In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS
No. 16-1070V
(To be published)

CATHY DESHLER, Petitioner, v. SECRETARY OF HEALTH AND HUMAN SERVICES, Respondent.	Chief Special Master Corcoran Dated: July 1, 2020 Guillain-Barré syndrome; Pneumococcal vaccine; *Althen* Prong One; *Althen* Prong Two

Amy A. Senerth, Muller Brazil, LLP, Dresher, PA, for Petitioner.

Colleen C. Hartley, U.S. Dep't of Justice, Washington, DC, for Respondent.

ENTITLEMENT DECISION[1]

On August 26, 2016, Cathy Deshler filed a petition seeking compensation under the National Vaccine Injury Compensation Program ("Vaccine Program").[2] Petitioner alleged that she suffered from Guillain-Barré syndrome ("GBS") as a result of receiving the pneumococcal conjugate vaccine on May 13, 2015. Petition ("Pet.") (ECF No. 2) at 1. An entitlement hearing in the matter was held October 1-2, 2019.

After review of the record and all submissions, I deny an entitlement award in this case.

[1] This Decision will be posted on the Court of Federal Claims' website in accordance with the E-Government Act of 2002, 44 U.S.C. § 3501 (2012)). **This means that the Decision will be available to anyone with access to the internet.** As provided by 42 U.S.C. § 300aa-12(d)(4)(B), however, the parties may object to the Decision's inclusion of certain kinds of confidential information. Specifically, under Vaccine Rule 18(b), each party has fourteen days within which to request redaction "of any information furnished by that party: (1) that is a trade secret or commercial or financial in substance and is privileged or confidential; or (2) that includes medical files or similar files, the disclosure of which would constitute a clearly unwarranted invasion of privacy." Vaccine Rule 18(b). Otherwise, the whole Decision will be available to the public. *Id*.

[2] The Vaccine Program comprises Part 2 of the National Childhood Vaccine Injury Act of 1986, Pub. L. No. 99-660, 100 Stat. 3758, codified as amended at 42 U.S.C. §§ 300aa-10 through 34 (2012) [hereinafter "Vaccine Act" or "the Act"]. Individual section references hereafter will be to § 300aa of the Act (but will omit that statutory prefix).

As discussed in greater detail below, the record does not permit the conclusion that the pneumococcal vaccine *can* cause GBS, or that it did so in this case.

I. Factual Background

Prior Medical History and Receipt of Pneumococcal Vaccine

Ms. Deshler's pre-vaccination medical history included depression, anxiety, gastroesophageal reflux ("GERD"), osteoarthritis, allergic rhinitis, diaphragmatic hernia, metabolic syndrome, diabetes mellitus (type 2), hyperlipidemia, fibroid tumors, diverticulosis of colon, and (most significantly for present purposes) breast cancer with radiation therapy. Ex. 1 at 2–3; Ex. 2 at 69, 185. She also had undergone some surgical procedures—a lumpectomy (right), hysterectomy, and back operation. Ex. 1 at 3. Ms. Deshler's prediabetic condition in particular caused her to experience neuropathic symptoms, for which she was prescribed gabapentin and metformin. Tr. at 91–92, 101.

On May 13, 2015, Petitioner (then fifty-nine years old) saw her primary care physician, Dr. Stephen Wood, at Foothill Family Clinic in Salt Lake City, Utah, for a routine medical examination. Ex. 1 at 1–8, 119–24, 174–77. Dr. Wood observed a new lump in Ms. Deshler's left breast, which was very suspicious for breast cancer given her past history of cancer on the right-side, and he therefore ordered some diagnostic testing. *Id*. at 1. Tests performed that day revealed borderline elevated blood pressure, metabolic syndrome, and a fatty liver. *Id*. In connection with her well-visit, Petitioner was administered the "Prevnar-13" formulation[3] of the pneumococcal vaccine. *Id*. at 7. The record identifies no immediate reaction to the receipt of this vaccine.

Post-Vaccination Health and Onset of Neurologic Symptoms

In the weeks immediately after the vaccination at issue, Petitioner received additional medical treatment, but not for neurologic issues. Within a month's time, however, she began to more regularly report symptoms relevant to her claim—although their presentation was erratic and interspersed among a series of ER visits that did not shed much light on the true nature of her complaints.

The day after receiving the pneumococcal vaccine (May 14, 2015), Ms. Deshler sought an evaluation for gradual perceived hearing loss with Rocky Mountain Hearing and Balance. Ex. 2 at 293. She specifically reported that she had experienced some "occasional general dizziness" when bending over in the morning, but her evaluation revealed mostly normal results, and although

[3] Prevnar-13 is the trade name for the pneumococcal 13-valent conjugate vaccine. Prevnar-13 Package Insert, filed as Ex. C-3 on July 31, 2018 (ECF No. 27-4). It is composed of a sterile suspension of saccharides taken from antigens of thirteen strains of the *streptococcus pneumoniae* ("*S. pneumoniae*") bacteria, conjugated to a non-toxic, genetically-modified variant of the diphtheria toxin to promote the vaccine's immunogenicity. *Id.*; Tr. at 20.

follow-up was proposed she ultimately opted to not seek additional treatment. *Id*. At the end of May, and at Dr. Wood's prior direction, Petitioner obtained a mammogram and ultrasound of her left breast at St. Mark's Hospital in Salt Lake City. *See* Ex. 4 at 2501–02. There were no significant changes noted on the mammogram when compared to prior studies, although the ultrasound reflected an irregular solid mass, and a biopsy was accordingly recommended. *Id.*

On June 2, 2015 (twenty days after the subject vaccination), Ms. Deshler returned to Dr. Wood's office, reporting (for the first time in the medical record) a new complaint: numbness. Ex. 2 at 34–36, 114–18, 171–73. She described the onset as "acute," and reported a feeling of constant numbness in her right hand and in both feet. *Id*. at 34. After a physical examination, Dr. Wood proposed that Petitioner's right-hand numbness was likely thoracic outlet syndrome.[4] *Id*. Dr. Wood also observed that Petitioner's foot numbness appeared to be worse in her right foot, and proposed that the "stocking like" distribution was consistent with a diabetic neuropathy. *Id*. Otherwise, Dr. Wood's primary concern at this point remained the new breast lump recently discovered, but he prescribed medication (Lyrica[5], a pregabalin) for Petitioner's nerve-related symptoms. *Id.* That same day, Ms. Deshler underwent a breast biopsy that was positive for a malignant ductal carcinoma. Ex. 4 at 2517–18. Approximately a week later, however, she also received a brain MRI that was normal and did not evidence metastatic disease. Ex. 4 at 2539–40.

On June 10, 2015, Petitioner went to the St. Mark's Hospital emergency room reporting a four-day history of posterior chest pain. Ex. 4 at 2357. It was noted that Ms. Deshler had been prescribed medication for her numbness, and the neurological exam she received was normal. *Id*. at 2359. Petitioner was diagnosed with chest pain and elevated blood pressure, and she was advised to follow-up with her primary care physician. *Id*. at 2362. She did so the next day, returning to Dr. Wood on June 11, 2015 and informing him of her chest pain, which she noted had begun in her back and radiated to her abdomen and chest, but which was alleviated with heat. Ex. 2 at 28–33, 107–12, 168–70. Dr. Wood noted that the immediately-prior ER visit had not discerned anything concerning on exam, however, and opined that Ms. Deshler's pain might have been triggered by shingles or a pinched nerve. *Id*. at 28. He therefore instructed Petitioner to take an anti-inflammatory and a muscle relaxant, in addition to applying heat to affected areas as she had before. *Id.*

On June 12, 2015, Petitioner returned to the St. Mark's ER and complained of right-sided abdominal pain. Ex. 4 at 2409. The ER physician, however, noted that her labs were unrevealing, and that other immediate testing revealed no acute findings. *Id*. at 2415. During her time at the ER, Petitioner reported improvement, and she was prescribed pain and anti-nausea medication. *Id*. As

[4] Thoracic Outlet syndrome results from arterial and/or nerve compression leading to ischemia, paresthesia, numbness, and weakness of the arms and hands. It can also result in pain and sensory disturbances in the upper extremities. *Dorland's Illustrated Medical Dictionary* 1850 (33d ed. 2020) (hereinafter *Dorland's*).

[5] Lyrical, https://www.lyrica.com/ (last visited June 15, 2020).

before, Ms. Deshler again saw Dr. Wood after her ER visit on June 15, 2015. Ex. 2 at 22–27, 100–06, 165–67. She complained of a one-week history of bilateral acute numbness in her hands and feet, adding that she found it difficult to walk or stand. *Id*. at 22. Her neurological examination was positive for stocking and glove hypoesthesia. *Id*. Dr. Wood proposed that Ms. Deshler likely had a "neurological deficit" that could reflect a paraneoplastic neuropathy[6] attributable to her breast cancer, and he ordered diagnostic studies of her neck and thoracic spine to rule out metastatic lesions and/or other explanations for her symptoms, as well as a neurology consultation. *Id.*

Then (and before the diagnostic studies and neurology consultation could be completed), Ms. Deshler went a third time to the St. Mark's ER on June 18, 2016, complaining of abdominal pain, constipation, and right wrist and hand pain, and adding that she had fallen the day before—an event she attributed to the weakness she was experiencing. Ex. 4 at 2273–74; Ex. 3 at 7. No neurological deficits were noted, and imaging confirmed a right distal radius fracture and fracture of the ulnar styloid (causing the treating physician to urge that Petitioner contact a hand specialist). *Id*. at 2284, 2287. The treater also observed that a recent CT scan of her abdomen had produced negative results, leading the treater to propose that Petitioner's pain was merely secondary to constipation from pain medication she was taking. *Id*. at 2286.

Five days later, on June 23, 2015, Ms. Deshler underwent diagnostic imaging of her cervical spine and thoracic spine for further investigation of her bilateral upper extremity numbness and weakness, but the results were largely deemed unremarkable. *See* Ex. 2 at 298–301. She returned thereafter to Dr. Wood with complaints of abdominal pain coupled with bloating and dizziness. *Id.* at 16–21, 91–98, 162–64. She did at this time reveal some decreased sensation in her lower extremities. *Id*. at 21. Dr. Wood gave her medication to relieve her abdominal pain, and noted that she was scheduled for an upcoming mastectomy with sentinel node biopsy. *Id.* at 16.

Medical Procedures and Proposed GBS Diagnosis

On June 29, 2015, Ms. Deshler was admitted to St. Mark's Hospital for a bilateral mastectomy with reconstruction. Ex. 4 at 2150–51. It was noted in the admission records that over the prior two weeks Petitioner had developed some neurological symptoms that made it difficult for her to stand and hold her weight, and that had also likely caused her to fall and injure her right arm. *Id*. at 2178. She also reported weakness and paralysis on the left side of her face. *Id*. In fact, before her planned surgery she displayed additional numbness and weakness in her extremities, and the anesthesiologist noted sagging or drooping of her left lip. *Id*. at 2048. Because of the above, her procedure was limited to a left mastectomy with a sentinel node biopsy, which proved negative for cancer. Ex. 2 at 246.

[6] Paraneoplastic syndrome occurs when a patient experiences a complex of symptoms that is not explained (directly) by the local or distant spread of a cancerous tumor. *Dorland's* at 1813.

Following this procedure, on June 30, 2015, Ms. Deshler obtained an evaluation for her neuropathic symptoms from Dr. Diana Banks of Rocky Mountain Neurological Associates in Salt Lake City. Ex. 3 at 2–6; Ex. 4 at 2151–56. Petitioner reported her history of symptoms and their progression (and her receipt of the pneumococcal vaccine in May was also recorded). Ex. 3 at 2. Examination revealed left-sided cranial nerve VII weakness, mild to moderate extremity weakness that was distal greater than proximal, reduced sensation distally, and absent reflexes. *Id*. at 5. Dr. Banks proposed that Petitioner's condition was most consistent with acute inflammatory demyelinating polyneuropathy ("AIDP"), a GBS variant, although paraneoplastic polyneuropathy was also considered given her pre-vaccination breast cancer diagnosis and recent treatment. *Id*. at 6. Dr. Banks initiated a five-day course of IVIG, and also ordered an MRI of the brain and cervical spine, both of which were unremarkable. *Id*.; Ex. 4 at 1962–63. Petitioner subsequently underwent a lumbar puncture that was not suggestive of any central nervous system-oriented condition such as multiple sclerosis. Ex. 4 at 1945.

Ms. Deshler continued to receive medical treatment for her GBS-AIDP symptoms for the remainder of 2015. *See* Ex. 4 at 2157–60 (July 7, 2015 evaluation and treatment by neurologist Dr. David Peterson); Ex. 3 at 7–10 (July 17, 2015 neurology evaluation with Dr. Banks). A July 23, 2015 nerve conduction study ordered by Dr. Banks produced abnormal results for her left arm and leg, attributed to a "severe sensorimotor demyelinating polyneuropathy." Ex. 3 at 18–20. She also concurrently obtained treatment for her breast cancer, with one oncologist representing in a record from August 2015 that Petitioner's GBS was attributable to the pneumococcal vaccine, although the record does not detail the basis for this conclusion. Ex. 7 at 20–23. By September 2015, Ms. Deshler was doing well enough with her GBS symptoms to complete her breast cancer treatment surgery. Ex. 4 at 953–54, 958–61. She also continued to have follow-up visits with Dr. Banks, to whom she reported improvement in her overall condition. Ex. 3 at 11–13.

Treatment in 2016

Although Petitioner experienced some sequelae from her GBS into 2016, overall her symptoms appear to have waned. Thus, she was able to undergo a right breast reconstruction procedure early that year, after her neurologist deemed her recovery sufficient to proceed with the surgery, and her post-operative progress was deemed good. Ex. 4 at 610–13, 617–19. As reported at a follow-up visit with Dr. Banks at the end of January 2016, Ms. Deshler regained some feeling to her hands, although she also experienced persistent finger numbness and unsteadiness when standing. Ex. 3 at 14–17. A physical exam also revealed some hand tremors, although it was not deemed associated with GBS (and Petitioner's recollection of onset suggested it may have preceded her other neurologic symptoms). *Id.* at 14.

Many of the same GBS sequelae remained present when Petitioner saw Dr. Banks again in

August 2016, although she reported overall improvement. Ex. 5 at 1–4. In September 2016, Dr. Wood also observed Petitioner's improvement, even if it was slow, but added that her purported reaction to the pneumococcal vaccine meant that she was no longer a good candidate for future vaccinations. Ex. 6 at 9–17.

II. Expert Witness Testimony

A. *Petitioner's Experts*

1. Dr. Donald Levy

Dr. Levy, an immunologist, provided testimony at the hearing and offered a single expert report. Tr. at 6–68, 293–302; Report, filed March 16, 2018, as Ex. 9-1 (ECF No. 25-2) ("Levy Rep."). Dr. Levy opined that the pneumococcal vaccine can cause GBS and did so in Petitioner's case.

Dr. Levy received his bachelor's degree in chemistry from Brooklyn College. Donald Levy Curriculum Vitae, filed as Ex. 10 on Mar. 16, 2018 (ECF No. 25-12) ("Levy CV") at 1. He then received his medical degree from S.U.N.Y. Downstate Medical Center College of Medicine. *Id.* Dr. Levy then completed his internship and residency in pediatrics at Kings County Medical Center before completing a fellowship in allergy and clinical immunology at the Children's Hospital of Los Angeles. *Id.* He is board certified in both pediatrics and allergy and immunology. *Id.* Dr. Levy's primary expertise arises from treatment of allergies or allergic disease, and research into such subjects (as opposed to vaccines or their effects on the immune system). *Id.* at 32–33 ("99 percent of what I do is allergy"), 36. In formulating his opinion, however, Dr. Levy primarily relied on review of the existing medical record, plus his own delve into medical articles exploring the relationship of GBS to the pneumococcal vaccine, rather than professional research or treatment experience. Tr. at 13–14.

Dr. Levy first discussed what was known about the overall pathologic processes relevant to GBS, noting that the 1970s swine flu epidemic had provided medical science with significant insights into it. Tr. at 15. GBS most often arose three to six weeks after the occurrence of an upper respiratory or gastrointestinal infection, and Dr. Levy listed some of the best-known specific viral or bacterial causes (e.g., Epstein-Barr virus, or *Campylobacter jejuni* ("*C. jejuni*") bacterium). *Id.* Such infectious agents were understood to cause GBS through an uncommon cross-reactive autoimmune process, in which ganglioside structures located on the myelin sheath of nerve fibers are attacked by antibodies produced in response to the infection, because the gangliosides contain protein sequences that molecularly resemble, or 'mimic,' the presenting antigens from the infectious agent. *Id.* at 15–17. He added that certain animal model studies had confirmed that this autoimmune, cross-reactive process was specifically possible with the *C. jejuni* bacterium. *Id.* at

17–19.[7] On cross examination, however, Dr. Levy denied that the specific autoantibody associated with GBS remained unknown (although Respondent pointed out that literature he cited generally on the subject said so). *Id.* at 38–39.

Next, Dr. Levy reviewed facts bearing on the pneumococcal vaccine. The Prevnar-13 version of the vaccine that Ms. Deshler received is typically administered on a regular schedule to children or individuals over the age of 55–60, to prevent infection from *S. pneumoniae*. Tr. at 20. It is conjugated to a lab-created version of the diphtheria toxin, CRM_{197}, in order to increase its immunogenicity, or to "trick the immune system into working better." *Id.* at 21, 24, 56–57, 65–66. In particular, inclusion of the diphtheria conjugate helps stimulate a more effective immune response in the immature immune systems possessed by children or the weakened, less robust immune systems of the elderly, as well as others whose immune response has been impacted by some chronic condition. *Id.* at 23.

Absent the diphtheria conjugate, an immune system response to the polysaccharide pneumococcal antigens would not provoke the T cell response critical to the adaptive system "learning" to identify the vaccine's antigens in the future. Rather, "the antigen-presenting cells are just throwing the bacteria/virus particle to—directly to B cell[s]," the immune cells responsible for antibody production. Tr. at 25. This is relevant to GBS's pathogenesis, Dr. Levy maintained, since an affirmative T cell response increases the likelihood that B cells will produce the autoantibodies likely to attack ganglioside protein sequence mimics of the viral/bacterial presenting antigen. *Id.* at 25–26. Alternatively, "preexisting" antibodies might be stimulated as well (although Dr. Levy admitted that this was a far less likely mechanistic explanation for how the GBS pathogenic process was likely to occur post-vaccination). *Id.* at 26–27, 66–67.

Despite such an emphasis on the impact of the conjugate, Dr. Levy agreed that his causation theory proposed that *any* autoimmune cross-reactive process initiated by receipt of the pneumococcal vaccine would ultimately depend on antibodies produced (by B cells) in response to the vaccine's bacterial antigenic components. Tr. at 64–65. As support, he referenced an item of literature. *Id.* at 65, F. Heidenreich et al., *T cell Dependent Activity in Ganglioside GM1-specific B Cells in Guillain-Barré Syndrome and Multifocal Motor Neuropathy in Vitro*, 49 J. Neuroimmunology 97, 97–108 (1994), filed as Ex. 9.13 on Mar. 16, 2018 (ECF No. 25-10) ("Heidenreich"). Dr. Levy acknowledged, however, that the underlying pneumococcal bacterial strains in the vaccine were not *themselves*, as a wild bacterial infection, associated with GBS (unlike, for example, *C. jejuni*). *Id.* at 27–28, 40. He also admitted that he could not identify homology between presenting antigens from the polysaccharide pneumococcal strains found in the vaccine and the nerve gangliosides where the cross-reactive process resulting in GBS is thought to likely occur. *Id.* at 67–68.

[7] I have omitted reference to the citations offered in support of these contentions, for the simple reason that (as far as the Program goes) they are largely well-established.

As additional support for a possible link between the pneumococcal vaccine and GBS, Dr. Levy referenced a few case reports. Tr. at 40–41; N. Ravishankar, *Guillain-Barré Syndrome Following PCV Vaccine*, J. Neurology and Neurosurgery 1, 1–3 (2017), filed as Ex. 9.14 on Mar. 16, 2018 (ECF No. 25-11) ("Ravishankar"). He admitted, however, that the individual in Ravishankar had received a different version of the pneumococcal vaccine (Pneumovax 23) in addition to Prevnar-13, thus distinguishing it somewhat from Ms. Deshler's circumstances. *Id.* at 42–43, Ravishankar at 1. Dr. Levy also referenced a case report involving a thirteen-year-old child who developed symptoms consistent with GBS and was subsequently found to be suffering from a concurrent pneumococcal infection. H. El Khatib et al., *Case Report: Guillain-Barré Syndrome with Pneumococcus – A New Association in Pediatrics*, 11 IDCases 36, 36–38 (2018), filed as Ex. 12 on Aug. 20, 2019 (ECF No. 52-3) ("Khatib"). Dr. Levy maintained that even though such case reports represented single-occurrence incidents, and did not establish causality, they still had evidentiary value to medical science. Tr. at 50–52.

Petitioner's medical history also was relevant to Dr. Levy's opinion. He observed that Ms. Deshler was "relatively healthy" before receiving the vaccine, and in particular did not appear to have suffered from a respiratory or gastrointestinal infection prior to vaccination—thus eliminating the possibility that one of the more commonly-understood causes of GBS could explain her illness. Tr. at 13–14. Dr. Levy also addressed the timeframe for Ms. Deshler's onset in light of his theory. As he previously had testified, GBS attributable to antecedent infection would be expected to manifest symptoms in three to six weeks thereafter (although Dr. Levy proposed it could begin as early as a week after). Tr. at 28. Accordingly, Ms. Deshler's onset in June 2015 after receipt of the vaccine in mid-May of that same year was consistent with the timeframe. *Id.* at 29.

In Petitioner's rebuttal case, Dr. Levy emphasized that molecular mimicry between the polysaccharide components of the vaccine and the myelin sheath was more likely than not the primary cause of Ms. Deshler's GBS. Tr. at 297–98, 300, 306. He did admit, however, that the exact portion of the polysaccharide capsule responsible for inducing molecular mimicry has not yet been identified. *Id.* at 304.

2. Dr. Nizar Souayah

Dr. Souayah, a neurologist, testified at hearing and prepared a single expert report on Petitioner's behalf. Tr. at 70–125 282–93; Report, filed June 19, 2017 (ECF No. 18-1) as Ex. 8.1 ("Souayah Rep."). He opined that a lack of alternatively causal agents made it more likely than not that the pneumococcal vaccine Ms. Deshler received was responsible for her development of GBS. Tr. at 70–71, 92.

Dr. Souayah attended the Medical School of Tunis in Tunisia. Nizar Souayah curriculum

vitae, filed as Ex. 11 on Aug. 20, 2019 (ECF No. 52-2) ("Souayah CV") at 1. He then completed an internship in primary care and family medicine in Tunisia. *Id.* He completed additional training in internal medicine in Strasbourg, France and the University of Pennsylvania in Philadelphia, Pennsylvania. *Id.* He then completed training in the area of neurology at Temple University Hospital in Philadelphia, Pennsylvania before completing a research fellowship in electromyographic/neuromuscular disease at Massachusetts General Hospital in Boston, Massachusetts and a post-doctoral fellowship in neuroscience at Drexel Medical School in Philadelphia, Pennsylvania. *Id.* at 1–2.

Dr. Souayah is board certified in neurology, electrodiagnostic medicine, and neuromuscular medicine. Souayah CV at 3. He currently serves as an associate professor of neurology, pharmacology, physiology, and neuroscience at Rutgers Medical School. *Id.* at 1; Tr. at 71. In addition to his teaching duties, Dr. Souayah regularly sees patients, and he estimates that he sees up to four new patients experiencing GBS each year. Tr. at 74. Dr. Souayah also performs medical research and has published numerous articles discussing research findings relating to neurology and neuromuscular disease. Souayah CV at 21–25; Tr. at 72. Some of these publications are specific to the relationship between vaccination and GBS, though none considered the relationship between pneumococcal vaccines and GBS. Tr. at 72. Dr. Souayah also acknowledged that (given his lack of direct immunologic expertise) he did not possess a "deep understanding" of the immunologic processes discussed by Dr. Levy in his testimony, and therefore relied on Dr. Levy for that aspect of his opinion. Tr. at 86–87, 99.

Dr. Souayah first reviewed the clinical and pathologic characteristics of GBS. He described it as "an inflammatory disorder of the peripheral nervous system," typically featuring ascending numbness and weakness from the lower to upper extremities, accompanied by an absence of or reduction in deep tendon reflexes. Tr. at 78–79. Evidence of increased proteins in a lumbar puncture, coupled with electrodiagnostic testing, can confirm the diagnosis. *Id.* at 79. Consistent with Dr. Levy, Dr. Souayah agreed that GBS is frequently attributed to viral or bacterial infections, although he allowed that its causes cannot be identified in many cases. *Id.* at 81, 105–07.

GBS is understood to be autoimmune-driven, and Dr. Souayah discussed the same kind of molecular mimicry process in which autoantibodies attack self-structures as Dr. Levy discussed. Tr. at 81–83. Dr. Souayah added, however, that the T cell/B cell processes that Dr. Levy had reviewed as part of the autoimmune cross-reaction leading to GBS were functions of the adaptive, rather than innate, immune system. *Id.* at 83–84. He characterized the adaptive system as the "more advanced" arm of the immune response. *Id.* at 83.

Moving to the allegations in this case, Dr. Souayah opined that the pneumococcal vaccine could in fact cause GBS. However, his opinion relied heavily on Dr. Levy's causal explanation, and he could not offer any specific refinement of it. *See generally* Tr. at 85–87, 89 (admitting he

did not know if a specific Prevnar-13 component was causal), 90. He otherwise referenced some studies that he maintained suggested a relationship between the vaccines and GBS. *Id.* at 97 (citing R. Baxter et al., *Lack of Association of Guillain-Barré Syndrome with Vaccinations*, 57 Clinical Infectious Disease 197, 197–203 (2013), filed as Ex. 8.28 on Aug. 3, 2017 ("Baxter"); P. Haber et al., *Post-licensure Surveillance of 13-Valent Pneumococcal Conjugate Vaccine (PCV13) in Adults Aged ≥ 19 Years Old in the United States, Vaccine Adverse Event Reporting System (VAERS), June 1, 2012 – December 31, 2015*, 34 Vaccine 6330, 6330–34 (2016), filed as Ex. 8.29 on Aug. 3, 2017 ("Haber"); C. Cordonnier et al., *Immunogenicity, Safety and Tolerability of 13-Valent Pneumococcal Conjugate Vaccine Followed by 23-Valent Pneumococcal Polysaccharide Vaccine in Recipients of Allogeneic Hematopoietic Stem Cell Transplant Aged ≥ 2 Years: An Open-Label Study*, 61 Clinical Infectious Disease 313, 313–23 (2015), filed as Ex. 8.30 on Aug. 3, 2017 ("Cordonnier").

Dr. Souayah first discussed Baxter—a study which considered the Pneumovax 23 vaccine (as opposed to the Prevnar-13 vaccine that Petitioner received) and its relationship to the development of GBS. Baxter at 198, 200; Tr. at 102. This study, however, ultimately concluded that there was *no association* between Pneumovax and the development of GBS. Baxter at 203. Dr. Souayah next discussed the Haber study, which analyzed Vaccine Adverse Event Reporting System ("VAERS")[8] data related to the Prevnar-13 vaccine. Haber at 6331. But Haber also found no association between the pneumococcal vaccine and new or unexpected adverse events such as GBS. *Id.* at 6334; Tr. at 102–03.

Lastly, Dr. Souayah discussed Cordonnier—a study which focused on the immunogenicity and safety of pneumococcal vaccines (both Prevnar-13 and Pneumovax) in individuals who have undergone a hematopoietic stem cell transplant and are therefore immunocompromised. Cordonnier at 314. The protocol of this study involved administering three doses of Prevnar-13 monthly, followed by a fourth dose of Prevnar-13 six months later, and a single dose of Pneumovax administered one month after that. *Id.* While the study concluded that the administration of pneumococcal vaccines to transplant recipients was generally safe, it did identify one patient who developed GBS twenty-nine days after receiving the fourth dose of Prevnar-13 and one day after receiving the Pneumovax dose. *Id.* at 319. Cordonnier, however, could not establish a causal relationship between the pneumococcal vaccines and the patient's GBS, because the patient suffered from several comorbidities, was taking numerous medications, and experienced multiple infections. *Id.* at 321. Dr. Souayah also admitted he could not cite epidemiologic evidence in support of the above theory, although he disclaimed the possibility of conducting a scientifically-valid controlled study given GBS's rarity. Tr. at 88.

[8] VAERS is a national safety surveillance program run by the Centers for Disease Control and Prevention and the Food and Drug Administration, which relies on voluntary reporting of adverse vaccine reactions by healthcare providers, patients, and vaccine manufacturers. Haber at 6331.

Dr. Souayah also attempted to highlight aspects of the record that he felt bulwarked the causal theory. Similar to Dr. Levy, he characterized Ms. Deshler as "relatively healthy," at least in the regard of not having experienced an identified infection prior to vaccination. Tr. at 85. He denied that her status as pre-diabetic was significant and/or alternatively causal, given the timeframe in which her symptoms manifested and their nature. *Id.* at 91–92. He also did not deem it more than a "possibility" that Petitioner's breast cancer might have caused a paraneoplastic syndrome, whereby the initial cancerous process introduces secondary neurologic complications that can be autoimmune in mechanism. *Id.* at 92–93. Dr. Souayah saw no objective evidence in the record to support that conclusion, adding that the GBS treatments Petitioner received were not consistent with that conclusion. *Id.* at 93–94.

Two weeks post-vaccination, however, Petitioner was experiencing numbness and tingling that progressed to motor issues and other clinical manifestations of GBS. Tr. at 85, 89. Dr. Souayah noted no other possible causes in the several-week period prior to her formal diagnosis. *Id.* He also felt the timing in which her symptoms began was consistent with the timeframe it would take for GBS to occur post-vaccination, noting that the autoimmune cross-reaction process had medical acceptance, as well as a generally-accepted timeframe derived from knowledge obtained after the 1970s swine flu epidemic. *Id.* at 87; L. Schonberger et al., *Guillain-Barre Syndrome Following Vaccination in the National Influenza Immunization Program, United States 1976-1977*, 110 Am. J. Epidemiology 105, 111–12 (1979), filed as Ex. 8.12 on Aug. 3, 2017.

On cross-examination, Dr. Souayah acknowledged that the record did reveal that Petitioner's pre-diabetic condition may have resulted in her experiencing some neuropathic symptoms as early as 2014, and even that she received medication to treat these symptoms. Tr at 100–01. And during rebuttal, Dr. Souayah again referenced the Haber study—this time to criticize its applicability to Petitioner's case. Tr. at 286–87. He acknowledged that the study could not be used to establish causation. Haber at 6334; Tr. at 286. But Haber would not have accurately accounted for all instances of post-vaccination GBS because it relied on criteria that would exclude any incomplete reports, or mild/atypical GBS cases. Tr. at 286. Thus, the likelihood of the studying being underinclusive of post-vaccination instances of GBS was high. *Id.* at 286–87.

B. *Respondent's Experts*

1. Dr. Vinay Chaudhry

Dr. Chaudhry, a neurologist, was Respondent's first expert to testify, and he also prepared a written report. Tr. at 127–204; Report, filed as Ex. A on Sept. 28, 2017 (ECF No. 21-1) ("Chaudhry Rep."). Dr. Chaudhry opined that Petitioner's GBS was not vaccine-caused. Tr. at 136.

Dr. Chaudhry obtained his Bachelor of Medicine and Bachelor of Surgery degrees from the All India Institute of Medical Sciences in New Delhi, India. Vinay Chaudhry Curriculum Vitae, filed as Ex. B on Sept. 28, 2017 (ECF No. 21-7) ("Chaudhry CV") at 1. He later completed residency training in neurology at the University of Tennessee Center for the Health Sciences and the University of Alabama at Birmingham School of Medicine. *Id.* at 2. He then completed a fellowship in neuromuscular disease at Johns Hopkins University School of Medicine. *Id.* After completing his fellowship, Dr. Chaudhry became an instructor at the Johns Hopkins University School of Medicine, where he eventually became a full professor of neurology. *Id.* at 2–3. In addition to his teaching duties, Dr. Chaudhry's clinical practice is focused on neuromuscular disease, and approximately sixty to seventy percent of the patients he sees have some form of peripheral neuropathy. Tr. at 128. In a year, Dr. Chaudhry estimates that he sees approximately twenty to thirty GBS patients. *Id.* at 131–32. He is board certified in neurology, clinical neurophysiology, neuromuscular medicine, and electrodiagnostic medicine, and he has written numerous articles on these subjects. *Id.* at 129–30; Chaudhry CV at 3–10.

Dr. Chaudhry started with an explanation of GBS. He deemed it a broad descriptor, encompassing a number of subcategories, although it classically is defined by "an acute, flaccid paralysis that evolves between two and twenty-eight days, peaks less than four weeks, and is associated with absent reflexes [areflexia]." Tr. at 137–38. Its diagnosis requires evidence of high protein levels in the spinal fluid, as well as electromyography ("EMG") confirmation of nerve sheath demyelination. *Id.* For a long period of time, the most common sub-type—the AIDP variant—was conterminous with GBS, and it was characterized by its rapid progression. *Id.* at 138–39. Other variants not directly relevant herein also exist, and although they may differ in course, nerve impact, or symptoms presentation, all are considered to be immune system-driven neuropathies. *Id.* at 139–42.

Consistent with Petitioner's experts, Dr. Chaudhry agreed that certain infections (such as a *C. jejuni* bacterial infection) are understood by medical science to be associated with different GBS variants. Tr. at 145–46, 148, 152. A wild *S. pneumoniae* infection, by contrast, is not so associated. *Id.* at 147, 152–53.[9] In fact, Dr. Chaudhry emphasized that *S. pneumoniae* infections are potentially so severe (in comparison to some of the other kinds of infections commonly associated with GBS) that it would be frequently noted in GBS patient histories if it were suspected to be causal. *Id.* at 153–55. He also observed (consistent with admissions in Dr. Souayah's expert report) that it was common not to be able to identify a "triggering pathological organism" in causing an individual case of GBS. *Id.* at 155; Souayah Rep. at 10. He later acknowledged that *C. jejuni* is associated with a distinguishable GBS variant rather than AIDP (the variant Ms. Deshler suffered from), but added that AIDP is widely studied, and that many *other* infectious processes

[9] In so testifying, Dr. Chaudhry contested a case report offered by Dr. Levy to suggest such an association, questioning whether the individual in question (a thirteen-year old) in fact had an *S. pneumoniae* infection *before* his first signs of extremity weakness. Tr. at 147–50, 185–86 (discussing Khatib).

are associated with the molecular mimicry mechanism understood to cause it (while *S. pneumoniae* is not). Tr. at 175–76, 177–78.

Dr. Chaudhry flatly disputed the contention that the pneumococcal vaccine could be causal of GBS, relying on his general knowledge of the medical community's views (although he deferred otherwise to Dr. Whitton, Respondent's immunology expert, on such matters). Tr. at 161, 168. He also supported this aspect of his opinion with literature. *See, e.g.*, Haber; Tr. at 165–66. Haber, for example, is a post-licensure survey article that Dr. Chaudhry asserted established the low incidence of GBS after receipt of the pneumococcal vaccine. Haber at 6331, 6334. He further bulwarked his opinion with a discussion of Baxter. Tr. at 166–67. Baxter, he emphasized, found no association between the pneumococcal vaccine and GBS, though he did acknowledge that the study focused on Pneumovax rather than the Prevnar-13 vaccine relevant to Petitioner's case. Tr. at 166–67, Baxter at 203.

In addition, Dr. Chaudhry criticized Dr. Souayah's reliance on Cordonnier. Tr. at 170–72; Chaudhry Rep. at 9. He noted that the patient population in Cordonnier was largely distinguishable from Ms. Deshler, given that the study participants had all received allogeneic hematopoietic stem cell transplants, making them immunologically-compromised (and thus susceptible to the kind of infections known to be associated with GBS). Tr. at 171–72; Chaudhry Rep. at 9. The study was further complicated by the complex constellation of comorbidities many of the patient population exhibited, including graft versus host disease and underlying lymphomas and myelomas. Cordonnier at 314; Tr. at 170–71. The article thus (as reflected in its authors' admissions) could not conclude that a causal relationship between the pneumococcal vaccine and GBS existed. Cordonnier at 320–21; Tr. at 171, 195. Ultimately, Dr. Chaudhry proposed that if the vaccine were in fact potentially causal of GBS, there would be considerably more awareness of the problem in the overall community (and it would show up more often in the VAERS reporting data at least). Tr. at 167–69, 181. He admitted, however, that he did not himself perform a review of VAERS reports of post-pneumococcal vaccine GBS to ascertain if his assumptions in this regard were accurate. *Id.* at 181–82.

Turning to the record evidence, Dr. Chaudhry agreed that Ms. Deshler had been properly diagnosed with GBS. Tr. at 136. But he felt other aspects of her medical history had potential significance in explaining her illness. For example, Ms. Deshler was being treated for breast cancer before and after vaccination—an occurrence *also* "temporal" to her receipt of the vaccine that he also felt could be potentially causal. Tr. at 155–56; Chaudhry Rep. at 5. At the same time, however, Dr. Chaudhry acknowledged that he could not say with certainty that Petitioner's cancer was likely associated with her GBS. *Id.* at 156–57. He also noted the evidence of Petitioner's May 2014 complaints of weakness and numbness in her extremities, although he allowed the possibility that these instances could be attributable to treatments she received at that time. *Id.* at 157–58, 188–89. Additionally, he highlighted that Petitioner was prediabetic, stressing the neuropathies associated

with diabetes while admitting that he could not conclude in this case that her symptoms reflected a diabetic neuropathy. *Id.* at 159–60, 199–201. At bottom, however, Dr. Chaudhry reiterated that a neuropathy like GBS could occur without an identifiable cause. *Id.* at 160.

On cross examination, Dr. Chaudhry admitted that some treater records (such as statements by an oncologist Ms. Deshler saw in August 2015 (Ex. 7 at 20–23)) did state that her GBS was associated with vaccination, and/or that she should avoid vaccination in the future as result, although he disputed the medical accuracy/reliability of the causation conclusions underlying such statements. Tr. at 196–98. He did, however, also assert that the pneumococcal vaccine was not contraindicated for individuals who previously had experienced GBS. *Id.* at 198.

2. Dr. Lindsay Whitton

Dr. Whitton provided additional testimony on behalf of Respondent as well as an expert report. Whitton Report, filed as Ex. C on July 31, 2018 (ECF No. 27-1) ("Whitton Rep."). His primary role in the matter was to evaluate the testimony of Petitioner's expert, Dr. Levy. *Id.* at 1; Tr. at 214. After reviewing Dr. Levy's report and listening to his testimony, Dr. Whitton opined that the Prevnar-13 vaccine in no way played a causal role in Ms. Deshler's development of GBS. Whitton Rep. at 2; Tr. at 242.

Dr. Whitton obtained his bachelor's and medical degrees as well as his PhD from the University of Glasgow in Scotland. Lindsay Whitton Curriculum Vitae, filed as Ex. D on July 31, 2018 (ECF No. 27-9) ("Whitton CV") at 1. He then began working as a senior research associate at the Scripps Research Institute in La Jolla, California, where he studied immunology, vaccinology, and viral pathogenesis. *Id.*, Tr. at 207. For thirty-five years—thirty-four of which were spent as head of his own lab—Dr. Whitton conducted extensive research in these subject areas and has published numerous articles on the subjects. Whitton CV at 2–15; Tr. at 207–08. In addition to his research, Dr. Whitton also serves as a professor in the department of Immunology and Microbial Science at Scripps Research Institute. Whitton CV at 1. In both his research and teaching, Dr. Whitton has focused on how vaccines trigger adaptive immune response. Tr. at 209, 247. Though he obtained a medical degree in the United Kingdom, Dr. Whitton did not seek board certification in the United States and therefore has never practiced medicine in a clinical setting in the U.S. Tr. at 207.

Dr. Whitton began his testimony by discussing wild *S. pneumoniae* bacterial infections. Like Drs. Levy and Chaudhry, he observed that wild *S. pneumoniae* infections are not associated with an increased risk of developing GBS. Tr. at 215. By contrast, other bacterial infections, such as *C. jejuni* and *Haemophilus Influenzae* type B ("Hib") infections, are so associated, but Dr. Whitton emphasized that the polysaccharide "shells" that encapsulate *C. jejuni* and Hib differ from those found in *S. pneumoniae*. *Id.* at 219, 223. Thus, while the polysaccharides specific to one

bacterial strain, such as *C. jejuni*, may reliably be understood to have an association with GBS, this fact provides little evidence to support the contention that *different* polysaccharides specific to a different class of bacteria could produce the same effect. *Id.* In fact, even amongst bacteria of the *same* class—Campylobacter bacteria—only *C. jejuni* causes GBS. Thus, the fact that *C. jejuni* is associated with an increased risk of GBS does not translate into a similarly heightened risk following *S. pneumoniae* infection as proposed in Dr. Levy's theory of causation. *Id.*

Dr. Whitton also spent a significant amount of time at hearing discussing the differences between the diphtheria toxin, toxoid, and CRM_{197}—the lab-created diphtheria toxin mutant that is contained in the form of the pneumococcal vaccine relevant herein. Tr. at 222–23, 259–262. Diphtheria bacterium (*Corynebacterium diphtheriae*) produces an active protein known as a toxin, and it is this toxin that causes disease. *Id.* at 260. When the toxin is combined with a chemical known as formalin, however, the amino acid sequences that make up the tightly-wound protein structure are loosened in a process known as denaturation. *Id.* at 260–61. This renders the proteins inactive and nullifies toxicity. *Id.* at 261. In this form, the denatured protein structure is known as a toxoid. *Id.* at 262. Unlike the diphtheria toxoid, CRM_{197} is not denatured, but it still features reduced toxicity and will therefore not produce the same deleterious effects as the diphtheria toxin—its mutation renders it non-toxic. *Id.* at 260–61. This reduced toxicity is achieved by incorporating a single mutation in the amino acid sequence. *Id.* at 262. While the mechanism is not well understood, CRM_{197} has been deemed more effective at initiating an immunogenic response than diphtheria toxoid, and it is therefore the preferred conjugate in vaccine manufacturing. *Id.* at 262.

This distinction served an important basis for Dr. Whitton's dismissal of Dr. Levy's proposed mechanism of causation. Dr. Levy maintained that because the tetanus, diphtheria, and acellular pertussis ("Tdap") vaccine has been associated with an increased risk of GBS, the fact that it and the pneumococcal vaccines *both* contain some form of diphtheria toxoid as a conjugate suggests the latter could also involve the same increased risk. Tr. at 222–23; *see also* Levy Rep. at 4; Whitton Rep. at 7–8. Dr. Whitton, however, stressed that the Prevnar-13 vaccine literally does not contain "diphteria [sic] bacteria" or the diphtheria toxoid present in the Tdap vaccine, but rather CRM_{197}. Levy Rep. at 4; Whitton Rep. at 7. Thus, literature cited by Dr. Levy regarding GBS post-Tdap vaccination provides little evidence to support a finding that the Prevnar-13 vaccine is similarly causal. Tr. at 222–23.

Dr. Whitton next focused his discussion on the role CRM_{197} plays in heightening the immunogenic response of the pneumococcal vaccine. He acknowledged that the vaccine was designed in part to stimulate a T cell reaction (as argued by Dr. Levy) that would aid the adaptive system in recognizing *S. Pneumoniae* in the future (such that it would produce antibodies responsive to it). Tr. at 250; *see also* Ravishankar at 2; P. Klouwenberg & L. Bont, *Neonatal and Infantile Immune Responses to Encapsulated Bacteria and Conjugate Vaccines*, Clinical and

Developmental Immunology 1, 4 (2008), filed as Ex. C Tab 2 on July 31, 2018 (ECF No. 27-3) ("Klouwenberg"). This type of response is initiated by first attracting and binding naïve B cells to the bacteria's antigen with CRM_{197}. Tr. at 227. The B cells engulf the antigen and display CRM_{197} on their surface before presenting CRM_{197} to T cells. *Id.* The T cells then release cytokines to enhance the antibody producing capacity of the B cells. *Id.* at 228. Thus, this T cell-dependent response is antigen specific, and will therefore only initiate an adaptive immune response when re-exposed to the same CRM_{197}-conjugated antigen. Whitton Rep. at 9.

But this mechanism (which describes how the vaccine functions) is distinctly different from the pathologic process leading to GBS proposed by Dr. Levy. Tr. at 25–27. According to Dr. Levy, the T cell dependent response initiated by the CRM_{197} component of Prevnar-13 increases the likelihood that either naïve B cells or pre-existing anti-ganglioside specific B cells will produce autoantibodies capable of inducing GBS. Tr. at 25–27 (referencing Ravishankar at 2; Heidenreich at 105). Dr. Whitton explained, however, that memory T cells will only interact with antigen-specific B cells. Tr. at 237–238; Whitton Rep. at 9. Therefore, in his view, memory T cells that are produced in response to CRM_{197} exposure only respond to B cells that are *themselves* anti-CRM_{197} specific. Whitton Rep. at 9. This interpretation would thus render Petitioner's reliance on Ravishankar questionable, as the patient in Ravishankar only developed GBS after receiving a non-conjugated Pneumovax vaccine (and hence did not contain CRM_{197}). Tr. at 230; Whitton Rep. at 9. While Dr. Whitton's argument does not account for the conclusions discussed in Heidenreich, both Drs. Whitton and Levy agreed that Dr. Levy's proposed theory of causation failed to explain how *B cells* would be stimulated by the conjugate to produce the autoantibodies necessary to trigger GBS. Tr. at 67, 239.

Dr. Whitton did concede that the general theory of molecular mimicry is applicable to the development of GBS under certain circumstances, though not all cases of GBS can be explained by the mechanism. Tr. at 232–33, 273. He also acknowledged the existence of homologies between flu proteins and protein structures of the nervous system (i.e. myelin basic protein, proteolipid protein, oligodendrocyte protein, and glycoprotein). *Id.* at 254–56. But Dr. Whitton again emphasized the fact that homologies between the polysaccharides associated with *S. pneumoniae* (the antigens contained in the pneumococcal vaccine) and nervous system structures have not been identified. *Id.* at 232–33, 257. While he ultimately concluded that no component of the Prevnar-13 vaccine caused Petitioner's GBS, Dr. Whitton ventured that at best, between the polysaccharide and CRM_{197} components, CRM_{197} would more likely be the causal agent. Tr. at 273.

III. Procedural History

As previously noted, this matter commenced with the filing of the Petition on August 26, 2016. Over the following months, Petitioner filed medical records in support of her claim. Respondent thereafter filed a Rule 4(c) Report on January 23, 2017, asserting that compensation

is not appropriate in this case. Respondent's Report, filed Jan. 23, 2017 (ECF No. 12). Petitioner subsequently filed an expert report from Dr. Souayah and supporting literature during the summer of 2017. Respondent filed a responsive report by Dr. Chaudhry on September 28, 2017, along with literature in opposition to Petitioner's position. Both Petitioner and Respondent then filed supplemental expert reports from Drs. Levy and Whitton on March 16, 2018 and July 31, 2018 respectively. The parties filed their respective pre-hearing briefs over the summer of 2019, and a two-day entitlement hearing took place on October 1-2, 2019. The parties elected to file post-hearing briefs, which they did on February 6-7, 2020, and the matter is fully ripe for resolution.

IV. Applicable Law

A. *Petitioner's Overall Burden in Vaccine Program Cases*

To receive compensation in the Vaccine Program, a petitioner must prove either: (1) that he suffered a "Table Injury"—i.e., an injury falling within the Vaccine Injury Table—corresponding to one of the vaccinations in question within a statutorily prescribed period of time or, in the alternative, (2) that his illnesses were actually caused by a vaccine (a "Non-Table Injury"). *See* Sections 13(a)(1)(A), 11(c)(1), and 14(a), as amended by 42 C.F.R. § 100.3; § 11(c)(1)(C)(ii)(I); *see also Moberly v. Sec'y of Health & Human Servs.*, 592 F.3d 1315, 1321 (Fed. Cir. 2010); *Capizzano v. Sec'y of Health & Human Servs.*, 440 F.3d 1317, 1320 (Fed. Cir. 2006).[10] In this case, Petitioner does not assert a Table claim.

For both Table and Non-Table claims, Vaccine Program petitioners bear a "preponderance of the evidence" burden of proof. Section 13(1)(a). That is, a petitioner must offer evidence that leads the "trier of fact to believe that the existence of a fact is more probable than its nonexistence before [he] may find in favor of the party who has the burden to persuade the judge of the fact's existence." *Moberly*, 592 F.3d at 1322 n.2; *see also Snowbank Enter. v. United States*, 6 Cl. Ct. 476, 486 (1984) (mere conjecture or speculation is insufficient under a preponderance standard). Proof of medical certainty is not required. *Bunting v. Sec'y of Health & Human Servs.*, 931 F.2d 867, 873 (Fed. Cir. 1991). In particular, a petitioner must demonstrate that the vaccine was "not only [the] but-for cause of the injury but also a substantial factor in bringing about the injury." *Moberly*, 592 F.3d at 1321 (quoting *Shyface v. Sec'y of Health & Human Servs.*, 165 F.3d 1344, 1352–53 (Fed. Cir. 1999)); *Pafford v. Sec'y of Health & Human Servs*., 451 F.3d 1352, 1355 (Fed. Cir. 2006). A petitioner may not receive a Vaccine Program award based solely on his assertions; rather, the petition must be supported by either medical records or by the opinion of a competent physician. Section 13(a)(1).

[10] Decisions of special masters (some of which I reference in this ruling) constitute persuasive but not binding authority. *Hanlon v. Sec'y of Health & Human Servs.*, 40 Fed. Cl. 625, 630 (1998). By contrast, Federal Circuit rulings concerning legal issues are binding on special masters. *Guillory v. Sec'y of Health & Human Servs.*, 59 Fed. Cl. 121, 124 (2003), *aff'd* 104 F. Appx. 712 (Fed. Cir. 2004); *see also Spooner v. Sec'y of Health & Human Servs.*, No. 13-159V, 2014 WL 504728, at *7 n.12 (Fed. Cl. Spec. Mstr. Jan. 16, 2014).

In attempting to establish entitlement to a Vaccine Program award of compensation for a Non-Table claim, a petitioner must satisfy all three of the elements established by the Federal Circuit in *Althen v. Sec'y of Health & Human Servs.*, 418 F.3d 1274, 1278 (2005) : "(1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of proximate temporal relationship between vaccination and injury."

Each of the *Althen* prongs requires a different showing. Under *Althen* prong one, petitioners must provide a "reputable medical theory," demonstrating that the vaccine received *can cause* the type of injury alleged. *Pafford*, 451 F.3d at 1355–56 (citations omitted). To satisfy this prong, a petitioner's theory must be based on a "sound and reliable medical or scientific explanation." *Knudsen v. Sec'y of Health & Human Servs.*, 35 F.3d 543, 548 (Fed. Cir. 1994). Such a theory must only be "legally probable, not medically or scientifically certain." *Id.* at 549.

Petitioners may satisfy the first *Althen* prong without resort to medical literature, epidemiological studies, demonstration of a specific mechanism, or a generally accepted medical theory. *Andreu v. Sec'y of Health & Human Servs.*, 569 F.3d 1367, 1378–79 (Fed. Cir. 2009) (citing *Capizzano*, 440 F.3d at 1325–26). Special masters, despite their expertise, are not empowered by statute to conclusively resolve what are essentially thorny scientific and medical questions, and thus scientific evidence offered to establish *Althen* prong one is viewed "not through the lens of the laboratorian, but instead from the vantage point of the Vaccine Act's preponderant evidence standard." *Id.* at 1380. Accordingly, special masters must take care not to increase the burden placed on petitioners in offering a scientific theory linking vaccine to injury.

In discussing the evidentiary standard applicable to the first *Althen* prong, the Federal Circuit has consistently rejected the contention that it can be satisfied merely by establishing the proposed causal theory's scientific or medical *plausibility*. *See Boatmon v. Sec'y of Health & Human Servs.*, 941 F.3d 1351, 1359 (Fed. Cir. 2019); *see also LaLonde v. Sec'y of Health & Human Servs.*, 746 F.3d 1334, 1339 (Fed. Cir. 2014) ("[h]owever, in the past we have made clear that simply identifying a 'plausible' theory of causation is insufficient for a petitioner to meet her burden of proof." (citing *Moberly*, 592 F.3d at 1322)). Petitioners otherwise always have the ultimate burden of establishing their *overall* Vaccine Act claim with preponderant evidence, regardless of what evidentiary level of evidence on the "can cause" prong is required. *W.C. v. Sec'y of Health & Human Servs.*, 704 F.3d 1352, 1356 (Fed. Cir. 2013) (citations omitted); *Tarsell v. United States*, 133 Fed. Cl. 782, 793 (2017) (noting that *Moberly* "addresses the petitioner's overall burden of proving causation-in-fact under the Vaccine Act" by a preponderance standard).

The second *Althen* prong requires proof of a logical sequence of cause and effect, usually supported by facts derived from a petitioner's medical records. *Althen*, 418 F.3d at 1278; *Andreu*,

569 F.3d at 1375–77; *Capizzano*, 440 F.3d at 1326; *Grant v. Sec'y of Health & Human Servs.*, 956 F.2d 1144, 1148 (Fed. Cir. 1992). In establishing that a vaccine "did cause" injury, the opinions and views of the injured party's treating physicians are entitled to some weight. *Andreu*, 569 F.3d at 1367; *Capizzano*, 440 F.3d at 1326 ("medical records and medical opinion testimony are favored in vaccine cases, as treating physicians are likely to be in the best position to determine whether a 'logical sequence of cause and effect show[s] that the vaccination was the reason for the injury'") (quoting *Althen*, 418 F.3d at 1280). Medical records are generally viewed as particularly trustworthy evidence, since they are created contemporaneously with the treatment of the patient. *Cucuras v. Sec'y of Health & Human Servs.*, 993 F.2d 1525, 1528 (Fed. Cir. 1993).

Medical records and statements of a treating physician, however, do not *per se* bind the special master to adopt the conclusions of such an individual, even if they must be considered and carefully evaluated. Section 13(b)(1) (providing that "[a]ny such diagnosis, conclusion, judgment, test result, report, or summary shall not be binding on the special master or court"); *Snyder v. Sec'y of Health & Human Servs*., 88 Fed. Cl. 706, 746 n.67 (2009) ("there is nothing . . . that mandates that the testimony of a treating physician is sacrosanct—that it must be accepted in its entirety and cannot be rebutted"). As with expert testimony offered to establish a theory of causation, the opinions or diagnoses of treating physicians are only as trustworthy as the reasonableness of their suppositions or bases. The views of treating physicians should be weighed against other, contrary evidence also present in the record—including conflicting opinions among such individuals. *Hibbard v. Sec'y of Health & Human Servs.*, 100 Fed. Cl. 742, 749 (2011) (not arbitrary or capricious for special master to weigh competing treating physicians' conclusions against each other), *aff'd*, 698 F.3d 1355 (Fed. Cir. 2012); *Veryzer v. Sec'y of Dept. of Health & Human Servs.*, No. 06-522V, 2011 WL 1935813, at *17 (Fed. Cl. Spec. Mstr. Apr. 29, 2011), *mot. for review denied*, 100 Fed. Cl. 344, 356 (2011), *aff'd without opinion*, 475 F. Appx. 765 (Fed. Cir. 2012).

The third *Althen* prong requires establishing a "proximate temporal relationship" between the vaccination and the injury alleged. *Althen*, 418 F.3d at 1281. That term has been equated to the phrase "medically-acceptable temporal relationship." *Id.* A petitioner must offer "preponderant proof that the onset of symptoms occurred within a timeframe which, given the medical understanding of the disorder's etiology, it is medically acceptable to infer causation." *de Bazan v. Sec'y of Health & Human Servs.*, 539 F.3d 1347, 1352 (Fed. Cir. 2008). The explanation for what is a medically acceptable timeframe must align with the theory of how the relevant vaccine can cause an injury (*Althen* prong one's requirement). *Id.* at 1352; *Shapiro v. Sec'y of Health & Human Servs.*, 101 Fed. Cl. 532, 542 (2011), *recons. denied after remand*, 105 Fed. Cl. 353 (2012), *aff'd mem.*, 503 F. Appx. 952 (Fed. Cir. 2013); *Koehn v. Sec'y of Health & Human Servs.*, No. 11-355V, 2013 WL 3214877 (Fed. Cl. Spec. Mstr. May 30, 2013), *mot. for rev. denied* (Fed. Cl. Dec. 3, 2013), *aff'd*, 773 F.3d 1239 (Fed. Cir. 2014).

B. *Legal Standards Governing Factual Determinations*

The process for making determinations in Vaccine Program cases regarding factual issues begins with consideration of the medical records. Section 11(c)(2). The special master is required to consider "all [] relevant medical and scientific evidence contained in the record," including "any diagnosis, conclusion, medical judgment, or autopsy or coroner's report which is contained in the record regarding the nature, causation, and aggravation of the petitioner's illness, disability, injury, condition, or death," as well as the "results of any diagnostic or evaluative test which are contained in the record and the summaries and conclusions." Section 13(b)(1)(A). The special master is then required to weigh the evidence presented, including contemporaneous medical records and testimony. *See Burns v. Sec'y of Health & Human Servs*., 3 F.3d 415, 417 (Fed. Cir. 1993) (it is within the special master's discretion to determine whether to afford greater weight to contemporaneous medical records than to other evidence, such as oral testimony surrounding the events in question that was given at a later date, provided that such determination is evidenced by a rational determination).

Medical records that are created contemporaneously with the events they describe are presumed to be accurate and "complete" (i.e., presenting all relevant information on a patient's health problems). *Cucuras*, 993 F.2d at 1528; *Doe/70 v. Sec'y of Health & Human Servs.*, 95 Fed. Cl. 598, 608 (2010) ("[g]iven the inconsistencies between petitioner's testimony and his contemporaneous medical records, the special master's decision to rely on petitioner's medical records was rational and consistent with applicable law"), *aff'd sub nom. Rickett v. Sec'y of Health & Human Servs*., 468 F. Appx. 952 (Fed. Cir. 2011) (non-precedential opinion). This presumption is based on the linked propositions that (i) sick people visit medical professionals; (ii) sick people honestly report their health problems to those professionals; and (iii) medical professionals record what they are told or observe when examining their patients in as accurate a manner as possible, so that they are aware of enough relevant facts to make appropriate treatment decisions. *Sanchez v. Sec'y of Health & Human Servs.*, No. 11-685V, 2013 WL 1880825, at *2 (Fed. Cl. Spec. Mstr. Apr. 10, 2013); *Cucuras v. Sec'y of Health & Human Servs.*, 26 Cl. Ct. 537, 543 (1992), *aff'd*, 993 F.2d at 1525 (Fed. Cir. 1993) ("[i]t strains reason to conclude that petitioners would fail to accurately report the onset of their daughter's symptoms").

Accordingly, if the medical records are clear, consistent, and complete, then they should be afforded substantial weight. *Lowrie v. Sec'y of Health & Human Servs.*, No. 03-1585V, 2005 WL 6117475, at *20 (Fed. Cl. Spec. Mstr. Dec. 12, 2005). Indeed, contemporaneous medical records are generally found to be deserving of greater evidentiary weight than oral testimony—especially where such testimony conflicts with the record evidence. *Cucuras*, 993 F.2d at 1528; *see also Murphy v. Sec'y of Dep't of Health & Human Servs.*, 23 Cl. Ct. 726, 733 (1991) (citing *United States v. United States Gypsum Co.*, 333 U.S. 364, 396 (1947) ("[i]t has generally been

held that oral testimony which is in conflict with contemporaneous documents is entitled to little evidentiary weight.")).

There are, however, situations in which compelling oral testimony may be more persuasive than written records, such as where records are deemed to be incomplete or inaccurate. *Campbell v. Sec'y of Health & Human Servs*., 69 Fed. Cl. 775, 779 (2006) ("like any norm based upon common sense and experience, this rule should not be treated as an absolute and must yield where the factual predicates for its application are weak or lacking"); *Lowrie*, 2005 WL 6117475, at *19 ("'[w]ritten records which are, themselves, inconsistent, should be accorded less deference than those which are internally consistent'") (quoting *Murphy*, 23 Cl. Ct. at 733)). Ultimately, a determination regarding a witness's credibility is needed when determining the weight that such testimony should be afforded. *Andreu*, 569 F.3d at 1379; *Bradley v. Sec'y of Health & Human Servs*., 991 F.2d 1570, 1575 (Fed. Cir. 1993).

When witness testimony is offered to overcome the presumption of accuracy afforded to contemporaneous medical records, such testimony must be "consistent, clear, cogent, and compelling." *Sanchez*, 2013 WL 1880825, at *3 (citing *Blutstein v. Sec'y of Health & Human Servs*., No. 90-2808V, 1998 WL 408611, at *5 (Fed. Cl. Spec. Mstr. June 30, 1998)). In determining the accuracy and completeness of medical records, the Court of Federal Claims has listed four possible explanations for inconsistencies between contemporaneously created medical records and later testimony: (1) a person's failure to recount to the medical professional everything that happened during the relevant time period; (2) the medical professional's failure to document everything reported to her or him; (3) a person's faulty recollection of the events when presenting testimony; or (4) a person's purposeful recounting of symptoms that did not exist. *Lalonde v. Sec'y of Health & Human Servs*., 110 Fed. Cl. 184, 203-04 (2013), *aff'd*, 746 F.3d 1334 (Fed. Cir. 2014). In making a determination regarding whether to afford greater weight to contemporaneous medical records or other evidence, such as testimony at hearing, there must be evidence that this decision was the result of a rational determination. *Burns*, 3 F.3d at 417.

C. *Analysis of Expert Testimony*

Establishing a sound and reliable medical theory often requires a petitioner to present expert testimony in support of his claim. *Lampe v. Sec'y of Health & Human Servs*., 219 F.3d 1357, 1361 (Fed. Cir. 2000). Vaccine Program expert testimony is usually evaluated according to the factors for analyzing scientific reliability set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 594–96 (1993). *See Cedillo v. Sec'y of Health & Human Servs.*, 617 F.3d 1328, 1339 (Fed. Cir. 2010) (citing *Terran v. Sec'y of Health & Human Servs.*, 195 F.3d 1302, 1316 (Fed. Cir. 1999)). "The *Daubert* factors for analyzing the reliability of testimony are: (1) whether a theory or technique can be (and has been) tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) whether there is a known or potential rate of error

and whether there are standards for controlling the error; and (4) whether the theory or technique enjoys general acceptance within a relevant scientific community." *Terran*, 195 F.3d at 1316 n.2 (citing *Daubert*, 509 U.S. at 592–95).

The *Daubert* factors play a slightly different role in Vaccine Program cases than they do when applied in other federal judicial fora (such as the district courts). *Daubert* factors are usually employed by judges (in the performance of their evidentiary gatekeeper roles) to exclude evidence that is unreliable and/or could confuse a jury. In Vaccine Program cases, by contrast, these factors are used in the *weighing* of the reliability of scientific evidence proffered. *Davis v. Sec'y of Health & Human Servs*., 94 Fed. Cl. 53, 66–67 (2010) ("uniquely in this Circuit, the *Daubert* factors have been employed also as an acceptable evidentiary-gauging tool with respect to persuasiveness of expert testimony already admitted"). The flexible use of the *Daubert* factors to evaluate the persuasiveness and reliability of expert testimony has routinely been upheld. *See, e.g.*, *Snyder*, 88 Fed. Cl. at 742–45. In this matter (as in numerous other Vaccine Program cases), *Daubert* has not been employed at the threshold, to determine what evidence should be admitted, but instead to determine whether expert testimony offered is reliable and/or persuasive.

Respondent frequently offers one or more experts in order to rebut a petitioner's case. Where both sides offer expert testimony, a special master's decision may be "based on the credibility of the experts and the relative persuasiveness of their competing theories." *Broekelschen v. Sec'y of Health & Human Servs.*, 618 F.3d 1339, 1347 (Fed. Cir. 2010) (citing *Lampe*, 219 F.3d at 1362). However, nothing requires the acceptance of an expert's conclusion "connected to existing data only by the *ipse dixit* of the expert," especially if "there is simply too great an analytical gap between the data and the opinion proffered." *Snyder*, 88 Fed. Cl. at 743 (quoting *Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997)); *see also Isaac v. Sec'y of Health & Human Servs*., No. 08-601V, 2012 WL 3609993, at *17 (Fed. Cl. Spec. Mstr. July 30, 2012), *mot. for rev. denied*, 108 Fed. Cl. 743 (2013), *aff'd*, 540 F. Appx. 999 (Fed. Cir. 2013) (citing *Cedillo*, 617 F.3d at 1339). Weighing the relative persuasiveness of competing expert testimony, based on a particular expert's credibility, is part of the overall reliability analysis to which special masters must subject expert testimony in Vaccine Program cases. *Moberly*, 592 F.3d at 1325–26 ("[a]ssessments as to the reliability of expert testimony often turn on credibility determinations"); *see also Porter v. Sec'y of Health & Human Servs*., 663 F.3d 1242, 1250 (Fed. Cir. 2011) ("this court has unambiguously explained that special masters are expected to consider the credibility of expert witnesses in evaluating petitions for compensation under the Vaccine Act").

Expert opinions based on unsupported facts may be given relatively little weight. *See Dobrydnev v. Sec'y of Health & Human Servs.*, 556 F. Appx. 976, 992–93 (Fed. Cir. 2014) ("[a] doctor's conclusion is only as good as the facts upon which it is based") (citing *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209, 242 (1993) ("[w]hen an expert assumes facts that are not supported by a preponderance of the evidence, a finder of fact may properly reject

the expert's opinion")). Expert opinions that fail to address or are at odds with contemporaneous medical records may therefore be less persuasive than those which correspond to such records. *See Gerami v. Sec'y of Health & Human Servs.*, No. 12-442V, 2013 WL 5998109, at *4 (Fed. Cl. Spec. Mstr. Oct. 11, 2013), *aff'd*, 127 Fed. Cl. 299 (2014).

D. *Consideration of Medical Literature*

Both parties filed medical and scientific literature in this case, but not every filed item factors into the outcome of this decision. While I have reviewed all the medical literature submitted in this case, I discuss only those articles that are most relevant to my determination and/or are central to Petitioner's case—just as I have not exhaustively discussed every individual medical record filed. *Moriarty v. Sec'y of Health & Human Servs.*, 844 F.3d 1322, 1328 (Fed. Cir. 2016) ("[w]e generally presume that a special master considered the relevant record evidence even though he does not explicitly reference such evidence in his decision") (citation omitted); *see also Paterek v. Sec'y of Health & Human Servs.,* 527 F. Appx. 875, 884 (Fed. Cir. 2013) ("[f]inding certain information not relevant does not lead to—and likely undermines—the conclusion that it was not considered").

E. *Consideration of Comparable Special Master Decisions*

In reaching a decision in this case, I have considered other decisions issued by special masters (including my own) involving similar injuries, vaccines, or circumstances. I also reference some of those cases in this Decision, in an effort to establish common themes, as well as demonstrate how prior determinations impact my thinking on the present case.

There is no error in doing so. It is certainly correct that prior decision in different cases do not *control* the outcome herein.[11] *Boatmon v. Sec'y of Health & Human Servs.,* 941 F.3d 1351, 1358–59 (Fed. Cir. 2019); *Hanlon v. Sec'y of Health & Human Servs.*, 40 Fed. Cl. 625, 630 (1998). Thus, the fact that another special master reasonably determined elsewhere, on the basis of facts not in evidence in this case, that preponderant evidence supported the conclusion that vaccine X caused petitioner's injury Y does not compel me to reach the same conclusion in *this* case. Different actions present different background medical histories, different experts, and different items of medical literature, and therefore can reasonably result in contrary determinations.

However, it is *equally* the case that special masters reasonably draw upon their experience

[11] By contrast, Federal Circuit rulings concerning legal issues are binding on special masters. *Guillory v. Sec'y of Health & Human Servs.*, 59 Fed. Cl. 121, 124 (2003), *aff'd* 104 F. Appx. 712 (Fed. Cir. 2004); *see also Spooner v. Sec'y of Health & Human Servs.*, No. 13-159V, 2014 WL 504728, at *7 n.12 (Fed. Cl. Spec. Mstr. Jan. 16, 2014). Special masters are also bound within a specific case by determinations made by judges of the Court of Federal Claims after a motion for review is resolved.

in resolving Vaccine Act claims. *Doe v. Sec'y of Health & Human Servs.,* 76 Fed. Cl. 328, 338–39 (2007) ("[o]ne reason that proceedings are more expeditious in the hands of special masters is that the special masters have the *expertise and experience to know the type of information that is most probative of a claim*") (emphasis added). They would therefore be remiss in ignoring prior cases presenting similar theories or factual circumstances, along with the reasoning employed in reaching such decisions. This is especially so given that special masters not only routinely hear from the same experts in comparable cases but are also repeatedly offered the *same* items of medical literature regarding certain common causation theories. It defies reason and logic to obligate special masters to "reinvent the wheel", so to speak, in each new case before them, paying no heed at all to how their colleagues past and present have addressed similar causation theories or fact patterns. It is for this reason that prior decisions can have high persuasive value—and why special masters often explain how a new determination relates to such past decisions.[12] Even if the Federal Circuit does not *require* special masters to distinguish other relevant cases (*Boatmon,* 941 F.3d at 1358), it is still *wise* to do so.

ANALYSIS

I. Overview of Pneumococcal Vaccine and GBS

As literature filed in this case establishes, GBS is a peripheral neuropathy involving rapidly-progressive and ascending motor neuron paralysis. S. Vucic et al., *Guillain-Barré Syndrome: An Update*, 16 J. Clinical Neuroscience 733, 733–34 (2009), filed as Ex. 8.4 on Aug. 3, 2017 ("Vucic").[13] Its etiology is unknown, although two-thirds of GBS cases follow an antecedent infection (typically an upper respiratory tract or gastrointestinal infection) beginning a few weeks prior to symptoms onset. *Id.* at 733. GBS has also been reported following surgery, head trauma, and vaccination. *Id.* at 734. It is believed to have an autoimmune mechanism. *Id.* at 733–34. A GBS diagnosis centers on a thorough medical assessment involving clinical presentation, nerve conduction studies, and CSF analysis. *Id.* at 734.

GBS's primary clinical features are generalized muscle weakness combined with sensory symptoms. Vucic at 734. GBS typically begins abruptly with paresthesia in the feet, progressing to a flaccid paralysis of the lower limbs and ascending to the trunk, upper limbs, and face (although some cases involve paresthesia in all four limbs simultaneously or paresthesia beginning in the upper limbs and descending downward). *Id.* at 733–34. Weakness of the facial muscles is common

[12] Consideration of prior determinations is a two-way street that does not only inure to the benefit of one party. Thus, I would likely take into account the numerous decisions finding no association between vaccination and autism when confronted with a new claim asserting autism as an injury and have informed such claimants early in the life of their case that the claim was not viable for just that reason. But I would *also* deem a non-Table claim asserting GBS after receipt of the flu vaccine as not requiring extensive proof on *Althen* prong one "can cause" matters, for the simple reason that the Program has repeatedly litigated the issue in favor of petitioners.

[13] Vucic was filed on compact disk, and therefore lacks an ECF filing number identifier.

and is frequently bilateral. *Id.* at 734. Respiratory weakness is a common feature (requiring arterial ventilation in severe cases). *Id.* Increased protein levels in the cerebral spinal fluid without a corresponding increase in cells is another common characteristic of GBS. Vucic at 735. The AIDP variant (consistent with Petitioner's diagnosis) is the most common form of GBS, accounting for approximately ninety percent of cases in the United States. *Id.* at 733.

GBS patients typically reach nadir of their illness between two and four weeks following onset. Vucic at 734, 737. Although GBS is considered a monophasic illness, between seven and sixteen percent of patients suffer recurrent episodes of worsening *after* initial onset and improvement. *Id.* at 734. Sequela of GBS can include persistent motor deficits in some cases. *Id.* at 737. The majority of patients reach a full recovery (with only ten to twenty percent experiencing significant deficits). *Id.* Up to one-third of GBS patients require some alteration to their daily routine due to the residual functional deficits. *Id.* Adverse prognosis factors can include: older age at disease onset (i.e., >50 years), severity of the disease course at nadir, rapid onset, and the presence of an underlying infection. *Id.*

The association between vaccines—specifically the flu vaccine—and GBS is well-established in the Vaccine Program. *See, e.g.*, *Chinea v. Sec'y of Health & Human Servs.*, No. 15-095V, 2019 WL 1873322 (Fed. Cl. Spec. Mstr. Mar. 15, 2019); *Strong v. Sec'y of Health & Human Servs.*, No. 15-1108V, 2018 WL 1125666 (Fed. Cl. Spec. Mstr. Jan. 12, 2018); *Stitt v. Sec'y of Health & Human Servs.,* No. 09-653V, 2013 WL 3356791 (Fed. Cl. Spec. Mstr. May 31, 2013); *Stewart v. Sec'y of Health & Human Servs.*, No. 06-777V, 2011 WL 3241585, at *16 (Fed. Cl. Spec. Mstr. July 8, 2011); *see also Barone v. Sec'y of Health & Human Servs.,* No. 11-707V, 2014 WL 6834557 (Fed. Cl. Spec. Mstr. Nov. 12, 2014). Such cases often rely on the theory of molecular mimicry, proposing that antibodies produced by B cells in response to the vaccine's viral antigen components cross-attack the myelin sheath (because the target antigen and gangliosides of the myelin sheath share structural homology), thereby causing demyelination of peripheral nerves. *See Chinea*, 2019 WL 1873322, at *15. Ultimately, GBS was added in 2017 as a Table Claim for the flu vaccine—although it is not a recognized Table injury for the pneumococcal vaccine. *See* 42 C.F.R. § 100.3(a).

Unlike the flu vaccine, pneumococcal vaccines can be non-conjugated (such as the Pneumovax vaccine) or conjugated (such as Prevnar-13), and target several strains of the *S. pneumoniae* bacteria. P. Durando et al., *Experience with Pneumococcal Polysaccharide Conjugate Vaccine (Conjugated to CRM197 Carrier Protein) in Children and Adults*, 19 Clinical Microbiology & Infection 1, 1–2 (2013), filed as Ex. 9.10 on Mar. 16, 2018 (ECF No. 25-8). The vaccine at issue in this matter, Prevnar-13, is a pneumococcal vaccine conjugated with CRM_{197} and induces immunity through a T cell-dependent response. *Id.* at 3. This is in direct contrast to unconjugated vaccines, in which immunity is induced exclusively through B cell antibody production (and are thus "T cell independent"). *Id.* Thus, as a threshold matter it is questionable whether a vaccine that functions through T cell stimulation, like the version of the pneumococcal

vaccine at issue, is as likely to cause a B cell-driven disease such as GBS – especially in the absence of evidence that the vaccine's other antigenic components are associated with that kind of peripheral neuropathy.

Although there are many Program cases in which a petitioner has successfully *settled* a claim alleging that the pneumococcal vaccine (usually when administered at the same time as a flu vaccine) caused GBS,[14] I have found no *reasoned decisions* reaching this conclusion. Indeed, there are very few reasoned decisions at all discussing the kinds of injuries the pneumococcal vaccine can cause, or has been explicitly found to likely cause—and those that do exist suggest that petitioners cannot prevail simply by arguing that the same medical and scientific evidence associating *viral* component vaccines with various peripheral or central nervous system neuropathies can simply be transferred wholesale to apply to a polysaccharide-based *bacterial* component vaccine. *See L.M. v. Sec'y of Health & Human Servs.*, No. 14-714V, 2019 WL 4072130, at *26 (Fed. Cl. Spec. Mstr. July 23, 2019) (discussing how vaccines generally can induce seizures through a variety of mechanisms, but not discussing which mechanisms specific to and/or components of the pneumococcal vaccine could cause the alleged injury).

II. Petitioner has not Carried Her Burden of Proof[15]

A. *Althen* Prong One

Petitioner was unable to preponderantly establish that the pneumococcal vaccine likely can cause GBS. As discussed above, the mechanism Petitioner embraces—molecular mimicry—is well-established in the Vaccine Program to explain the pathogenic process behind GBS. *See, e.g.*, *Chinea*, 2019 WL 1873322, at *29. Molecular mimicry is predominantly driven by B cell activity, occurring when antibodies are produced that recognize both antigenic components of the vaccine and self-structures due to shared structural homology, resulting in harmful cross-reactions. *See id.* at *15. Program cases alleging GBS after receipt of the flu vaccine have shown that both the wild

[14] *See Dyttmer v. Sec'y of Health & Human Servs.*, No. 18-1546V, 2019 WL 6045557 (Fed. Cl. Spec. Mstr. Oct. 15, 2019) (alleging development of GBS following administration of both the flu and pneumococcal vaccines); *Johnson v. Sec'y of Health & Human Servs.*, No. 17-1810V, 2019 WL 6242278 (Fed. Cl. Spec. Mstr. Sept. 24, 2019) (alleging development of GBS after receipt of the pneumococcal vaccine); *Lepper v. Sec'y of Health & Human Servs.*, No. 18-984V, 2019 WL 5718066 (Fed. Cl. Spec. Mstr. Aug. 6, 2019) (alleging development of GBS following administration of both the flu and pneumococcal vaccines); *Franco v. Sec'y of Health & Human Servs.*, No. 16-99V, 2018 WL 945851 (Fed. Cl. Spec. Mstr. Jan 26, 2018) (alleging development of GBS after administration of the pneumococcal vaccine); *Emmons v. Sec'y of Health & Human Servs.*, No. 11-211V, 2011 WL 5299382 (Fed. Cl. Spec. Mstr. Sept. 29, 2011) (alleging development of GBS following receipt of the Tdap and pneumococcal vaccines).

[15] With respect to the third *Althen* prong, the onset of Petitioner's neuropathic symptoms—approximately one to three weeks post-vaccination—is consistent with the timeframe for clinical manifestations of an autoimmune response after causal trigger under Petitioner's theory. However, *the theory itself*, as noted above, is insufficiently supported with reliable scientific or medical evidence. Because my determination herein turns more on the first and second prongs, Petitioner's success or failure at establishing evidence to support this one does not alter my conclusion.

flu virus and flu vaccines contain proteins that share sequential and structural homology to self-structures (gangliosides) capable of cross reactivity. *Id.*

The parties appear to agree that molecular mimicry can also occur after exposure to certain bacterial antigens. *See* Tr. at 15, 145, 220, 254–56; Vucic at 733–34 (describing the pathogenesis of GBS following exposure to both viral and bacterial infections and/or immunizations). Indeed, much of the literature offered in this matter establishes that exposure to bacteria such as *C. jejuni* is associated with an increased risk of developing GBS via molecular mimicry. Vucic at 733–34. But as Petitioner's and Respondent's experts agreed, there is *no* such association between wild *S. pneumoniae* bacterial infections and the subsequent development of GBS. Tr. at 27, 40, 106, 147, 215. Thus, the remaining question is whether vaccines derived from the polysaccharides of *S. pneumoniae* possess sufficient homology to initiate cross reactivity when the wild bacteria itself does not.

Rather than attempt to address that question, Petitioner's theory relied on the purported *amplification* of such mimicry-driven autoimmune processes due to the induction of T cell-dependent responses attributable to the diphtheria conjugate in the pneumococcal vaccine. Tr. at 24–26. But the contribution of T cells to the vaccine's functioning (due to the inclusion of CRM_{197}) does not explain how the autoimmune process necessary to cause GBS, which is B cell-oriented, would *also* begin after receipt of the pneumococcal vaccine. How would the pneumococcal vaccine theoretically drive this B cell reaction? Dr. Levy argued that the polysaccharide components of the pneumococcal vaccine were likely responsible, yet he conceded that homology between *S. pneumoniae* polysaccharides and self-structures has not been identified. Tr. at 64, 304. Respondent's expert, Dr. Whitton, similarly noted that the polysaccharides contained in the pneumococcal vaccine do not share structural homology with self-structures of the peripheral nervous system, and therefore do not contribute to the pathogenesis of GBS. *Id.* at 257. It thus is not likely that the autoimmune cross-reaction understood to result in GBS after exposure to different viruses or bacteria would also necessarily occur after exposure to *this vaccine*—even if the vaccine is formulated to induce a heightened T cell response.

Though molecular mimicry is a generally accepted scientific principle, mere invocation of the scientific term does not carry a petitioner's burden in a Program case. *Forrest v. Sec'y of Health & Human Servs.*, No. 14-1046V, 2019 WL 925495, at *3 (Fed. Cl. Spec. Mstr. Jan. 18, 2019) (citing *Caves v. Sec'y of Health & Human Servs.*, 100 Fed. Cl. 119, 135 (2011), *aff'd without opinion*, 463 F. App'x 932 (Fed. Cir. 2012)). Instead, petitioners must demonstrate that the mechanism likely does link the vaccine in question to the relevant injury. *See Yalacki v. Sec'y of Health & Human Servs.*, No. 14-278V, 2019 WL 1061429, at *34 (Fed. Cl. Spec. Mstr. Jan. 31, 2019), *aff'd*, 146 Fed. Cl. 80 (2019). No such showing was made in this matter. Petitioner did not persuasively establish that *any* component of the pneumococcal vaccine can initiate B cell production of autoantibodies associated with GBS. As a result, the role the conjugate might play

in boosting an immune response into a pathogenic process does not matter if the process *itself* is unlikely to lead to disease (since that process is not T cell dependent at the end of the day).

Even ignoring the above, Petitioner's showing with respect to the role the diphtheria conjugate was proposed to play herein was itself not reliably established. Dr. Whitton did concede that the CRM_{197} component of the vaccine was more likely to be the causal agent than the *S. pneumoniae* polysaccharide components (assuming the vaccine could cause GBS at all—an assumption Dr. Whitton rejected). Tr. at 273. However, Dr. Whitton accurately pointed out that the pathogenic nature of CRM_{197} could not be conflated with what was known about the diphtheria toxoid used as a conjugate in other vaccines. Tr. at 259–62, 272–73. Nor were the case reports,[16] offered to suggest that this component might be the key factor in triggering GBS, particularly persuasive as evidence of causation. *See Pearson v. Sec'y of Health & Human Servs.*, No. 17-489V, 2019 WL 1150044, at *11 (Fed. Cl. Spec. Mstr. Feb. 7, 2019) (concluding that case reports receive only limited evidentiary weight and cannot cure *Althen* prong one deficiencies); *see also Harris v. Sec'y of Health & Human Servs*., No. 10-322V, 2014 WL 3159377, at *18 (Fed. Cl. Spec. Mstr. June 10, 2014) (noting that "case reports are generally not a valuable form of evidence")). And no other evidence was offered to support a finding that CRM_{197} can induce cross reactivity resulting in GBS.

Petitioner's argument was further undermined by the literature filed in this matter. Baxter, for example, found no increased risk of GBS following vaccination—although it admittedly involved a different, unconjugated version of the vaccine, thus limiting the weight to give to its conclusions. Baxter at 203. Haber, however, which studied VAERS data related to the conjugated Prevnar-13 vaccine, *also* found "no disproportionate reporting for GBS." Haber at 6334. And although Petitioner offered some credible expert testimony in this matter, Respondent's experts, and particularly Dr. Whitton, were ultimately more persuasive. Dr. Souayah's expertise in elucidating the diagnostic criteria of GBS did not make him qualified to opine on the immunologic issues. Petitioner's second expert, Dr. Levy, did possess such immunologic qualifications, but was unable to bulwark his views with persuasive and reliable supportive evidence.

As a result, my analytic weighing of the evidence in this case did not permit the conclusion that the pneumococcal vaccine likely can cause GBS. In another case, with better medical or scientific evidence of how the pneumococcal vaccine (or even wild *S. pneumoniae* bacterial infections) can impact specific parts of the CNS, the outcome could easily be favorable to a petitioner. As science advances, and/or the issue is subject to further (or updated) study, more evidence may be developed that supports the kind of claim asserted herein. But it does not exist *today,* and was not offered in this case.

[16] *See* R. Bakshi, *Guillain-Barré Syndrome After Combined Tetanus-diphtheria Toxoid Vaccination*, 147 J. Neurological Sci. 201, 201–02 (1999), filed as Ex. 9.11 on Mar. 16, 2018 (ECF No. 25-9); H. Ammar, *Guillain-Barré Syndrome After Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine: A Case Report*, 5 J. Med. Case Rep. 1, 1–3 (2011), filed as Ex. 9.12 on Mar. 19, 2018 (ECF No. 26).

B. *Althen* Prong Two

The second *Althen* prong requires petitioners to preponderantly establish that the vaccine in question *did cause* the alleged injury. *Althen*, 418 F.3d at 1278. The medical record in this case does contain some favorable evidence on this point, mainly in the form of statements made by Petitioner's treating physicians in which they expressed the opinion that her GBS was the result of the pneumococcal vaccine she received. Ex. Ex. 6 at 9; 7 at 20–23. Such evidence is worthy of *some* weight.

It is, however, well understood in the Program that I am not bound by treater opinions, especially when other evidence rebuts or contradicts the grounds for such views. *Snyder*, 88 Fed. Cl. at 746 n.67 ("there is nothing . . . that mandates that the testimony of a treating physician is sacrosanct—that it must be accepted in its entirety and cannot be rebutted"). Here, and as previously discussed, none of the literature filed in this matter or expert testimony marshalled at hearing was sufficient to establish a causal relationship between the pneumococcal vaccine and Petitioner's subsequent development of GBS. And though Drs. Levy and Souayah were credible and knowledgeable in their respective fields, neither was able to preponderantly substantiate his opinions with reference to his own experience researching or studying the condition or its relationship to vaccination.

Thus, although the treater views in this case do aid Petitioner's showing, they ultimately relied too much on the obvious temporal relationship between vaccination and injury to carry Petitioner's "did cause" burden. This determination is bulwarked by the unpersuasive showing Petitioner made on the first, "can cause" prong. Even if I had found in this case that Petitioner had satisfied the "did cause" prong, her failure to preponderantly establish the first prong would still be fatal to her claim. *W.C.*, 704 F.3d at 1356.

C. Alternative Causation

Though the parties agree that Petitioner was accurately diagnosed with AIDP-type GBS, it is undisputed that she suffered from several other concurrent comorbidities. Specifically, Petitioner had a known medical history of diabetic neuropathy, which was treated with gabapentin and metformin. Tr. at 91–92, 101. Additionally, just weeks before her GBS diagnosis, Ms. Deshler was also diagnosed with breast cancer. Ex. 4 at 2517–18. This diagnosis, in conjunction with her neuropathic symptoms, led some treaters to question whether her neuropathic symptoms were attributable to a paraneoplastic syndrome. Ex. 3 at 6 ("Also to be considered is a paraneoplastic polyneuropathy given her recent breast cancer diagnosis.").

Respondent's arguments did not ultimately turn on whether Petitioner's condition was more likely due to paraneoplastic syndrome or something else, and Respondent's experts did not firmly propose these as better-supported explanations or preponderantly establish them. I thus do not find that an alternative cause for Petitioner's GBS was established. However, the burden to so prove never shifted to Respondent in the first place, for the reasons stated above. *See de Bazan v. Sec'y of Health & Human Servs.*, 539 F.3d 1347, 1354 (Fed. Cir. 2008) (the burden to prove alternative causation shifts only after a petitioner has met their own burden). And while the evidence offered in this case only permits me to conclude that Petitioner's GBS was idiopathic in origin, I note that Petitioner herself did not adequately explain away these other factors complicating the factual record. At a minimum, they undermine the claim of experts like Dr. Levy that the record set forth no other possible explanations for the genesis of Petitioner's GBS. Tr. at 13–14.

CONCLUSION

The Vaccine Act permits me to award compensation to a petitioner alleging a "non-Table Injury" only if she can show by medical records or competent medical opinion that the injury was more likely that not vaccine-caused. Here, Petitioner's claim depends on my finding that her GBS could be, and was, caused by the pneumococcal vaccine, but the weight of the evidence does not support that conclusion. Thus, there is insufficient evidence to support an award of compensation, leaving me no choice but to hereby **DENY** this claim.

In the absence of a motion for review filed pursuant to RCFC Appendix B, the clerk of the court **SHALL ENTER JUDGMENT** in accordance with the terms of this decision.[17]

IT IS SO ORDERED.

s/ Brian H. Corcoran
Brian H. Corcoran
Chief Special Master

[17] Pursuant to Vaccine Rule 11(a), the parties may expedite entry of judgment if (jointly or separately) they file notices renouncing their right to seek review.