OFFICE OF SPECIAL MASTERS

No. 91-1642V

(Filed: October 30, 1998)

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PAMELA A. GALL and ROBIN R. GALL	*	
as legal representatives of the	*	
estate of KARLEA RAE GALL,	*	
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Petitioners,	*	**TO BE PUBLISHED**
	*	
v.	*	
	*	
SECRETARY OF HEALTH AND	*	
HUMAN SERVICES,	*	
	*	
Respondent.	*	
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* *		

ORDER

The special master *reissues for publication* the decision on entitlement that he entered in this case on October 31, 1996. The decision contains an analysis of the actual causation standard under *Knudsen v. Secretary of HHS*, 35 F.3d 543 (Fed. Cir. 1994) and *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

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John F. Edwards

Special Master

Office of Special Masters

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Respondent.	*	
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* *		

Barbara Ziegler Ashley, Wayzata, Minnesota, for petitioners.

Karen P. Hewitt, United States Department of Justice, Washington, D.C., for respondent.

DECISION ON ENTITLEMENT

EDWARDS, *Special Master.*

Petitioners, Pamela A. Gall and Robin R. Gall (Mrs. Gall and Mr. Gall or the Galls), as legal representatives of the estate of their daughter, Karlea Rae Gall (Karlea), seek compensation under the National Vaccine Injury Compensation Program (Program).[(1)] The Galls allege that Karlea received a diphtheria-pertussis-tetanus (DPT) vaccination and an oral polio vaccine (OPV) on August 8, 1989, which "was directly and causally related to" Karlea's death on December 1, 1989. Petitioners' exhibit (Pet. ex.) 21 at 1-2. The Galls assert: "[T]he vaccine was the triggering event which led to a hemophagocytic process which resulted in neutropenia which then predisposed Karlea to an invasive and fatal fungal infection." Pet. ex. 21 at 2. The Galls recognize that they must prove "that Karlea's death

was caused in fact by her vaccine, not that [Karlea] represents a Table injury." Pet. ex 21 at 4.

Respondent denies that the Galls are entitled to Program compensation. Respondent maintains that there is no medical or scientific basis for the Galls' claim. *See* Respondent's Prehearing Memorandum, Witness and Exhibit List (R's Memo), filed September 19, 1994, at 2. Thus, respondent contends that the Galls' claim "amounts to merely a hypothesis." R's Memo at 2-3.

The special master convened a hearing. Ralph S. Shapiro, M.D. (Dr. Shapiro), one of Karlea's treating physicians, testified for the Galls. James B. Nachman, M.D. (Dr. Nachman), testified for respondent.

THE STATUTORY SCHEME

The same legal principles for actual causation that apply in traditional tort litigation apply in Program cases. The petitioner's burden is "heavy." *Whitecotton v. Secretary of HHS*, Nos. 92-5083, 93-5101, slip op. at 5 (Fed. Cir. Apr. 16, 1996). The mere temporal relationship between a vaccination and an injury is patently insufficient to prove actual causation. *Grant v. Secretary of HHS*, 956 F.2d 1148 (Fed. Cir. 1992). Instead, a petitioner must establish "a logical sequence of cause and effect showing that the vaccine was the reason for the injury." *Id.* A petitioner must support the logical sequence of cause and effect with a "sound and reliable medical or scientific explanation." *Knudsen v. Secretary of HHS*, 35 F.3d 543, 548 (Fed. Cir. 1994), *citing Jay v. Secretary of HHS*, 998 F.2d 979, 984 (Fed. Cir. 1993). "The analysis undergirding" the medical or scientific explanation must "fall within the range of accepted standards governing" medical or scientific research. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 43 F.3d 1311, 1316 (9th Cir. 1995).

According to the United States Court of Appeals for the Federal Circuit, special masters neither "`diagnos[e]' vaccine-related injuries" nor determine "how and why DTP and other vaccines sometimes destroy the health and lives of certain children." *Knudsen*, 35 F.3d at 549. Rather, special masters ascertain only "whether a sequence of cause and effect is `logical' and legally probable, not medically or scientifically certain." *Knudsen*, 35 F.3d at 548-549, *citing Bunting v. Secretary of HHS*, 931 F.2d 867, 873 (Fed. Cir. 1991). Thus, the causation inquiry is "based on the circumstances of the particular case, having no hard and fast *per se* scientific or medical rules." *Knudsen*, 35 F.3d at 548. Indeed, a "detailed medical and scientific exposition on the biological mechanisms" of an injury is not necessary. *Knudsen*, 35 F.3d at 549.

A petitioner must prove each element of the *prima facie* case by the preponderance of the evidence. § 300aa-13(a). The preponderance of the evidence standard requires the special master to believe that the factual predicates of a claim are more likely than not. *Conley v. Secretary of HHS*, No. 91-1050V, slip op. at n.4 (Cl. Ct. Spec. Mstr. May 26, 1992); *see also, In re Winship*, 397 U.S. 358, 372-73 (1970) (Harlan, J., concurring), *quoting* F. James, Civil Procedure 250-51 (1965). The United States Court of Federal Claims has characterized the standard as "very hospitable." *McClendon v. Secretary of HHS*, 24 Cl.Ct. 329, 333 (1991). According to the Court of Federal Claims, a petitioner's "proof needs only to `tip the scale' by the slightest of evidentiary margins." *Id.* However, mere conjecture or speculation will not meet the preponderance of evidence standard. *Snowbank Enter. v. United States*, 6 Cl. Ct. 476, 486 (1984); *Centmehaiey v. Secretary of HHS*, 32 Fed. Cl. 612 (1995), *aff'd*, 73 F.3d 381 (1995).

FACTS

Karlea was born on April 14, 1989, at the St. Alexius Medical Center in Bismarck, North Dakota. Pet. ex. 1 at 1. Karlea weighed six pounds, 11 ounces. Pet. ex. 4 at 3. Karlea's "[d]elivery was slightly difficult." *Id.* At birth, Karlea "was cyanotic and congested." *Id.* Karlea required "neonatal resuscitation with oxygen mask and bagging for about two or three minutes." Pet. ex. 4 at 8. Karlea experienced "irregular respirations" at approximately 6:00 p.m. on April 14, 1989. *Id.* Karlea transferred to the intensive care nursery. Pet. ex. 4 at 10. Karlea remained in the hospital until April 20, 1989. Pet. ex. 4 at 6. Karlea's discharge diagnosis included "[r]espiratory distress due to aspiration" and "[g] astroesophageal reflux." *Id.*

Karlea underwent several physical examinations at the Mid Dakota Clinic in Bismarck, North Dakota, after her discharge from the St. Alexius Medical Center. *See generally* Pet. ex. 5. Except for "congestion" and "cough" on May 24, 1989, Karlea appeared to be healthy and to develop normally. Pet. ex. 5 at 1, 9. Karlea received her first DPT/OPV vaccinations on June 5, 1989. *Id.* Karlea experienced "[n]o problem with shots." Pet. ex. 5 at 10; *see also* Pet. ex. 5 at 134. Karlea received her second DPT/OPV vaccinations on August 8, 1989. Pet. ex. 5 at 2.

Karlea returned to the Mid Dakota Clinic on August 10, 1989. Pet. ex. 5 at 11. She presented "for evaluation of fever." *Id.* Mrs. Gall reported apparently that Karlea had exhibited a temperature that ranged between 100 Fahrenheit and 101 Fahrenheit beginning on August 9, 1989. *Id.* Karlea's physician, John Erickstad, M.D. (Dr. Erickstad), suspected a urinary tract infection. *Id.* Dr. Erickstad recommended fluids and "observation." *Id.*

On August 11, 1989, Dr. Erickstad monitored Karlea for fluctuating fever. *See* Pet. ex. 5 at 11-12. Karlea became increasingly irritable and lethargic, prompting admission into St. Alexius Medical Center. Pet. ex. 5 at 180, 203. A consulting physician "suggested the possibility of leukemia and advised bone marrow" biopsy. Pet. ex. 5 at 178. The "preliminary report" indicated a negative result for leukemia. *Id.* Karlea's fever remained "unresponsive to medications." Pet. ex. 5 at 183. Karlea developed "a severe hepatosplenomegaly," as well as "thrombocytopenia and anemia." *Id.*; *see also* Pet. ex. 5 at 195. Karlea's white blood counts continued to increase. Pet. ex. 5 at 179. Karlea transferred by "fixed wing aircraft" to Minneapolis Children's Medical Center on August 15, 1989, with a diagnosis of "[h] epatosplenomegaly with resultant hepatic dysfunction and possibly early disseminated intravascular coagulopathy, ascites, bilateral pleural effusion." *Id.*; *see also* Pet. ex. 5 at 184-186.

Upon admission to Minneapolis Children's Medical Center, Karlea was "pale" and "paralyzed" from intubation. Pet. ex. 9 at 2. Karlea's "[a]bdomen showed marked hepatosplenomegaly." *Id.* Karlea's condition worsened "initially." *Id.* Karlea's "immunologic studies were sent to the University of Minnesota and Dr. Shapiro consulted." Pet. ex. 9 at 3. When Dr. Shapiro examined Karlea on August 24, 1989, he noted that he had been "[a]sked to see this young child with very unusual response to second DPT and OPV." Pet. ex. 9 at 60. Dr. Shapiro considered Karlea's history to be "[consistent with] an exaggerated lymphocytic reaction to immunization." *Id.* Dr. Shapiro agreed "with diagnosis of a `VAHS'[-]like [virus-associated hemophagocytic syndrome]" process. *Id.* Dr. Shapiro cautioned against reducing Karlea's medications "too soon." *Id.* Dr. Shapiro commented that "[t]hese processes can wane only to come roaring back." *Id.*

Karlea remained in the Minneapolis Children's Medical Center until August 31, 1989. Pet. ex. 9 at 2. Upon discharge, Karlea's hepatosplenomegaly was "improved." *Id.* Karlea's herpes titer, CMV titer and TORCH titer were negative, "except for a EBV. . . which was felt to be transfusion related, as well as a hepatitis A, IgG elevated but not IgM." Pet. ex. 9 at 3. The Galls received instructions to follow-up with Dr. Erickstad and with Dr. Shapiro and to observe Karlea carefully. *Id.*

By September 4, 1989, Karlea exhibited again "severe hepatosplenomegaly." Pet. ex. 8 at 118. Karlea entered St. Alexius Medical Center. Pet. ex. 8 at 121. Karlea transferred to the University of Minnesota Hospital Pediatric Immunology Service during the early morning hours of September 5, 1989. Pet. ex. 10 at 11. Karlea's principal diagnosis was "Familial Erythrophagocytic Lymphohistiocytosis (FEL) vs. VAHS." Pet. ex. 10 at 4. Karlea remained at the University of Minnesota Hospital until her death on December 1, 1989. *See* Pet. ex. 10 at 1. Karlea's voluminous medical records document Karlea's complicated course--including bone marrow transplant--at the University of Minnesota Hospital.

The University of Minnesota College of Medicine Department of Laboratory Medicine and Pathology performed an autopsy on Karlea. *See* Pet. ex. 5 at 129-142. The autopsy contained an overview of Karlea's history of "lymphohistiocytic proliferative syndrome with erythrophagocytosis." Pet. ex. 5 at 130. The autopsy prosecutor concluded that Karlea's "cause of death was overwhelming disseminated Aspergillosis, leading to diffuse alveolar damage and pulmonary infarction, as well as generalized CNS damage." Pet. ex. 5 at 133.

THE TESTIMONY

Dr. Shapiro

Dr. Shapiro received his medical degree from the University of Minnesota in 1981. Transcript (Tr.), filed February 27, 1995, at 10. After completing a pediatric internship and his residency, Dr. Shapiro accepted a fellowship in pediatric hematology and oncology at the University of Minnesota. *Id.* Dr. Shapiro serves as an assistant professor at the University of Minnesota Department of Pediatrics "in the division of pediatric immunology and bone marrow transplantation." Tr. at 10-11. Dr. Shapiro was instrumental in establishing the division of pediatric immunology. Tr. at 11. Dr. Shapiro is board-certified in pediatrics and in pediatric hematology and oncology. Tr. at 10.

In his clinical practice, Dr. Shapiro treats children who present with "a variety of hematologic disorders that are immune[-]based" or who present with "complications of immune deficiency, such as lymphomas that develop secondary to viral infections and in patients that are on immune-suppressive drugs." Tr. at 12. Dr. Shapiro conducts also research. Tr. at 11. Dr. Shapiro has "a very strong interest in hemophagocytic disorders," such as the disorder from which Karlea suffered. Tr. at 12. In fact, Dr. Shapiro wrote a chapter in an immunologic textbook "summarizing the current state of" hemophagocytic lymphohistiocytosis (HLH). Tr. at 14. Dr. Shapiro has "lectured numerous times at various international meetings on" HLH. Tr. at 15. Moreover, Dr. Shapiro has participated in "pioneer[ing]" the "unrelated-donor bone marrow transplant" procedure, "the only cure for" a congenital type of hemophagocytic disorder in "children without a sibling as a donor." Tr. at 16.

According to Dr. Shapiro, the Minneapolis Children's Medical Center enlisted him as a consultant on Karlea's case "when [Karlea's physicians at Minneapolis Children's Medical Center] suspected that [Karlea] had" HLH. Tr. at 17, 18. Dr. Shapiro stated that he and his colleague, Alexandra Filipovich, M.D. (Dr. Filipovich), then became Karlea's primary attending physicians during Karlea's hospitalization from September 1989 to December 1989 at the University of Minnesota. Tr. at 17. Dr. Shapiro testified that while he was treating Karlea, he "made an association" between Karlea's DPT/OPV vaccinations and Karlea's condition. Tr. at 27. Dr. Shapiro offered that Karlea's course "was very consistent with a trigger such as a vaccination." *Id.* Thus, Dr. Shapiro opined to a reasonable degree of medical certainty that Karlea's DPT/OPV vaccinations caused the onset of Karlea's HLH. *Id.* Dr. Shapiro explained his conclusion.

Dr. Shapiro discussed first HLH in layman's terms. Dr. Shapiro labeled HLH as "a bizarre, rare syndrome." Tr. at 22. He remarked that HLH has "been described pathologically for a number of years." *Id.* Dr. Shapiro indicated that the disorder requires either an "immune suppression or an immune defect." Tr. at 25; *see also* Tr. at 24. He said that the syndrome is "an immune response that gets turned on[,] that does not shut off, and cells are activated to destroy other cells." *Id.* Dr. Shapiro stated that people who manifest the disorder "develop a fever, and they get big livers and spleens, they have seizures, and then progressively go downhill and will die." *Id.*

Dr. Shapiro related that there are two general forms of HLH. Tr. at 24-25, 46. According to Dr. Shapiro, the primary form is genetic--an inherited "immune deficiency of some kind," Tr. at 44--known as familial hemophagocytic lymphohistiocytosis (FHL). Tr. at 25, 46. Dr. Shapiro said that FHL "usually happens in young children." Tr. at 24. Dr. Shapiro placed "[t]he median age [for FHL]" at age "two months," Tr. at 24, although he noted that the disorder "can happen as late as six or seven years." Tr. at 25. Dr. Shapiro stated that FHL is often distinguished by the "difficulty" of "finding hemophagocytic histiocytes early on." Tr. at 25; *see also* Tr. at 50. Dr. Shapiro identified the secondary form as virus-associated or infection-associated hemophagocytic syndrome (IAHS), Tr. at 46, which occurs with "the suppression of the immune system," Tr. at 44, usually as a result of medications. Tr. at 24.

Dr. Shapiro discussed next the effect of vaccines. Dr. Shapiro stated that vaccines are "designed" to provoke an immune response. Tr. at 29. Indeed, Dr. Shapiro testified that he administers regularly vaccinations in his practice "as a challenge" to children who exhibit a suspected immune-deficiency because they have not developed antibodies against previous vaccinations. *See* Tr. at 15. Dr. Shapiro said that a vaccine causes the body to "make a much more vigorous response" when the body is exposed to "the real toxin" or virus. Tr. at 29; *see also* Tr. at 63.

Dr. Shapiro discussed then his theory regarding the interplay between vaccination and HLH. According to Dr. Shapiro, the immune response to a vaccine involves T-cell activation. Tr. at 30, 61. Dr. Shapiro asserted that "the pathophysiology" of HLH includes "a lot of evidence for T-cell activation." Tr. at 28; *see also* Tr. at 60-61. Dr. Shapiro stated that "when the T-cells get turned on [in the HLH syndrome], they don't have whatever it takes to turn off. And then [the syndrome] progresses from there." Tr. at 29. Therefore, Dr. Shapiro linked the expected immune reaction from vaccination to the onset of HLH. *See, e.g.*, Tr. at 27, 58, 60. Dr. Shapiro maintained that there are numerous "anecdotal reports" in medical literature of "atypical" immune responses following vaccination to support the basis of his theory. Tr. at 28; *see also* Tr. at 30-31.

Dr. Shapiro discussed finally his experience with Karlea. Dr. Shapiro depicted Karlea as "critically ill" upon admission to the Minneapolis Children's Medical Center on August 15, 1989. Tr. at 38. Dr. Shapiro related that Karlea's blood counts which revealed "predominantly activated T-cells" showed that Karlea's "rapidly progressive process" was "some sort of an exaggerated expansion or response to something." Tr. at 40; *see also* Tr. at 61. Dr. Shapiro recounted that Karlea's preliminary differential diagnosis was "an overwhelming viral illness versus a hemophagocytic syndrome." Tr. at 21. Dr. Shapiro stated that "after all the cultures and all of the studies came back, and looking at the biopsies and everything," he decided ultimately that Karlea exhibited a hemophagocytic syndrome that was "driven by" FHL. Tr. at 21; *see also* Tr. at 25.

Dr. Shapiro said that he evaluated "extensively" Karlea for "any viral insult that triggered her disease." Tr. at 34. Dr. Shapiro was confident that he eliminated identifiable infectious causes for Karlea's condition. Dr. Shapiro discredited a history that Karlea had been exposed to a virus in her community. Tr. at 53. Dr. Shapiro recalled that he "never cultured a virus" from Karlea, much less any "respiratory virus" which, Dr. Shapiro maintained, he should have been able to culture "pretty easily." Tr. at 53; *see also* Tr. at 42, 62. Dr. Shapiro relied also upon Karlea's autopsy report which did not disclose "any old

plaques or lesions that were consistent with a congenital viral illness." Tr. at 34. In addition, Dr. Shapiro claimed that changes in Karlea's retinal microvascular on an ophthalmological examination were consistent with lesions that result from "histiocytes that infiltrate along the optic nerve," rather than with lesions that result from "one of the common congenital viral infections," because Karlea exhibited "negative TORCH titers prior to blood transfusion." Tr. at 41-42, *see also* Tr. at 55. Thus, Dr. Shapiro declared that he "feels so strong" that Karlea's vaccination is the "very likely event" that generated the "amplification" of Karlea's immune response. Tr. at 62; *see also* Tr. at 71. Indeed, Dr. Shapiro asserted that Karlea is to him "one of the clearest cases" in which he has been able to identify a "triggering event" for the onset of a hemophagocytic process. Tr. at 65, 66; *see also* Tr. at 35, 71-72.

Dr. Shapiro expressed that "it's not surprising" that medical literature does not report the phenomenon of a vaccine-triggered onset of FHL. Tr. at 35. Dr. Shapiro maintained

that "the literature is pretty small with this disease." *Id.*; *see also* Tr. at 64. Indeed, Dr. Shapiro claimed that he has "a larger experience [with FHL] than anybody in North America." Tr. at 65. Yet, Dr. Shapiro estimated that he has "probably seen about thirty patients with this disease." Tr. at 64. Nonetheless, Dr. Shapiro mentioned as an aside that his colleagues at the University of Minnesota and his associates in the Histiocyte Society appear to agree with the proposition that a vaccine may trigger FHL. Tr. at 33-35.

In addition, Dr. Shapiro is not concerned that Karlea did not experience the onset of her FHL after her first DPT/OPV vaccinations. According to Dr. Shapiro, physicians administer a series of vaccinations in order "to amplify the response." Tr. at 63. Dr. Shapiro offered that Karlea's "degree of response [to Karlea's first DPT/OPV vaccinations] may not have been adequate" to prompt Karlea's FHL. *Id.*

Further, Dr. Shapiro implied that he did not believe that Karlea recovered from her disease while she was hospitalized in August 1989. Dr. Shapiro stated that Karlea's "disease never really quieted down completely." Tr. at 49. Dr. Shapiro remarked that Karlea's attending physician at Minneapolis Children's Medical Center decided that Karlea had improved enough to be discharged on August 31, 1989. *Id.* Dr. Shapiro stressed that he did not make the decision to discharge Karlea. *Id.*

Dr. Shapiro attributed "directly" Karlea's death to the progression of Karlea's FHL. Tr. at 36. Dr. Shapiro said that "the phagocytic process destroys the bone marrow and the bone marrow cells," as well as "neutrophils, which are important for protecting" against "various fungal infections." Tr. at 35. Dr. Shapiro stated that Karlea "had prolonged neutropenia and developed a bad fungal infection which was deep-seated." *Id.* Dr. Shapiro indicated that the fungal infection "was able to survive" in Karlea "because she did not have the ability to respond to it." *Id.*

Dr. Nachman

Dr. Nachman received his medical degree from Johns Hopkins University. Tr. at 75. He completed his residency training and a fellowship at Children's Memorial Hospital in Chicago, Illinois. *Id.* Dr. Nachman served one year as chief resident in pediatrics at Wyler Children's Hospital at the University of Chicago Medical Center in Chicago, Illinois, before joining the oncology staff at the hospital. *Id.* He is currently the director of the clinical oncology program at Wyler Children's Hospital. Tr. at 74. Dr. Nachman is board-certified in pediatrics and in pediatric hematology and oncology. Tr. at 75.

Dr. Nachman has "seen a number of HLH cases in [his] practice over twenty years." Tr. at 75. Based

upon his experience and upon his review of Karlea's medical records, Dr. Nachman concurred with Dr. Shapiro's diagnosis that Karlea suffered "clearly" FHL, which Dr. Nachman defined as "some predisposition to develop HLH upon exposure to some infecting agent." Tr. at 80; *see also* Tr. at 84, 107. However, Dr. Nachman disputed Dr. Shapiro's theory that Karlea's DPT/OPV vaccinations initiated Karlea's FHL. *See* Tr. at 84.

Dr. Nachman stated that "in all probability" HLH is triggered by an immune response. Tr. at 104. In addition, Dr. Nachman acknowledged that "there is no question" that vaccines are designed to stimulate a general immune response within the body. Tr. at 102; *see also* Tr. at 104, 111. Further, Dr. Nachman stated that "it's likely that" Karlea "had some type of an immune response" to her DPT/OPV vaccinations. Tr. at 111. Nonetheless, Dr. Nachman asserted that "there is nothing in the medical literature that suggests" that "a hemophagocytic syndrome follows DPT and OPV." Tr. at 112; *see also* Tr. at 86, 109. Thus, while Dr. Nachman stated that it is possible--in the sense that "almost anything is possible," Tr. at 109--that Karlea's DPT/OPV vaccinations spurred Karlea's FHL, he maintained that "it is not medically probable at all, and very, very unlikely that the DPT actually triggered" Karlea's FHL. *Id.*; *see also* Tr. at 106, 109.

Dr. Nachman challenged also Dr. Shapiro's interpretation of information in Karlea's medical history. Based upon "all kinds of methodologic [sic] difficulties," Dr. Nachman discounted the significance of Dr. Shapiro's inability to culture any virus that may have contributed to Karlea's illness. Tr. at 79. Further, Dr. Nachman considered "compelling" a reference in Karlea's medical records that Karlea had been exposed to a virus in her community. Tr. at 94. In addition, Dr. Nachman considered "compelling" an "ophthalmologic finding, which strongly suggests" that Karlea "had had some kind of prior infection." *Id.* Therefore, Dr. Nachman assessed essentially Dr. Shapiro's opinion as "basically all speculation." Tr. at 82.

Dr. Nachman confirmed that Karlea's death from infection with aspergillus was "certainly associated with immunodeficiency" and "associated with" Karlea's FHL. Tr. at 113.

DISCUSSION

There is no dispute that Karlea died as a pathological consequence of her FHL. *See* Tr. at 35-36, 113. Dr. Shapiro believes that Karlea's August 8, 1989 DPT/OPV vaccinations provoked Karlea's FHL. Dr. Nachman insists that Dr. Shapiro's opinion is unfounded. Dr. Nachman counters that it is far more likely that a virus or a previous infection sparked Karlea's FHL.

In the special master's view, the resolution of the case depends upon the weight that the special master accords to each expert's testimony. After careful consideration, the special master determines that Dr. Shapiro was a solid, impressive witness.[(2)] Dr. Shapiro's testimony was superior in every aspect to Dr. Nachman's testimony. Dr. Shapiro presented a simple, coherent and rational theory about the relationship between Karlea's DPT/OPV vaccinations and Karlea's condition. In addition, Dr. Shapiro defended his theory by responding well to potential weaknesses raised by Dr. Nachman. For instance, Dr. Shapiro persuaded the special master that a viral agent did not cause the onset of Karlea's condition. Further, Dr. Shapiro persuaded the special master that Karlea's condition had not resolved by the time of Karlea's discharge from the Minneapolis Children's Medical Center on August 31, 1989, and that Karlea's hospitalization at the University of Minnesota on September 5, 1989, represented merely a continuation of the FHL process that began in response to Karlea's DPT/OPV vaccinations. Finally, Dr. Shapiro persuaded the special master that the fact that Karlea did not react to her first DPT/OPV

vaccinations was not significant.

The special master recognizes that even Dr. Shapiro concedes that there is not direct epidemiological evidence that supports his theory. *See* Tr. at 35. However, it appears that the lack of epidemiological evidence is not necessarily fatal to an expert's conclusion. *See, e.g., Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993)(District court erred in concluding that expert opinion which is not based on epidemiological evidence is not admissible to establish causation). Rather, to be probative, an expert's theory must rest only upon a "reliable foundation." *Daubert*, 509 U.S. at 597. In this case, Dr. Shapiro applied generally-accepted medical knowledge about vaccines and their purposes; generally-accepted medical knowledge about FHL; and his experience as a leading expert in FHL to support a novel theory regarding the effect of vaccines upon a child who has FHL. Dr. Shapiro's theory has not yet been tested formally within the medical community by being subjected to peer review and publication. However, Dr. Shapiro offered that the reason there is a lack of literature on his theory is that general knowledge about FHL is just now evolving. Tr. at 35. As the Supreme Court acknowledged in *Daubert*, "in some instances well-grounded but innovative theories will not have been published. . . Some propositions, moreover, are too particular, too new, or of too limited interest to be published." *Daubert*, 509 U.S. at 593. Therefore, the special master rules that Dr. Shapiro's theory is nonetheless legally probable.

Moreover, Dr. Shapiro was not a professional witness who was attempting to reanalyze or to refute published studies that undermine the Galls' claim. *Compare Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 43 F.3d 1311 (9th Cir. 1995). In addition, Dr. Shapiro did not formulate his opinion merely for litigation. Rather, Dr. Shapiro appeared as a treating physician to explain his expert medical conclusion regarding the "sequence of cause and effect" that culminated in Karlea's death. Indeed, it is absolutely clear from Dr. Shapiro's initial consultation record that Dr. Shapiro has *always* believed that Karlea's vaccinations were responsible for the onset of Karlea's hemophagocytic condition. *See* Pet. ex. 9 at 60. Thus, based upon Dr. Shapiro's overwhelmingly credible expert testimony, the special master is convinced that Karlea's DPT/OPV vaccinations caused the manifestation of Karlea's FHL.

CONCLUSION

The Galls have established by the preponderance of the evidence that Karlea's August 8, 1989 DPT/OPV vaccinations induced Karlea's FHL response leading to Karlea's death. There is not a preponderance of the evidence that Karlea's FHL response leading to Karlea's death was caused by factors unrelated to Karlea's DPT/OPV vaccinations. Therefore, the special master determines that the Galls are entitled to Program compensation. In the absence of a motion for review filed under RCFC Appendix J, the clerk of court shall enter judgment in the Galls' favor for $250,000.00.

The special master's secretary shall provide a courtesy copy of this decision to the parties by facsimile.

_____

John F. Edwards

Special Master

1. [1] The statutory provisions governing the Vaccine Program are found in 42 U.S.C.A. §§ 300aa-1 *et. seq.* (West Supp. 1996). For convenience, further reference will be to the relevant section of 42 U.S.C.A.

2. [2] The special master discussed his assessment of Dr. Shapiro's testimony and Dr. Nachman's testimony with the parties at an oral argument. The special master incorporates by reference the substance of the special master's remarks from the bench into this decision on entitlement. *See* Transcript, filed July 7, 1995 at 39-48.