotterdam program is diverse, including work with langur diets, fish nutrition, vitamin D and ultra-violet light with reptiles, among other projects. The first European Zoo Nutrition Conference was organized by the Rotterdam Zoo and held there in 1999 [Nijboer, 2001].

Barbara Toddes at the Philadelphia Zoological Garden began as a nutrition intern in 1984 and developed her program, and title from Animal Nutrition Intern to Nutrition Program Manager over the next 15 years. She began keeping systematic diet records that included daily animal intake correlated with keeper behavioral observations. It was during her tenure, the use of Zoo Cake was discontinued and replaced by more nutritionally complete and commercially available products [Toddes, 2001].

Since 1986, Dr. Ellen Dierenfeld at Wildlife Conservation Society promoted the value of zoo nutrition in every aspect of captive management and

to zoo animal managers and veterinarians nationwide and in Europe and Latin America. Her work with vitamin E made it clear that nutrition was important to every captive animal's health. The program has supported numerous other nutritionists, full and part-time as well as interns and graduate students [Dierenfeld, 2001].

While the nutrition programs begun in the 1970s and early 1980s continued to improve and expand, it was not until years later that other zoos hired nutritionists. These programs, along with the others, are the nutrition programs of the future and have begun to make major headway with nutrition research, diet formulation, and the feeding of captive exotic animals. More recently added nutrition programs include: Johnson Oba at Dallas Zoo in Texas (1990); Ann Ward at Fort Worth Zoo in Texas (1993) hiring Amy Hunt in 1999 and Mike Maslanka in 2001 and complete with a nutrition laboratory to analyze minerals and vitamins; Jan Dempsey at Saint Louis Zoological Park in Missouri (1994); Dr. Mark Edwards at Zoological Society of San Diego in California (1994) hiring Associate Nutritionists Karen Lisi in 1999, and Dr. Michael Schlegel in 2001 [Dempsey, 2001; Edwards, 2001; Ward, 2001]. Dr. Eduardo Valdez moved from Toronto to establish a zoo nutrition program for Disney's Animal Programs in 2001.

At the Durrell Wildlife Conservation Trust (formerly Jersey Wildlife Preservation Trust), there is no official nutritionist position on staff but, Anna Feistner (employed as the Head of Research since 1990) has promoted systematic collection of feeding data from captive animals and updated the 1986 *Nutritional Handbook* in addition to publishing and presenting a number of successful diets [Feistner, 2001; Fidgett and Feistner, 1997]. Dr. Mauvis Gore, Head of Animal Conservation and Research at the Royal Zoological Society of Scotland began to work in zoo nutrition there in 1998 [Gore, 2001]. A survey taken in 1998 showed that there are about 15 full or half-time zoo nutritionists in Europe. Zoos with dedicated nutrition departments on other continents are unknown [van Wees et al., 1999].

Academics

While there are numerous human and animal nutrition, and wildlife programs, rarely do any of these programs incorporate captive exotic animal nutrition into their studies. Dr. Duane Ullrey, professor emeritus at Michigan State University (MSU), is considered the modern-day mentor of zoo nutrition and zoo nutritionists. Ullrey, on faculty at MSU since 1956, began deer nutrition studies in 1959. The diets developed in this work served as the basis for many of the herbivore diets in use today. In 1968, Ullrey was part of a Detroit Zoo Medical Advisory Team. He extended that experience to other zoos and began consulting work with the San Diego Zoo in the early 1970s. He developed the

first comparative animal nutrition program focused on exotic animals [Ullrey, 2001]. Dr. Nancy Irlbeck at Colorado State University, consulting with the Denver Zoological Gardens since 1992, has begun to develop a program for the study of zoo nutrition [Irlbeck, 2001]. There is a cooperative master's degree program developed by Drs. Robert Bray and Mark Edwards, between the Zoological Society of San Diego and California State Polytechnic University-Pomona that focuses on applied animal nutrition [Edwards, 2001]. A similar program between the Smithsonian's National Zoo and the University of Maryland has been developed by Mary Allen and Dr. Roselina Angel, a faculty member at the College Park, MD campus [Allen, 2001].

Industry

Anderson's Feed Company in Maumee, Ohio, worked with Dr. Ullrey to produce his formulas, making them available to zoos in the late 1970s. Soon to follow was A.J. Higginbottom, as well as some other specialized food producers, who continue to service the zoo community [Ullrey, 2001]. Special Diet Services (SDS) in the United Kingdom developed specific manufactured zoo diets in the late 1970s. In 1988, Purina Mills joined with them, and developed the Mazuri line of zoo animal diets and became a significant player in helping develop, study, and supply diets to zoos [Sadler, 2001].

Software

The first software for formulating zoo animal diets was adapted from human and livestock diet programs. New software packages have recently become available. Zootrition™, is a Windows based software program with comprehensive linked databases of ingredient composition and nutrient requirements, developed by the Wildlife Conservation Society [Dierenfeld, 2001]. Since its development in the 1980s the Zoo Diet Analysis Program™ developed by Dr. David Baer is the original comprehensive software program designed specifically for zoo diet analyses [Baer, 2001].

Consulting

Consulting in zoo nutrition has had a slow beginning. While few zoos have invested in maintaining a dedicated nutrition program led by a nutritionist, some utilize consultants. Dr. Ullrey and his students performed some of the first consulting, branching into Allen and Baer Associates in about 1986. Dr. Dick Patton also began offering zoo nutrition consulting services at about that time and Dr. Howard Frederick, more recently established his zoo nutrition consulting business [Frederick, 2001; Ullrey, 2001]. There are a number of current zoo nutrition programs that also provide consulting services.

Information exchange

The application of sound nutritional information to captive exotic animal diets moved forward with the establishment of the American Zoo and Aquarium Association (AZA) Nutrition Advisory Group (NAG) in 1994. The Lincoln Park Zoological Gardens in Chicago held the Dr. Scholl Conference on the Nutrition of Captive Wild Animals nine times between 1980 and 1991 [Meehan, 2001]. This conference was coordinated primarily under the guidance of then veterinarian Tom Meehan and Mary Allen. In 1995, the first of the biannual NAG Conferences was held in Toronto, Canada. These conferences focus primarily on scientific information geared to the practical applications of captive animal nutrition. The Comparative Nutrition Society (CNS; 1996) was created to foster communication among laboratory and field scientists from various disciplines with interests in comparative nutrition. The Society has convened three symposia [Baer, 2001]. In 1999, the First Biannual Zoo Animal Nutrition Conference of the European Zoo Nutrition Research Group was held.

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