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13 Attorneys for Defendant,
14 through the Arizona Justice Project

15 IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
16 IN AND FOR THE COUNTY OF MARICOPA

17 STATE OF ARIZONA,

18 Plaintiff,

19 vs.

20 DRAYTON SHAWN WITT,

21 Defendant.

No. CR2000-017311

**MOTION TO EXCLUDE THE
STATE'S EXPERT TESTIMONY**

(Assigned to the Honorable Robert
Gottsfield)

Hearing Set for Feb. 1, 2013

22 *"The problem is not what we don't know, but what we do know that isn't so."*

23 -- quote often attributed (incorrectly) to Will Rogers.

24 **I. Introduction**

25 This is a Shaken Baby Syndrome ("SBS") prosecution. That means it is a
26 prosecution based on a scientific hypothesis that has crumbled over the last decade. In
27 2002, the State and its medical experts invoked SBS to convict Drayton Witt of shaking
28 his baby son to death. They claimed it was a reliable diagnosis that proved beyond a
reasonable doubt that Mr. Witt violently shook his son even though: the baby had been

1 sick his whole life and even hospitalized for a week with seizures less than a month before
2 he died; the baby had no bruises, grip marks, or other outward sign of abuse; and the baby
3 had no focal lesions on his brain to indicate whiplash-like trauma. Today, the medical
4 examiner and overwhelming scientific and medical evidence tell us that the SBS diagnosis
5 in this case was plainly wrong, yet the State stubbornly persists.

6 In 2000, when baby Steven died at the age of 4 months 28 days, SBS was widely
7 accepted in the medical community. The Phoenix Children’s Hospital (“PCH”) doctors
8 who briefly treated Steven before he died diagnosed him with SBS almost immediately
9 after looking into his eyes and seeing his CT scan. But in the decade since PCH made that
10 diagnosis, an avalanche of science has exposed the SBS hypothesis as unreliable,
11 particularly in cases like Steven’s, where there were no outward signs of impact or abuse.
12 That is why Dr. Mosley, the Maricopa County medical examiner who in 2000 declared
13 Steven’s death a homicide based on SBS, has, in this case, given sworn testimony
14 recanting his conclusion and saying that he now believes Steven died of natural causes.
15 Similarly, Dr. A. Norman Guthkelch, the British pediatric neurosurgeon whose 1971 paper
16 set forth the original SBS hypothesis has given sworn testimony in this case that the SBS
17 hypothesis has never been validated in cases like Steven’s and that he, too, believes Steven
18 died of natural causes. And Dr. Patrick Barnes, the pediatric neuroradiologist who
19 famously testified against nanny Louise Woodward in 1997, likewise has given sworn
20 testimony in this case that Steven’s medical records contain zero indicators of non-
21 accidental trauma, and it is also his opinion that Steven died of natural causes. They have
22 altered their opinions because both the science underpinning the SBS hypothesis and the
23 method used to diagnose non-accidental head trauma in infants has evolved.

24 This motion to preclude is brought under revised Arizona Rule of Evidence 702
25 (“Rule 702”) and *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993)
26 (“*Daubert I*”), which require the Court to play a pretrial “gatekeeping” role to ensure that
27 proffered expert testimony is: (1) reliable, that is, grounded in valid scientific methods and
28 principles, (2) directly relevant to the case at hand, and (3) that the proposed experts are

1 qualified on the subjects that form the basis of their opinions.¹ If the State cannot
2 demonstrate that its medical causation evidence meets the standards of Rule 702 and
3 *Daubert*, the Court must preclude the evidence.

4 Although the State has not designated any experts on retrial,² the State’s medical
5 witnesses who testified in 2000 undeniably testified as purported experts; each rendered a
6 medical opinion about both the mechanism of SBS generally and the specific cause of
7 Steven’s death, supposedly based on their understanding of the scientific literature
8 pertaining to SBS and their review of Steven’s medical records. Medical causation
9 testimony, whether offered by a treating or independent expert, is subject to judicial
10 scrutiny under *Daubert* and Rule 702.

11 Since the *Daubert* decision, when faced with controversial expert testimony, courts
12 often reiterate this caution: “The courtroom is not the place for scientific guesswork, even
13 of the inspired sort. Law lags science; it does not lead it.”³ At best, SBS is a highly
14 controversial, unproven hypothesis unfit to serve as the basis for a murder prosecution; at
15 worst, SBS is junk science, a tragic hoax caused by overzealousness within the child
16 protection community that has contributed to hundreds if not thousands of wrongful
17 convictions. In either event, testimony about SBS must be precluded from any retrial of
18 Mr. Witt.

19 **II. Background**

20 Babies sometimes die without an obvious explanation. Beginning in the
21 1970s, pediatric doctors began advancing a hypothesis that, if a baby became very

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23 ¹ As of January 2012, Arizona’s Rule of Evidence 702, which sets forth the standard for
24 admissibility of expert testimony, now conforms to the federal rule. Accordingly,
25 Arizona’s courts now have a duty to “serve as gatekeepers in assuring that proposed expert
26 testimony is reliable and thus helpful to the jury’s determination of facts at issue.” See
27 Rule 702 cmt to 2012 Amendment.

28 ² Drayton intends to separately file a Motion to Dismiss the State’s case pursuant to
Arizona Rule of Criminal Procedure 15.7 based on the State’s failure to disclose its expert
witnesses under Rules 15.3 and 15.6 and this Court’s prior order.

³ See, e.g., *Hendrix v. Evenflo Co.*, 609 F.3d 1183, 1203 (11th Cir. 2010) (quoting *Rider v.*
Sandoz Pharms. Corp., 295 F.3d 1194, 1202 (11th Cir. 2002) (quoting *Rosen v. Ciba-*
Geigy Corp., 78 F.3d 316, 319 (7th Cir. 1996)).

1 ill or died without an obvious reason why, and the baby had a certain “triad” of
2 findings -- (1) blood in the subdural area around the brain (subdural hemorrhage);
3 (2) microscopic bleeding within its retina (retinal hemorrhage); and (3)
4 encephalopathy (damage of the brain itself often accompanied by brain swelling
5 and a comatose state) -- that meant the baby had been violently shaken. They
6 called this constellation of symptoms “Shaken Baby Syndrome.” Those
7 advocating the hypothesis claimed that this triad of physical findings is virtually
8 unique to violent shaking.

9 By the time Steven died, the SBS hypothesis included well-accepted
10 dogma -- repeatedly espoused at child abuse trials -- about *how* shaking caused
11 these symptoms. Specifically, SBS advocates said that shaking causes the baby’s
12 brain to slide back and forth, which, in turn, causes bridging veins around the
13 brain to tear or rupture and thus hemorrhage into the subdural area overlying the
14 brain. Similarly, shaking forces were believed to cause retinal blood vessels to
15 strain and then burst, causing microscopic retinal hemorrhages. And the real
16 harm -- the brain damage and swelling -- was believed to be caused by nerve
17 fibers within the baby’s brain shearing during shaking. A shaken baby, the
18 hypothesis went, would be immediately comatose from these injuries, meaning
19 that an SBS diagnosis was seen as pinpointing the perpetrator and the time of
20 injury as well.

21 The following background discussion lays out Steven’s medical history,
22 which essentially constitutes the “facts” that the State’s experts claim prove SBS.
23 It also summarizes the expert SBS testimony given at Mr. Witt’s initial trial --
24 testimony that falsely convicted Mr. Witt and that cannot be allowed again.

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A. Steven Witt

1. His Parents

Drayton Witt⁴ and Maria Holt met while they were very young. In January of 1999, they began dating. Maria was 19 and Drayton was 17. About two months later, they briefly separated. While they were apart, Maria was involved in another relationship and became pregnant. (App. Tab 25 at 39:3-15.)⁵ Shortly thereafter, Maria and Drayton decided to give their relationship another try. Drayton told Maria that he loved her and he would love the baby. (*Id.* at 40:7-14.) Drayton kept his word.

2. Steven’s Traumatic Birth

Steven was born on January 5, 2000, at Paradise Valley Hospital, identified in the hospital records as a “FULL TERM NEONATE W MAJOR PROBLEMS.” (App. Tab 9 at PET-000002.) The delivery was traumatic for Steven. He was born with the umbilical cord wrapped tightly around his neck, had aspirated meconium (fecal matter), and he was in respiratory distress. (*Id.* at PET-000003-6.) The medical staff assigned Steven an APGAR score of 4 on a 10 point scale and diagnosed him as a “sick” baby with metabolic acidosis, low blood pressure, and low blood flow. (*Id.* at PET-000004.) He required fluid resuscitation, oxygen, and sodium bicarbonate to counteract the metabolic acidosis. (*Id.* at PET-000011.) He was noted to have a depressed central nervous system. (*Id.* at PET-000005.) Steven seemed to improve rapidly, however, and on January 7, 2000, was discharged home with his mother and father. (*Id.* at PET-000001.)

3. Steven’s Health Problems During His First 3 Months

Although the first few weeks following Steven’s release from the hospital were uneventful, this respite was short-lived. On February 4, 2000, Maria brought Steven to the pediatrician because he had been running a fever, coughing, and vomiting for three days. (App. Tab 10 at PET-000183.) The doctor diagnosed Steven with an upper respiratory

⁴ Throughout the remainder of this brief we refer to Drayton Witt as “Drayton” to more easily distinguish when we are talking about him as opposed to his wife or son.

⁵ The “App” references in this brief are to the Appendix filed by the defense in conjunction with the Petition for Post-Conviction Relief. For the Court’s convenience, however, we have attached the declarations referenced in this motion as exhibits.

1 infection and ordered a blood culture and urinalysis. (*Id.* at PET-000182-93.) Maria
2 called the doctor that same day to try to learn the result of the day’s testing. (*Id.* at PET-
3 000184.) Maria brought Steven back in the next day for a follow-up. (*Id.* at PET-
4 000194.)

5 A few weeks later, Steven was sick again. When Maria brought Steven back to his
6 pediatrician for his two-month check-up on March 7, it was noted that Steven had a fever
7 and was recovering from an upper respiratory infection. (*Id.* at PET-000195.) From
8 approximately this time forward, Maria was “always on the phone with the doctor or
9 going in to see his pediatrician.” (App. Tab 25 at 45:22-23.)

10 The following month, on Sunday, April 30, 2000, Maria took Steven to the
11 emergency room. He again had a fever, congestion, and was vomiting. (App. Tab 10 at
12 PET-000197.) Emergency room doctors suspected that Steven had early pneumonia and
13 gave him antibiotics. (App. Tab 11 at PET-000051.) They directed Maria to follow up
14 with Steven’s pediatrician the next day, which she did. (*Id.*; App. Tab 10 at PET-000198.)
15 When Maria called Steven’s pediatrician, she informed the doctor that Steven appeared a
16 little better but was still feverish. Although the emergency room doctors at Paradise
17 Valley Hospital had intended for Steven to be seen by his pediatrician the very next day
18 (Monday, May 1, 2000), Steven’s pediatrician decided not to schedule a visit until the
19 following Thursday. Instead, over the phone, Steven’s pediatrician prescribed Cefzil,
20 another antibiotic. (App. Tab 12 at PET-000068; App. Tab 10 at PET-000198.)

21 4. *Steven Has Massive Seizures*

22 Maria followed the pediatrician’s instructions, but, just a few hours after giving
23 Steven his first dose of Cefzil, Steven’s eyes deviated and his left eye could not focus.
24 Steven refused his bottle and simply laid there, holding his mother’s hand. Maria stayed
25 up all night with him alone, while Drayton was at work. (App. Tab 25 at 47:7-23.) Early
26 the next morning, on May 2, 2000, Maria was holding Steven when he suddenly threw up
27 and started to shake. At that moment, Drayton came home and they rushed Steven to the
28 Paradise Valley Hospital Emergency Room. (*Id.*)

1 Upon arriving at the ER, the doctor’s notes state that Steven was feverish and his
2 eyes were veering to the left. (App. Tab 12 at PET-000069.) Within an hour of his
3 arrival, while still in the ER, Steven had a grand mal seizure.⁶ (*Id.* at PET-000073.) The
4 ER doctors gave him Valium and the seizure activity initially appeared to stop. But he
5 remained semi-conscious, his body stiffening at times followed by a crying sound. (*Id.* at
6 PET-000073-74.) This continued for the next few hours even though doctors
7 administered several more doses of Valium. (*Id.* at PET-000074.) Doctors ordered a CT
8 scan and chest X-ray, but both were read as negative. (*Id.* at PET-000069, 000075.)
9 Paradise Valley ER doctors arranged for Steven’s transfer and admission to PCH. (*Id.* at
10 PET-000069.)

11 5. *Steven Spends Six Days at PCH*

12 When Steven arrived at PCH, he was sedated and identified as postictal -- in an
13 altered state of consciousness brought on by his seizures. (App. Tab 13 at PET-000230.)
14 The doctor’s notes indicate that there were no lesions on his skin and that his fontanel was
15 soft.⁷ (*Id.* at PET-000230, 000243.) Steven’s pupils were sluggish and pinpoint and he
16 was feverish. Despite having already received five doses of Valium, he soon again began
17 having seizures. (*Id.* at PET-000231.) Doctors did not know the cause of Steven’s
18 seizures. (*Id.*)

19 Steven underwent an EEG that came back “[s]everely abnormal” and indicated that
20 he was having “massive” subclinical seizures, despite having been administered
21 Phenobarbital, an anti-seizure medicine. (*Id.* at PET-000238, 000267, 000285.) The EEG
22 suggested “a significant encephalopathy associated with underlying bihemispheric disease
23 and cortical abnormalities.” (*Id.* at PET-000285.) The reading doctor wrote that these
24 findings could be attributable to an infectious or metabolic process or could indicate an

25 ⁶ A grand mal seizure is a significant seizure typically characterized by a loss of
26 consciousness and violent muscle contractions.

27 ⁷ A baby Steven’s age has soft areas in his skull where the cartilage between skull bones
28 has not yet hardened. These areas are called fontanels. When a fontanel hardens, bulges,
or feels “full” to the touch that is a sign that there may be increased intracranial pressure
and/or a build-up of blood or fluid.

1 anomalous central nervous system. (*Id.*) Steven also underwent a lumbar puncture, which
2 came back normal. Based on this result, doctors ruled out infection, homed in on a
3 structural abnormality as the most likely cause of Steven’s seizures and ordered an MRI.
4 (*Id.* at PET-000239.) Steven was transferred to the pediatric intensive care unit. (*Id.* at
5 PET-000238.) During the night, the oxygen level in Steven’s blood repeatedly declined.
6 The doctors believed that this indicated Steven was continuing to suffer repeated
7 subclinical seizures. (*Id.* at PET-000234, 000244.)

8 Steven improved somewhat on May 3 and, after the nurses noted that he had no
9 seizures on the night of May 3, on the morning of May 4, 2000, the PCH doctors
10 determined that Steven was doing well enough to be transferred out of the intensive care
11 unit. The nurse’s transfer notes from that morning, however, state that Steven was
12 “sluggish,” had manifested a “high-pitched” “neuro cry,” and had “pinpoint pupils” that
13 were thought to be secondary to seizure activity. (*Id.* at PET-000245-47, 000334.) The
14 nurse noted, however, that, “[i]n between episodes,” Steven was smiling and cooing. (*Id.*
15 at PET-000246.) The nurse on duty also documented that Steven’s fontanel had changed
16 and was now full, but the doctors did not document their response to the change in
17 fontanel. (*Id.* at PET-000334.) An EEG ordered the morning of May 4 confirmed
18 continued seizure activity. (*Id.* at PET-000247.) Additionally, Steven was noted to have
19 an ear infection as well as a heart murmur that previously went undetected. (*Id.* at PET-
20 000216, 000218, 000245, 000247.)

21 On May 5, while still at the hospital, Maria told the doctors that Steven did not
22 have the same head control as he had before, that his cry was different, and that he did not
23 track with his eyes as he had before. (*Id.* at PET-000248.) The doctor noted Maria’s
24 comments, but nonetheless stated that there were “no new issues.” (*Id.*) Steven was put
25 on ceftriaxone to rule out sepsis. (*Id.*) Steven underwent another EEG which was read as
26 mildly abnormal, consistent with a postictal state or mild encephalopathy.⁸ (*Id.* at PET-
27

28 ⁸ The term “encephalopathy” means a disorder or malfunction of the brain.

1 000292.) Although this was a significant improvement over the May 2 EEG, the
2 reviewing doctor noted that clinical observation was still warranted. (*Id.*)

3 May 6 was relatively uneventful, and Steven was discharged the following day, a
4 Sunday. (*Id.* at PET-000223-24, 000252.) Maria was instructed to take Steven to his
5 pediatrician on Tuesday and to continue giving him amoxicillin over the next 6 days and
6 Phenobarbital until a neurologist instructed otherwise. (*Id.* at PET-000224.) Maria also
7 was told to “go to the nearest emergency department if [Steven] has seizures with lethargy
8 or respiratory difficulty.” (*Id.*) Maria was to follow up with Steven’s neurologist “in four
9 to six weeks.” (*Id.* at PET-000224, 000368.) Sadly, Steven would not live to make that
10 appointment.

11 **6. Steven Continues Unwell After His Discharge from PCH**

12 The day after he was discharged by PCH, Steven’s eyes began twitching back and
13 forth again and his pupils would pinpoint, like they did in the hospital when he was having
14 a seizure. Maria called the PCH Emergency Room to ask whether this was a side effect of
15 the Phenobarbital. (App. Tab 25 at 50:11-18.) Two days following Steven’s discharge
16 from PCH, Maria brought Steven to his pediatrician as directed. The pediatrician noted
17 Steven’s hospital stay for seizures and the possibility of an unproven sepsis infection.
18 Maria was told to follow up with the neurologist as scheduled and to hold off on further
19 immunizations until cleared by the neurologist. (App. Tab 10 at PET-000200.)

20 Steven was never the same again. He would have better days and worse days, but
21 he was never a normal, healthy child. (*Id.* at 52:19-53:3.) Maria continued to call
22 Steven’s pediatrician and PCH to ask if Steven’s worrisome behavior was a normal effect
23 of the strong medications he was taking. (*Id.* at 50:11-18.) Steven’s maternal
24 grandmother observed that Steven was sick all the time during the month of May,
25 repeatedly throwing up. (*Id.* at 98:8-17.) Maria’s neighbor, a former nurse, also saw that
26 Steven had problems following his return home from PCH. (App. Tab 29 at 89:20-90:15.)

27 In the last two weeks of May, Steven’s health deteriorated. On Friday, May 26th,
28 Maria brought Steven back to his pediatrician. Steven had been feverish and projectile

1 vomiting since the previous Sunday (May 21) and as a result was not able to keep his food
2 or medication down. (App. Tab 25 at 51:13-52:18; App. Tab 10 at PET-000201.) The
3 pediatrician noted Steven's seizure disorder, but found him to be well hydrated and in
4 good spirits and told Maria that his symptoms likely were being caused by the flu. (App.
5 Tab 10 at PET-000201; App. Tab 25 at 53:4-22.) He instructed Maria to monitor Steven,
6 continue on the course of antibiotics and Phenobarbital, and gave her information on oral
7 rehydration therapy due to the continued loss of fluids from vomiting. (App. Tab 10 at
8 PET-000201.) The pediatrician noted Maria's request for a referral to a pediatric
9 neurologist; Maria had asked for one that would be covered by her insurance plan. (*Id.*;
10 App. Tab 25 at 59:15-60:3.)

11 Steven's condition worsened. During the last week of May, he was very feverish
12 and his pupils again appeared pinpoint. He again had a high-pitched cry and had
13 difficulty sleeping. He could only stay asleep while holding onto Drayton or Maria's
14 fingers. (App. Tab 25 at 60:4-14.)

15 On May 28th, Drayton placed Steven on the bed for a minute to grab dry cloths
16 following a bath. Drayton came back to find that Steven had rolled off the bed. (*Id.* at
17 56:17-57:5.) Drayton called Maria to tell her what had happened and, when she returned
18 home, they brought Steven to see their neighbor, a former nurse. (App. Tab 29 at 85:4-7.)
19 The neighbor examined Steven and determined that he had not been harmed by the fall.
20 (*Id.* at 85:8-86:8.)

21 On May 29 and 30, Maria made calls to PCH and her pediatrician, trying to figure
22 out if Steven's condition was normal. Maria called Steven's pediatrician again on
23 Tuesday, May 30, to tell him that Steven was still throwing up. The pediatrician
24 suggested that she follow up with the neurologist. When Maria reminded him that he was
25 supposed to refer her to a neurologist covered by her insurance, he promised to get back to
26 her that same day. The pediatrician, however, did not call her back with a referral. (App.
27 Tab 25 at 59:24-60:3.) On Wednesday, May 31, Steven was watched by a neighbor while
28 Maria was at work. Again, he vomited his food and medicine. (*Id.* at 61:22-62:6.)

1 Maria's mother was so concerned about Steven's health that, on May 31, she brought
2 Maria a cross because she sensed that things were not right with Steven. (*Id.* at 99:22-24.)

3 7. *Steven's Seizures Return With Catastrophic Results*

4 On June 1, 2000, Maria thought that Steven was doing better. He had half of a
5 Pediatric Pop and slept most of the day. (*Id.* at 63:1-6.) That afternoon Drayton drove
6 Maria to work while Steven slept in the back of the car. Maria called Drayton several
7 times to check on Steven. A little after 8:00 p.m., Maria again called to check on Steven
8 and Drayton told her that he thought Steven might be having a seizure because his eyes
9 were not normal and he was fussy. They agreed that Drayton would come pick her up at
10 work and they would take Steven to the hospital. (*Id.* at 64:7-65:6.) Drayton picked up
11 Maria, but Steven had a major seizure. Drayton told Maria to drive so that he could get in
12 the back seat and perform CPR on Steven. (*Id.* at 66:8-11.)

13 After approximately a thirty-minute drive, Drayton and Maria arrived at Paradise
14 Valley Hospital at approximately 9:15 p.m. and reported that Steven had had seizures and
15 stopped breathing. (App. Tab 14 at PET-000091.) According to the ER notes, when
16 Steven arrived he was pale and not breathing. (*Id.* at PET-000091-92.)

17 Doctors had tremendous trouble trying to resuscitate Steven. Dr. Farha Kahn
18 initially tried to intubate Steven, but records indicate that she had "some difficulty." (*Id.*
19 at PET-000087.) Dr. Michael Haley was asked to assist her. At 9:20 p.m., Dr. Haley
20 inserted a tube into Steven's trachea, he thought successfully, but Steven soon began to
21 look dusky. (*Id.*) A chest x-ray revealed severe hypoinflation, indicating the tube was not
22 in the right place. (*Id.* at PET-000087, 000097.) Dr. Haley reintubated Steven and
23 reported an initial good response, but Steven's heart rate slowed and a chest x-ray
24 revealed that the tube again was displaced and in the esophagus. (*Id.*) At 9:55 p.m.,
25 Steven was intubated yet again and his vital signs stabilized. (*Id.*)

26 During this time, the hospital notes, in sequence, indicate: asystole heart rhythm
27 (Steven's heart stopped), 4 doses of epinephrine given (to try to start his heart), recovery
28 of pulse, another asystole heart rhythm, ventricular fibrillation (grossly abnormal

1 heartbeat), another dose of epinephrine, followed by a notation of persistent unstable
2 pulse. (App. Tab 15 at PET-000385.) In total, it took approximately 32 minutes to get
3 Steven’s heart started again. (App. Tab 29 at 16:5-11.)

4 As the doctors at Paradise Valley Hospital prepared to transfer Steven to PCH, Dr.
5 Haley recorded that Steven was profoundly dehydrated. (App. Tab 14 at PET-000087.)
6 They placed a catheter in Steven, but no urine could be taken out. Doctors also made
7 multiple attempts to find a visible vein to insert a line into Steven’s external jugular, but
8 wrote that Steven’s “profound dehydration” made visualization of the veins impossible.
9 (*Id.* at PET-000087-88.)

10 Steven was diagnosed with cardiopulmonary arrest, profound dehydration,
11 probable metabolic acidosis, and possible sepsis. (*Id.* at PET- 000088.) Dr. Haley
12 expressed grave concerns regarding Steven’s prognosis because of the “significant risk of
13 brain injury secondary to dehydration, metabolic acidosis, and hypoxemia.”⁹ (*Id.*)

14 8. *PCH Doctors Almost Immediately Suspect SBS*

15 Steven was air-evac'd to PCH and arrived in grave condition at around 10:30 p.m.
16 (App. Tab 14 at PET-000093; App. Tab 15 at PET-000380.) Despite his extensive history
17 of medical problems, and despite the lack of any outward evidence that he had been
18 abused, within less than an hour of Steven’s arrival at PCH doctors suspected abuse.

19 Shortly after Steven arrived, Dr. Patricia Teaford assessed him and noted his
20 unresponsive condition and the presence of retinal hemorrhages. (App. Tab 15 at PET-
21 000385.) Because of the retinal hemorrhages, she immediately concluded that child abuse
22 needed to be investigated. (*Id.*) Steven’s CT scan came back with findings of bilateral
23 subdural hygromas,¹⁰ subdural hemorrhage, and cortical (outer part of the brain) damage.¹¹

24 _____
25 ⁹ Hypoexemia is a reference to insufficient oxygen in Steven’s blood.

26 ¹⁰ To understand the medical history in this case requires one to understand the meaning
27 and differences between subdural hemorrhage, subdural hematoma, and subdural
28 hygroma. The brain itself is encased by a protective sac or membrane known as the dura.
The subdural area is a reference to the extremely thin area between the brain and the dura.
Subdural hemorrhage is thus blood found within the subdural area. When there is a
pooling of blood in the area, it sometimes is referred to as a subdural hematoma. When
there is cerebrospinal fluid in the subdural area, that is called a subdural hygroma.

1 (*Id.* at PET-000389, 000430-31.) Although she noted the absence of any bruising on
2 Steven’s skin or head, Dr. Teaford concluded that non-accidental trauma was the probable
3 cause of Steven’s condition. (*Id.* at PET-000389.)

4 By 2:15 a.m., a social worker consult for suspected child abuse was ordered as was
5 a consult with a PCH child abuse expert. (*Id.* at PET-000403.) By 2:51 a.m., PCH filed a
6 report with Child Protective Services and the City of Phoenix Police had initiated their
7 criminal investigation. (*Id.* at PET-000427.) By 3:15 a.m., Phoenix police officers were
8 talking to Drayton and Maria in the hospital’s consultation room. (*Id.* at PET-000465.)
9 Detective Kathi Galbari, the detective who would take over the case, was called at home
10 at 3:45 a.m. by the homicide sergeant and told to report to PCH. (App. Tab 20 at 000008.)
11 The social worker showed up at 4:00 a.m., also noted the presence of retinal and subdural
12 hemorrhage, and wrote that Drayton and Maria could not provide any specific explanation
13 for Steven’s “severe head trauma.” (PET 0417, 465.) Detective Galbari arrived at the
14 hospital at 4:40 a.m. and was briefed by the officers who had already spoken to Drayton
15 and Maria. (*Id.*) Before speaking to Drayton and Maria, Detective Galbari and an
16 attending nurse conducted a visual inspection of Steven’s body. They found no visible
17 trauma. (*Id.* at 000009.)

18 Later that morning, at approximately 7:00 a.m., Dr. Emily Pollack, the PCH child
19 abuse expert, evaluated Steven and noted that his skin was normal, without bruising.
20 (App. Tab 15 at PET-000406, 000411.) She recommended a skeletal survey (to look for
21 old or new fractures or injuries) and an ophthalmology consult to examine the retinal
22 hemorrhages. (*Id.* at PET-000412.) The skeletal survey came back negative; there were
23 *no* old or new fractures or injuries on Steven’s body. (*Id.* at PET-000433.) The
24 ophthalmology consult never occurred.

25
26 ¹¹ Notably, Dr. Graham, another PCH doctor evaluating Steven, determined that Steven’s
27 subdural effusions (of blood and fluid) were of different ages. (App. Tab 15 at PET-
28 000393.) This observation -- which is evidence of an ongoing disease process -- should
have been highly relevant to the analysis of what had happened to Steven but the other
PCH doctors seemingly were unaware of Dr. Graham’s conclusion.

1 Dr. Kim Manwaring was called to conduct a neurosurgical consult. (*Id.* at PET-
2 000413-15.) He also examined Steven at approximately 7:00 a.m. and noted retinal
3 hemorrhages, a bulging fontanel, blood around the brain and “no bruising.” (*Id.* at PET-
4 000414.) He determined that these findings “are most consistent with shaken-baby
5 syndrome, plus or minus hypoxic injury.”¹² (*Id.*) Dr. Manwaring recommended a consult
6 with Dr. Kaplan, a PCH neurologist who treated Steven during his hospitalization the
7 prior month. (*Id.*) The consult with Dr. Kaplan never occurred.

8 That same morning, law enforcement busily gathered evidence of the “crime.”
9 Officers seized Drayton and Maria’s car in the hospital parking lot and prepared an
10 affidavit of search warrant. (App. Tab 15 at PET-000456, 000475, 000481.) The search
11 warrant was signed at 10:09 a.m. and officers arrived at Drayton and Maria’s home at
12 11:24 a.m., pried the screens off of the windows, then went through the back door and
13 began photographing the home and removing property. (App. Tab 19 at 000024; App.
14 Tab 18.)

15 Steven was declared brain dead at 11:45 a.m. (App. Tab 15 at PET-000394,
16 000475, 000456, 000481.) Drayton and Maria spent Steven’s last few hours by his side,
17 then life support was removed and Steven passed away in his mother’s arms at 3:30 p.m.
18 Within the hour, the County Attorney and CPS were together preparing homicide charges
19 against Drayton.

20 There is no evidence that PCH ever spent any meaningful time looking at potential
21 alternative diagnoses such as, for example, venous thrombosis, sinus thrombosis, stroke,
22 clotting disorders, genetic issues or any of numerous other disorders. Steven had retinal
23 hemorrhages and subdural bleeding -- that apparently was enough for the PCH doctors at
24 the time to declare Steven to have been murdered by violent shaking and to turn the matter
25 over to the medical examiner.

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27
28 ¹² The term “hypoxic injury” refers to injury to the brain caused by a lack of oxygen.

1 9. *Steven's Autopsy*

2 Steven died on June 2, 2000. Dr. Mosley of the Maricopa County Medical
3 Examiner's Office conducted his autopsy the next day. Before he began his autopsy, Dr.
4 Mosley knew that doctors at PCH believed that Steven's death was the result of SBS.
5 (App. Tab 16 at PET-000121.) He understood he was to page Detective Galbari before
6 beginning the autopsy. (*Id.* at PET-000139.) The police were present during the autopsy
7 and photographed the findings. (App. Tab 27 at 79:14-17.) Dr. Pollack, the PCH child
8 abuse expert, attended the brain cutting portion of the autopsy. (*Id.* at 101:18-102:2.)

9 During the autopsy, Dr. Mosley noted that there were no signs of trauma on
10 Steven's body. (*See, e.g., id.* at 80:18-22.) Nor was there any sign of neck injury:
11 "Examination of the soft tissues of the neck, including strap muscles and large vessels,
12 reveals no abnormalities." (App. Tab 16 at PET-000123.) Nor was there bruising or
13 lesions on the brain or spinal cord. (*Id.* at PET-000122-23, 000125.) However, Dr.
14 Mosley found subdural hemorrhage, retinal hemorrhages, perioptic nerve hemorrhages,
15 cerebral edema (brain swelling), left occipital subarachnoid hemorrhage, and hemorrhage
16 in Steven's cervical spinal canal. (*Id.* at PET-000120.) (App. Tab 16 at PET-000140.)
17 Dr. Mosley concluded that Steven's death was a "HOMICIDE" caused by
18 "SHAKEN/IMPACT SYNDROME." (App. Tab 16 at PET-000118.)

19 Drayton was then charged with murdering his son.

20 **B. Drayton's Trial**

21 1. *The State's Theory Was Entirely Premised on SBS*

22 The State's case against Drayton was a medical one based on SBS. From the
23 State's opening statement:

24 On June 2nd, Steven Witt died. He died as a result of ***violent, severe***
25 ***shaking***, which caused bleeding on the surface of his brain, brain
26 swelling, bleeding in the retinas, behind the retinas of his eyes, and
bleeding to the optic nerve that connects the eyes to the brain.

1 (App. Tab 25 at 25:3-8) (emphasis added.) The State then called several physicians to
2 testify about SBS and how they could tell from findings in the medical records and
3 autopsy report that Steven had been violently shaken.

4 **a. Dr. Emily Pollack**

5 On the second day of trial, the State called Dr. Pollack – the PCH child abuse
6 expert. Dr. Pollack testified that she was called sometime after midnight to conduct a
7 child abuse consult. (App. Tab 26 at 16:3-8.) Dr. Pollack testified that she found retinal
8 hemorrhages and that such hemorrhages indicate child abuse. She proceeded to say that
9 many ophthalmologists would say that retinal hemorrhages are “not just indicative, but
10 diagnostic of child abuse.” (*Id.* at 18:22-19:22.) She also stated that Steven’s eyes
11 revealed that he had optic nerve sheath hemorrhages and that such hemorrhages were
12 caused by severe trauma. (*Id.* at 37:4-38:4.) Given the state of the science at the time,
13 Drayton’s trial lawyer did not seriously attempt to dispute these opinions about the eye
14 findings, but instead tried to discredit Dr. Pollack by demonstrating that Dr. Pollack did
15 not have the necessary expertise to determine the extent of Steven’s retinal hemorrhages.
16 (*Id.* at 73.)

17 Dr. Pollack also testified that Steven had subdural hemorrhage and cerebral edema.
18 (*Id.* at 24:9-25:5.) Dr. Pollack told the jury that Steven’s condition and findings meant
19 either child abuse or one particular metabolic disorder that she referred to as lysergic
20 aciduria. (*Id.* at 29:4-25.) When blood tests did not confirm lysergic aciduria, Dr. Pollack
21 stated that she was left with only one conclusion – child abuse. (*Id.* at 30:13-31:5.) At the
22 time of trial Dr. Pollack had not been practicing for about a year, but she said that, when
23 she was, she “average[d] one to two cases a month of infants who were fatally shaken.”
24 (*Id.* at 95.)

25 Additionally, Dr. Pollack testified about how shaking supposedly caused Steven’s
26 injuries. Specifically, she explained that it was her belief that when an infant is violently
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28

1 shaken, the brain strikes back and forth against the front and back of the cranium.¹³ (*Id.* at
2 32:1-3.) This whiplash shaking action, she explained, eventually causes the tearing of
3 bridging veins that run on the outside of the brain (thereby causing hemorrhage) and of
4 neurons inside the brain (leading to brain damage and swelling). (*Id.* at 32:15-22.)

5 Dr. Pollack told the jury that after Steven was violently shaken, “[h]e would have
6 immediately been rendered unconscious.” (*Id.* at 33:10-11.) This unconsciousness would
7 have been “followed pretty rapidly by cardiovascular collapse.” (*Id.* at 33:20.) According
8 to Dr. Pollack, because Steven would have been comatose immediately following the
9 shaking, the shaking must have occurred while Steven was in Drayton’s care, following
10 his last feeding at around 8:00 p.m. (*Id.* at 34:9-12.)

11 After Dr. Pollack’s testimony, the jurors had questions. One juror asked if hitting
12 one’s head can cause retinal hemorrhages. Dr. Pollack responded, “Yes it can if it’s
13 severe injury, on the magnitude of a car accident. They have been reported in massive
14 head injuries after things like car accidents.” (*Id.* at 101:5-8.) Finally, despite a complete
15 lack of any evidence in the autopsy or in the PCH records, Dr. Pollack told the jury that
16 the bridging veins in Steven’s brain were, in fact, stretched or torn. (*Id.* at 105:23-25.)

17 **b. Dr. Michael Haley**

18 Dr. Haley, the Paradise Valley Hospital emergency room physician, testified that
19 Steven was very dehydrated when he saw him. He explained that Steven’s lips were dry,
20 his eyes were sunken, and his skin was mottled -- all likely caused by dehydration. (App.
21 Tab 27 at 45:9-20.) Dr. Haley also stated that when a child presents with subdural
22 hematoma, retinal hemorrhages, and massive cerebral edema, he would be concerned

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24 ¹³ In 2002, this was a common description of the SBS mechanism -- that shaking, through
25 its whiplash mechanism, causes the brain to move within the skull and hit the cranium. It
26 later was pointed out that, in cases of whiplash sufficient to cause intracranial injury, the
27 brain typically slides forward and/or back and impacts the cranium, leaving the brain with
28 contusions or focal lesions -- findings not found in most SBS cases or in Steven’s case.
See Talbert, *Shaken Baby Syndrome: Does It Exist?*, 72 MEDICAL HYPOTHESES 131, 133
(2009) (“The SBS definition is internally inconsistent. The condition cannot be due to
shaking if subdural bleeding is found in the absence of contusional damage as appears in
the definition.”) As noted, no bruises or lesions were found visibly or microscopically on
Steven’s brain.

1 about trauma such as shaking. (*Id.* at 47:13-19.) He concluded that Steven’s injuries
2 could have been the result of severe shaking. (*Id.* at 48:2-4.)

3 **c. Dr. A.L. Mosley**

4 Dr. Mosley, the medical examiner, testified that Steven’s condition exhibited the
5 classic characteristics of Shaken Baby Syndrome and that the presence of subdural blood
6 indicated traumatic injury. (*Id.* at 95:5-96:6.) He stated that, based on his training and
7 experience, the subdural blood found around Steven’s brain was caused by violent
8 shaking. (*Id.* at 85:17-86:1.)

9 Dr. Mosley also told the jury that Steven’s subarachnoid hemorrhage¹⁴ and the
10 hemorrhage along his spinal canal were traumatic findings. (*Id.* at 90:18-91:1, 93:5-21.)
11 He agreed with Dr. Pollack that during shaking the brain hits the inside of the skull,
12 causing an impact and associated injury (*id.* at 95:16-18), even though Dr. Mosley
13 admitted that he saw no evidence that Steven’s brain had been impacted (*id.* at 128:16-
14 18). He also insisted that Steven likely had brain injury caused by the shearing of the
15 brain’s neurons, but he admitted he did not actually see any evidence of this. (*Id.* at
16 135:2-18.)

17 Dr. Mosley concluded that the combination of retinal, optic nerve sheath,
18 subarachnoid subdural hemorrhage, and cerebral edema meant SBS, “based on what I’ve
19 read, [and] the fact that I couldn’t find another doctor who could tell me another
20 explanation for that constellation of symptoms.” (*Id.* at 121:21-23.)

21 **d. Dr. Kim Manwaring**

22 Dr. Manwaring, the PCH neurosurgeon who assessed Steven, testified that the
23 presence of cerebral edema, bleeding around the brain, and the retinal hemorrhages seen
24 in Steven’s eyes caused him to believe that Steven’s death was caused by SBS. (App. Tab
25 28 at 38:18-21.) Although not an eye doctor, Dr. Manwaring testified that retinal
26 hemorrhages have a characteristic appearance depending on what caused them and that

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28 ¹⁴ The arachnoid is a very thin membrane on the surface of the brain. Subarachnoid
hemorrhage is bleeding into the space between the brain and the arachnoid.

1 Steven had a particular type of retinal hemorrhage, which he described as large globules
2 of blood with sharp edges. He told the jury that this particular type of retinal hemorrhage
3 “almost assuredly” is brought on by severe flexion and extension or shaking. (*Id.* at
4 22:17-24.) He said that, outside of shaking, the “other way” that they “can be created is a
5 severe high-speed car injury.” (*Id.* at 22:25-23:5.) He stated “I have seen them extremely
6 rarely, outside of the instance of shaken baby syndrome, in severe head-on car accidents.
7 Not rollovers, severe car accidents.” (*Id.*)

8 Dr. Manwaring further stated that shaking causes the brain to move “back and forth
9 within the cranium” and that Steven would have been rendered immediately unresponsive
10 and unable to feed following the shaking. (*Id.* at 28:18-25, 30:10-31:2.) Dr. Manwaring
11 testified that he had treated “perhaps a hundred” children with SBS. (*Id.* at 8:16-20.)

12 **e. Dr. Patricia Teaford**

13 Dr. Teaford, the PCH intensivist who treated Steven the night before he died,
14 testified that, when she first examined Steven, she saw retinal hemorrhages, which caused
15 her immediately to suspect SBS. (App. Tab 29 at 19:12-17.) In fact, according to Dr.
16 Teaford, whenever she sees bleeding on the brain and retinal hemorrhages, she is
17 predisposed to believe that the cause is child abuse unless it is proven not to be. (App.
18 Tab 29, 48:1-9.)

19 After seeing the retinal hemorrhages, Dr. Teaford testified that she ordered a CT
20 scan which revealed cerebral edema and bleeding around the brain – confirming for her
21 that this was a traumatic injury. (*Id.* at 20:16-21.) Dr. Teaford thus testified that she knew
22 Steven’s medical history, including his history of seizures, resuscitation, dehydration,
23 vomiting, lethargy, constipation, difficult birth, infection, and the fall from his parents’
24 bed, but did not consider any of these facts in reaching her SBS diagnosis: “He came in
25 with really a catastrophic, unexplained event *with little history to support it.*” (App. Tab
26 29 at 19:12-23.)

27 Dr. Teaford incorrectly testified that retinal hemorrhages have different
28 appearances depending on the different mechanisms; those caused by CPR, she

1 contended, are tiny and pinpoint while those caused by shaking are big. (*Id.* at 52:17-
2 53:4.) Dr. Teaford testified that, after suspecting abuse, she called in Dr. Manwaring, the
3 neurosurgeon, Dr. Pollack, the child abuse expert, and ensured that CPS and law
4 enforcement were notified. (*Id.* at 20:22-21:16.) She told the jury that Steven’s death was
5 caused by “a very violent, high velocity acceleration-deceleration injury that [she] would
6 equate with a patient who’s been in a high-velocity motor vehicle accident.” (*Id.* at 29:16-
7 18.) Dr. Teaford also testified that Steven’s cascade of injuries were caused when the
8 shaking tore the bridging veins around Steven’s brain. (*Id.* at 30:4-7.)

9 Dr. Teaford told the jury that she did not know a single pediatrician who did not
10 believe it was possible to shake a baby to a similar degree as the force present in a violent
11 car accident. (*Id.* at 47:17-20.) Notwithstanding her claim that shaking must be very
12 violent to cause such injuries, when asked whether in cases she diagnoses as SBS it is
13 typical to see external signs of trauma, she said that it is “usual not to.” (*Id.* at 29:19-22.)

14 **2. *Drayton Could Not Muster An Adequate Rebuttal to the State’s***
15 ***Medical Testimony in 2002***

16 Drayton called a single expert during the trial, Dr. Karen Griest. Unable to
17 confront the SBS diagnosis head-on due to its then-general acceptance within the pediatric
18 community, Dr. Griest focused on Steven’s profound dehydration as a potential cause for
19 the constellation of injuries found at the time of his death. (App. Tab 30 at 15:24-17:21.)
20 Dr. Griest did not dispute the theory that torn bridging veins can lead to significant brain
21 injury, but she testified that those veins are more likely to rupture in a dehydrated baby
22 with a shrunken brain. (*Id.* at 41:18-42:13.)

23 **3. *The SBS Testimony Allows the Case to Go to the Jury***

24 At the close of the State’s case, Mr. Witt’s attorney moved for a directed
25 verdict. He argued that the expert medical testimony was inconsistent and that
26 there was a distinct lack of physical evidence or visual observation to support a
27 verdict that Steven had been violently abused. The court denied the motion,
28

1 noting the expert SBS testimony. (App. Tab 29 at 58:7-15.) The jury convicted
2 Drayton of second-degree murder. He received a sentence of 20 years.

3 **C. Drayton’s Conviction Is Vacated**

4 *“You keep screaming. Eventually, someone will hear you.”*

5 -- Drayton Witt¹⁵

6 Despite his conviction, Drayton always maintained his innocence. Eventually, with
7 pro bono help from the Arizona Justice Project, he submitted a Rule 32 petition for post-
8 conviction relief. In his petition, he argued that the SBS theory had unraveled since his
9 conviction. His petition was supported by sworn testimony from leading experts in the
10 fields of neuropathology, neuroradiology, neurosurgery, forensic pathology,
11 ophthalmology, and biomechanics, all of whom testified there is no medical evidence that
12 Steven was abused.

13 Based on the change in understanding about SBS, even Dr. Mosley -- the medical
14 examiner who declared Steven’s death an SBS homicide -- stated that he now believes
15 Steven died of natural causes. In 2002, Dr. Mosley testified that his 2000 SBS diagnosis
16 was correct “based on what [he’d] read” and “the fact that [he] couldn’t find another
17 doctor who could tell [him] another explanation for [Steven’s] constellation of symptoms.”
18 In 2012, however, based on his review of “an expansive body of post-2000 SBS literature,
19 as well as the significant developments in the medical and scientific community’s
20 understanding of SBS and several of the conditions that mimic SBS,” he believes that
21 “Steven’s death was likely the result of a natural disease process.” (App. Tab 6 ¶ 10.) The
22 changes in science have been significant enough to cause the medical examiner to
23 completely reverse his medical conclusion.

24 In addition, several of the physicians explained why Steven’s medical records
25 indicate that his death may have been caused by complications from a condition called
26 venous thrombosis. With the petition, and again with this motion, we submit declarations

27 _____
28 ¹⁵ Ruelas, *New Doubts in ‘Shaken Baby’ Fatalities*, ARIZONA REPUBLIC, Sept. 16, 2012, at A1.

1 from Drs. Plunkett (a forensic pathologist), Squier (a neuropathologist), and Barnes (a
2 pediatric neuroradiologist), that Steven’s medical history and autopsy findings strongly
3 point to venous thrombosis as the cause of his death.

4 In his declaration, Dr. Plunkett explains venous thrombosis:

5 [S]ince 2000, it has become increasingly well-established that the
6 differential diagnosis in cases such as Steven’s include[s] . . . venous
7 thrombosis (‘VT’), . . . a form of childhood stroke that is difficult to
8 detect and, at least previously, was under-diagnosed. It has symptoms
9 that mimic so-called SBS symptoms. In the case of VT, a vein becomes
10 blocked and the blood that usually drains away from the brain cannot get
11 out. As a result, it backs up into the tissues, prevents fresh blood from
12 getting in, and the brain cells die; areas of such brain cells are called
13 infarcts. The cascade of intracranial events caused by the thrombosis and
14 corresponding infarcts can be hemorrhage, edema, and the development
15 of hypo-ischemic areas (parts of the brain that do not receive enough
16 oxygen or have abnormal blood flow to work properly but are not dead).

17 VT (“childhood stroke”) is described on the [PCH] website, which notes
18 that causes of such strokes may include infection, dehydration or other
19 causes. The website correctly identifies the most common sign of such
20 strokes to be “seizure.” Other common signs include “Severe headache,
21 possibly with vomiting,” “Visual problems,” and “Decreased alertness or
22 sleepiness.”

23 (Plunkett Dec. ¶¶ H, I (App. Tab 7); *see also* Squier Dec. ¶¶ 4-6 (App. Tab 8) (explaining
24 venous thrombosis); Krasnokutsky, *Cerebral Venous Thrombosis: A Potential Mimic of*
25 *Traumatic Brain Injury in Infants*, 197 ROENTGEN 503 (Sept. 2011) (App. Tab 46) (noting
26 that most studies on VT have been done in last 10 years and that the underlying causes of
27 VT “are numerous, with infection and dehydration as the most common causes”).

28 Dr. Squier has published on the two distinct types of cerebral venous thrombosis,
which together she refers to as CVST. She summarizes CVST as follows:

Radiological studies show . . . bleeding, including subdural, subarachnoid
and subpial haemorrhage and subdural effusion in association with CVST. .
. . There is a striking male predominance (up to 75%) in infant CVST.
Clinical diagnosis is difficult in infants; at least 10% of babies are
asymptomatic, and others have non-specific presentation including
depressed consciousness, lethargy, poor feeding, vomiting or seizures.

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Venous thrombosis is associated with a number of common illnesses. 75% have infection . . . 4% recent head trauma.

(Squier, *The “Shaken Baby” Syndrome: Pathology and Mechanisms*, ACTA NEUR. 1, 15-17 (2011) (App. Tab 56).)

Venous thrombosis is an alternative, and probable, explanation for Steven’s death that was neither ruled in nor ruled out by the State’s expert witnesses. First, Steven’s symptoms almost perfectly fit the clinical criteria for venous thrombosis just described. He was a male, with a history of lethargy, visual abnormalities, vomiting, dehydration, infection, and seizures.

Second, it appears undisputed that the bleeding and cerebrospinal effusion around Steven’s brain began well before his collapse on June 1, 2000. This was recognized by a physician at PCH who did not testify at Drayton’s trial and who does not appear to have been consulted by the other PCH physicians. (*See supra* n. 11.) Moreover, Dr. Squier examined brain tissue preserved at Steven’s autopsy. She explains that Steven’s infarction (area of dying brain tissue) was old -- predating his death by at least 3 to 7 days. “This indicates that something was happening in Steven’s brain days before his collapse.” (Ex. 8, Squier Dec. ¶ 5.) Similarly, Dr. Plunkett arranged for iron-staining on slides of blood and dura taken at Steven’s autopsy and confirmed there were iron-positive macrophages within them. This indicates “that the process that was causing the subdural bleeding began significantly before June 1, 2000.” (Ex. 7, Plunkett Dec. ¶ 18(D).) Dr. Barnes, in the course of recording observations during a blind review of Steven’s CTs and MRIs (*i.e.*, a review done before he knew what other doctors had said or had looked at the medical records), noted that Steven’s May 3 MRI at PCH, rather than being normal as the reading doctor at PCH claimed, actually shows “subtle asymmetric swelling, right more than left. Also, there may be small amounts of extracerebral small bleeding or small clots. This could be an indication of a venous thrombosis” (Ex. 1, Barnes Dec. ¶ 14.) He goes on to note, again during his blind review, that the hygromas that appear on Steven’s June 2

1 MRI “are grey dark which indicates that they are older, not acute. The recent hemorrhage
2 is extracerebral, white, and multifocal, which is a sign of venous thrombosis.” (*Id.* ¶ 17.)

3 Third, the autopsy findings strongly support a finding of venous thrombosis. In
4 particular, autopsy photograph 17 (App. Tab 16 PET-000140), “shows a thrombosed
5 superficial cortical vein” on the right side of Steven’s brain being held in a gloved hand.
6 (Ex. 7, Plunkett Dec. ¶ 18(f)); *accord* Ex. 1, Barnes Dec. ¶¶ 19-20; Ex. 8, Squier Dec. ¶ 5.)
7 Again, thrombosis events are generally triggered by and associated with infections,
8 dehydration, vomiting, clotting problems and seizures -- not trauma.

9 After taking months to review the petition, the State *conceded* that Drayton had
10 submitted evidence sufficient to warrant vacating his conviction. The Court vacated the
11 conviction on May 1, 2012, and Drayton was subsequently freed.

12 Unfortunately, without ever providing any explanation to either the Court or the
13 defense about why it believes SBS remains a reliable theory in this case, or about how its
14 experts can rule out venous thrombosis as a potential cause beyond a reasonable doubt, the
15 State insists on a retrial.

16 **III. The State’s SBS Testimony Must Be Precluded**

17 The State carries the burden to prove Drayton caused Steven’s death,¹⁶ and here the
18 State’s only evidence of causation is the testimony of the PCH doctors that it is their
19 belief, based solely on Steven’s medical findings, that Drayton must have shaken Steven
20 violently enough to kill Steven without leaving a single mark on his body. Because the
21 causal connection is not “readily apparent to the trier of fact” and there is no other
22 evidence that will satisfy the State’s burden of proving that Drayton caused his son’s
23 death, the “causal connection between [the alleged] act or omission and the ultimate injury
24 [must be proven] through expert medical testimony.” *Barrett v. Harris*, 207 Ariz. 374,

25 _____
26 ¹⁶ “Lest there remain any doubt about the constitutional stature of the reasonable doubt
27 standard, we explicitly hold that the Due Process Clause protects the accused against
28 conviction except upon proof beyond a reasonable doubt of *every fact necessary* to
constitute the crime with which he is charged.” *In re Winship*, 397 U.S. 358, 364 (S. Ct.
1970) (emphasis added).

1 378 (App. 2004); *cf. Claar v. Burlington N.R.R. Co.*, 29 F.3d 499, 503-04 (9th Cir. 1994)
2 (affirming the district court’s grant of summary judgment following plaintiff’s failure to
3 proffer admissible expert testimony on the issue of causation).

4 When Drayton was tried in 2002, Arizona followed the *Frye/Logerquist* “general
5 acceptance test,” under which only new scientific methods were subjected to judicial
6 scrutiny. As a result, the opinions of the PCH doctors who testified for the State in
7 Drayton’s first have never been vetted for reliability. But the State cannot shield its faulty
8 science from scrutiny any longer.

9 This year, the Arizona Supreme Court amended Arizona Rule of Evidence 702 to
10 conform to its federal counterpart. ARIZ. R. EVID. 702 cmt. “The amendment recognizes
11 that trial courts should serve as gatekeepers in assuring that proposed expert testimony is
12 reliable and . . . helpful to the jury’s determination of facts at issue.” (*Id.*) New Rule 702
13 now allows expert testimony to be admitted *only* if: (1) such testimony is reliable, that is,
14 “based on sufficient facts or data” and “the product of reliable principles and methods;”
15 (2) such testimony is relevant, meaning that the expert has “reliably applied those
16 principles and methods to the facts of the case;” and (3) the expert has “specialized
17 knowledge [that] will help the trier of fact to understand the evidence or to determine a
18 fact in issue.” ARIZ. R. EVID. 702. Unlike the prior *Frye/Logerquist* rule, new Rule 702
19 requires that all manner of expert testimony, whether based “upon professional studies or
20 personal experience, employs in the courtroom the same level of intellectual rigor that
21 characterizes the practice of an expert in the relevant field.” *Kumho Tire Co. v.*
22 *Carmichael*, 526 U.S. 137, 152 (1999); *accord McClain v. Metabolife Int’l, Inc.*, 401 F.3d
23 1233, 1237 (11th Cir. 2005).

24 **A. The State’s Medical Evidence Must Be Excluded Because SBS Is an**
25 **Unreliable, Unproven, and Highly Controversial Hypothesis**

26 Baby Steven was sick his whole life. He had a documented history of serious
27 neurologic problems, including seizures. He had intracranial bleeding and pathology that
28 predated his collapse by at least several days. When he died, his body had no bruises, grip

1 marks, crush injuries, or broken bones. Yet, the State claims that medical science proves
2 beyond a reasonable doubt that he died because his father violently shook him. Not so.

3 Instead, SBS is a controversial scientific hypothesis that has yet to be validated. It
4 is a medical diagnosis with no precise criteria and no known rate of error. It is a
5 hypothesis about one possible explanation -- with dozens of known alternative causes --
6 for the triad of clinical findings associated with the diagnosis. It is a supposition of *how*
7 certain injuries *might* occur that is now known to be at odds with biomechanical science,
8 pediatric neurology, and ophthalmology. SBS is no longer generally accepted, particularly
9 in cases where there is no other evidence of abuse. It is a white-hot controversy being
10 debated in medical, scientific, legal, and social publications, where new information has
11 caused even its founder and the medical examiner in this case to come forward to say that
12 SBS is not a reliable diagnosis here.

13 To determine whether proffered medical causation testimony is reliable, Courts
14 look to the following non-exclusive factors: (1) whether the method or technique has
15 been tested; (2) whether the method or technique has been subjected to peer review and
16 publication; (3) the potential or known rate of error; and (4) whether the method or
17 technique is generally accepted within the relevant scientific community. *Daubert I*, 509
18 U.S. at 593-94. In addition, “[o]ne very significant fact to be considered is whether the
19 experts are proposing to testify about matters growing naturally and directly out of
20 research they have conducted independent of the litigation, or whether they have
21 developed their opinions expressly for purposes of testifying.” *Clausen v. M/V New*
22 *Carissa*, 339 F.3d 1049, 1056 (9th Cir. 2003) (citing *Daubert v. Merrell Dow Pharms.,*
23 *Inc.*, 43 F.3d 1311, 1317 (9th Cir. 1995) (“*Daubert II*”)); *see also Snyder v. Sec’y of HHS*,
24 No. 01-162V, 2009 WL 332044 (Fed. Ct. 2009).

25 The role of the Court in conducting a *Daubert* reliability analysis of proposed
26 expert testimony is to ensure that the expert’s opinions are based on scientifically valid
27 methods and principles. To be admissible, “it is critical that an expert’s analysis be
28 reliable at every step.” *Amorgianos v. Amtrak*, 303 F.3d 256, 267 (2d Cir. 2002).

1 Accordingly, “any step that renders the analysis unreliable under the *Daubert* factors
2 renders the expert’s testimony inadmissible.” *In re Paoli R.R. Yard Pcb Litig.*, 35 F.3d
3 717, 745 (3d Cir. 1994) (emphasis original).

4 Viewed under any of the *Daubert* factors, SBS is unreliable. It “evolved as a result
5 of faulty application of scientific reasoning and a lack of appreciation of mechanisms of
6 injury.” Uscinski, *Shaken Baby Syndrome: An Odyssey*, 46 NEUROL. MED. CHIR. 57
7 (2006) (App. Tab 58) (emphasis added). As a result, the hypothesis that shaking alone
8 could cause the triad of clinical findings that led to Steven’s death -- whether cloaked
9 under the new moniker “abusive head trauma,” SBS, or some other name -- is based on
10 faulty scientific principles and lacks sufficient facts and data and the testimony must be
11 excluded.

12 ***1. SBS Has Never Been Validated By The Relevant Scientific***
13 ***Communities***

14 The SBS hypothesis was first raised in a 1971 article by Dr. A. Norman Guthkelch,
15 a pediatric neurosurgeon. Dr. Guthkelch cited a 1968 whiplash study involving adult
16 rhesus monkeys and also discussed two patients of his that had subdural hematomas yet no
17 sign of head trauma -- in one, the mother said she had shaken her infant when he was
18 having a coughing fit and she feared he was choking; in the other, the infant had grip
19 marks and the mother said that she “might have” shaken him when he cried at night. (*Id.*
20 at 431.) From the 1968 Ommaya study and his two case reports, Dr. Guthkelch
21 hypothesized that infants might sustain whiplash-type injuries, including subdural
22 hematoma, from being violently shaken. Although not yet called SBS, the shaking
23 hypothesis was born.

24 In 1972 and 1974, famed pediatric radiologist and textbook author John Caffey
25 published two articles about the potential dangers of shaking infants. In the first article,
26 Dr. Caffey collected instances of what he deemed “convincing” examples of children who
27 had suffered brain injury as a result of shaking, most of which came from a Newsweek
28 article about a nurse who had confessed to abusing children in her care. (App. Tab 37 at

1 163.) In the second article, Dr. Caffey cited the 1968 Ommaya study for the proposition
2 that shaking infants could cause subdural hemorrhage. In addition to causing subdural
3 hemorrhage, he speculated that shaking damaged capillaries within the retina, as he had
4 seen retinal hemorrhages in children he thought had been abused. 54 PEDIATRICS at 401
5 (App. Tab 38). Although he admitted that his data set was “meager” and “manifestly
6 incomplete,” he broadly concluded that the evidence “indicates that manual whiplash
7 shaking of infants is a common primary type of trauma in the so-called battered infant
8 syndrome. It appears to be the major cause in these infants who suffer from subdural
9 hematomas and intraocular bleedings.” 54 PEDIATRICS at 402 (App. Tab 38).¹⁷

10 Dr. Caffey ended his article by calling for a “nationwide educational campaign”
11 that he said could be summarized by the following stanza:

12 Guard well your baby’s precious head,
13 Shake, jerk and slap it never,
14 Lest you bruise his brain and twist his mind,
15 Or whiplash him dead forever.

16 *Id.* at 403.

17 Notwithstanding that Dr. Guthkelch expressly was offering merely a hypothesis
18 about *one* possible cause of subdural hematoma in infants,¹⁸ and that Dr. Caffey reached
19 his conclusions based on evidence that even he acknowledged was “meager” and
20 “manifestly incomplete,” but propelled by a nationwide campaign highlighting the dangers
of shaking infants, the SBS hypothesis rapidly gained “acceptance and enormously

21 ¹⁷ In a passage that perhaps should have caused Dr. Caffey pause but which only later
22 would be recognized as somewhat chilling, Dr. Caffey noted that children who presented
23 with subdural hematoma and no external evidence of trauma -- children that he assumed
24 had been shaken -- often had histories of vomiting, hyperirritability, infection, stupor, birth
25 trauma, fever, bulging fontanel, anemia, enlarged head, and abnormal ocular fundi.
26 Caffey, 54 PEDIATRICS at 400 (App. Tab 38.) It is now well accepted that these symptoms
27 turn out to be associated with several non-traumatic neurological conditions that mimic the
28 intracranial conditions supposedly caused by SBS.

29 ¹⁸ “I am aware that my 1971 article has been cited by doctors and researchers in support of
30 a prosecutorial suggestion that babies who have subdural hematoma, retinal hemorrhages,
31 and brain swelling can be *assumed* to be suffering from ‘Shaken Baby Syndrome,’ even
32 though there are no other signs of abuse. However, I consider that this is a distortion of
33 the article I wrote in 1971 ***[T]here was not a vestige of proof when the name was
34 suggested that shaking, and nothing else, caused the triad.***” Ex. 4, Guthkelch Dec. ¶¶ 3-
4 (emphasis added).

1 widespread popularity, *with no real investigation or even question as to its scientific*
2 *validity.*” Uscinski, *Shaken Baby Syndrome: An Odyssey*, 46 NEUROL. MED. CHIR. 57
3 (2006) (App. Tab 58) (emphasis added).¹⁹

4 By 2000, when the PCH physicians and the medical examiner “diagnosed” Steven
5 as an SBS victim, hardly anyone openly questioned the existence and reliability of SBS,
6 even though science had not yet validated the hypothesis. In the 1980s and 1990s, dozens
7 of articles that merely *presumed* the existence and validity of the SBS hypothesis filled
8 the medical literature, and physicians (particularly pediatricians and ER doctors) were
9 trained to diagnose SBS based on the triad of findings.

10 Indeed, prior to 2002, the medical community followed the dogma of SBS largely
11 without question. Dr. Barnes explained that at the time he testified for the Louise
12 Woodward prosecution in 1997, “doctors practiced what I call authoritarian medicine.
13 We were told what certain symptoms meant, and we didn’t question whether the
14 authorities were right. When we saw bleeding in the brain (subdural hematoma or SDH)
15 and bleeding in the eyes (retinal hemorrhages or RH), we were taught, and so we
16 assumed, that the child had been violently shaken and that the last caregiver with the baby
17 must have done the shaking.” (Ex. 1, Barnes Dec. at ¶ 3.)

18 But, in about 1999, the medical community embraced what is called the Evidence-
19 Based Medicine (EBM) movement, which sought to ensure that medical practice was
20 based on the best available medical and scientific evidence, as opposed to over-reliance on
21 anecdote and historic practice. (*See, e.g., id.* ¶ 4.) A key part of the EBM movement was
22 the promulgation of criteria to gauge the reliability of the evidence upon which particular
23 medical practices and diagnoses rested, with Level I being the highest/most reliable
24 evidence and Level IV being the lowest/least reliable.

25 After some physicians began to question whether the SBS hypothesis met EPM
26 standards, Dr. Mark Donohoe, in a 2003 article, compiled the SBS literature through 1998

27 ¹⁹ As discussed *infra* in section V(A)(2)(c), the neurosurgeon-trained scientist who
28 conducted the biomechanical study that Drs. Guthkelch and Caffey relied upon later
detailed why his study does not actually support the SBS hypothesis.

1 and then classified it against those standards. His conclusions were startling. Although
2 there were 55 published articles on SBS, *none* exceeded Level III-2, “**which means that**
3 **there was inadequate scientific evidence to come to a firm conclusion on most aspects**
4 **of causation, diagnosis, treatment, or any other matter pertaining to SBS.”** *Evidence-*
5 *Based Medicine and Shaken Baby Syndrome Part I: Literature Review, 1966-1998*, 24
6 AM. J. FORENSIC MED. PATH. 239, 241 (2003) (emphasis added) (App. Tab 39). Dr.
7 Donohoe concluded that “there was an urgent need for properly controlled, prospective
8 trials into SBS, using a variety of controls. Without published and replicated studies of
9 that type, **the commonly held opinion that the finding of SDH [subdural hematoma]**
10 **and RH [retinal hemorrhage] in an infant was strong evidence of SBS was**
11 **unsustainable**, at least from the medical literature.” *Id.* (emphasis added).²⁰

12 In 2006, Dr. Jan Leestma, a neuropathologist at the Children’s Memorial Hospital
13 at Northwestern University, lamented that the medical community’s immediate acceptance
14 of SBS had resulted in a lack of studies into other potential causes of the SBS triad of
15 findings, even while SBS itself remained unproven:

16 It should be apparent that from virtually every perspective
17 many flaws exist in the theory that shaking is causative. *No*
18 *case studies have ever been undertaken to prove even a*
19 *partial list of possible confounding variables/phenomena,*
20 such as the presence of intracranial cysts or fluid collections,
21 hydrocephalus, congenital and inherited diseases, infection,
22 coagulation disorders and venous thrombosis ... or recent or
23 remote head trauma.

24 Leestma, “*Shaken Baby Syndrome*”: *Do Confessions by Alleged Perpetrators Validate*
25 *the Concept*, 11 J. AM. PHYS. AND SURGEONS 14, 15-16 (2006) (App. Tab 49) (emphasis
26

27 ²⁰ Subsequent reviews of the pro-SBS literature demonstrate that such literature suffers
28 badly from rampant circularity, observer bias, and failure to account for what we now
know to be numerous potential alternative causes. *See, e.g.,* Findlay, *supra*, at 39-58 (also
documenting that even supporters of the SBS diagnosis have recognized the serious
methodological flaws in the pro-SBS literature); *see also* Christian, et al., *Abusive Head*
Trauma in Infants and Children, Committee on Child Abuse and Neglect, NEWS FROM
THE FIELD at 1409 (June 2009) (while still endorsing shaking as a theory of abuse, the
American Academy of Pediatrics also “acknowledge[d] that precise mechanisms for all
abusive injuries remain incompletely understood.”).

1 added). Echoing Dr. Leestma’s call for greater consideration and investigation into other
2 conditions that mimic the SBS findings, Dr. Barnes compiled and published a lengthy
3 paper that included a five-page summary of known non-traumatic causes that mimic SBS.
4 Barnes, et al., *Imaging of the Central Nervous System in Suspected or Alleged*
5 *Nonaccidental Injury, Including the Mimics*, 18 TOP MAG RESON IMAGING 53 (App. Tab
6 36). Indeed, even staunch SBS advocates concede that “controversy remains” in part
7 because “there is no single or simple test to determine the accuracy of the diagnosis.”
8 Christian, *supra*, at 1410. In fact, the State’s own witness in this case, Dr. Manwaring,
9 conceded in his 2002 testimony that “many areas” of the SBS diagnosis “remain
10 confusing, particularly because *shaken baby syndrome is not necessarily correctly*
11 *explained when we get the facts.*” Manwaring TT at 41:20-25 (App. Tab 28) (emphasis
12 added). As a result, “in the instance of witnessed trauma being compared to unwitnessed
13 apparently non-accidental trauma, *we are left with the necessity to conjecture in some*
14 *cases.*” *Id.* at 41:20-42:3 (emphasis added).

15 2. ***Today, SBS Has Been Largely Debunked and Is Not Generally***
16 ***Accepted by the Relevant Scientific Communities***

17 Even under *Logerquist*, which did not require the type of scrutiny subsequently
18 imposed by *Daubert*, where “significant dispute exists among experts in the relevant field
19 concerning the validity of the scientific evidence, it is not admissible.” *State v. Garcia*,
20 197 Ariz. 79, 82 (1999). Although a lack of consensus about the reliability of a medical
21 diagnosis is not per se fatal to admissibility of causation testimony based on that
22 diagnosis, such lack of consensus is a factor that weighs heavily against admissibility. To
23 reiterate, under *Daubert*: “Law lags science; it does not lead it.” *Hendrix*, 609 F.3d at
24 1203 (quoting *Rider*, 295 F.3d at 1202 (quoting *Rosen*, 78 F.3d at 319)).

25 While almost no one in the scientific mainstream questioned SBS’ existence and
26 reliability in 2000, today questioning SBS is mainstream. *See, e.g.*, Szalavitz, *The Shaky*
27 *Science of Shaken Baby Syndrome*, TIME (Healthland) (online, Jan. 17, 2012); Bazelon,
28 *Shaken-Baby Syndrome Faces New Questions in Court*, N.Y. TIMES (Dec. 2, 2011);

1 Hansen, *Unsettling Science*, ABA. J. (Dec. 2011); Gabaeff, *Challenging the*
2 *Pathophysiologic Connection Between Subdural Hematoma, Retinal Hemorrhage and*
3 *Shaken Baby Syndrome*, 12 W. J. EMER. MED. 144 (2011) (App. Tab 40) (“It appears that
4 SBS does not stand up to an evidence-based analysis.”); Miller, et al. *Overrepresentation*
5 *of Males in Traumatic Brain Injury of Infancy and in Infants with Macrocephaly: Further*
6 *Evidence that Questions the Existence of the Shaken Baby Syndrome*, 31 AM. J. FORENSIC
7 MED. PATH. 165, 169 (2010) (App. Tab 53) (“Several recent observations have converged
8 to raise serious questions about SBS and whether shaking alone can cause the triad. . . .
9 How could such a diagnosis based on such flimsy evidence and with such far-reaching
10 implications become so entrenched in pediatric and legal medicine?”); Talbert, *Shaken*
11 *Baby Syndrome: Does It Exist?*, 72 MED. HYPOTHESES 131 (2009); Anderson, *Does*
12 *Shaken Baby Syndrome Really Exist?*, DISCOVER (Dec. 2, 2008); Gena, Comment, *Shaken*
13 *Baby Syndrome: Medical Uncertainty Casts Doubt on Convictions*, 2007 WIS. L. REV.
14 701, 710 (“Today, there is no consensus among medical professionals as to whether the
15 symptoms that have traditionally been attributed to SBS are necessarily indicative of
16 shaking.”); Leestma, “*Shaken Baby Syndrome*”: *Do Confessions by Alleged Perpetrators*
17 *Validate the Concept*, 11 J. AM. PHYS. AND SURGEONS 14, 15-16 (2006) (“It should be
18 apparent that from virtually every perspective many flaws exist in the theory that shaking
19 is causative.”); Uscinski, *Shaken Baby Syndrome: An Odyssey*, 9 J. AM. PHYS. AND
20 SURGEONS 76 (2004) (SBS is “a widely proclaimed *yet still hypothetical* supposition”);
21 Lyons, Note, *Shaken Baby Syndrome: A Questionable Scientific Syndrome and A*
22 *Dangerous Legal Concept*, 2003 UTAH L. REV. 1109 (“Shaken baby syndrome . . . quite
23 possibly does not exist.”); V. DiMaio, et al., FORENSIC PATHOLOGY 362 (2d ed. 2001)
24 (“[We] have grave reservations as to the existence of SBS.”); Lloyd Dec. ¶ 10 (“Based on
25 research to date, the current understanding in the biomechanics field is that SBS is not a
26 valid mechanistic explanation for the triad findings in infants”); *see also Wisconsin v.*
27 *Edmunds*, 746 N.W.2d 590, 596 (Wis. Ct. App. 2008) (“a significant and legitimate
28

1 debate in the medical community has developed in the past ten years over whether infants
2 can be fatally injured through shaking alone”).

3 In 2001, the National Association of Medical Examiners issued a position
4 statement endorsing SBS. (Ex. 7, Plunkett Dec. ¶ 8). In 2006, the group withdrew its
5 endorsement. (*Id.*) At its annual meeting that year, presentations were made with titles
6 such as “*Where’s the Shaking?: Dragons, Elves, the Shaken Baby Syndrome and Other*
7 *Mythical Entities*” and “*The Use of the Triad of Scant Subdural Hemorrhage, Brain*
8 *Swelling, and Retinal Hemorrhages to Diagnose Non-Accidental Injury Is Not*
9 *Scientifically Valid.*” (*Id.*)

10 The debate about SBS is particularly controversial -- and the diagnosis is definitely
11 **not** generally accepted -- in cases such as this one where there is no outward or
12 radiographic evidence of abuse (*e.g.*, bruises, grip marks, crush injuries, focal lesions on
13 the brain, or broken or fractured bones), yet medical experts entrenched in the old dogma
14 continue to claim they can diagnose abuse from the triad alone. *See, e.g.*, Findlay, et al.,
15 *Shaken Baby Syndrome, Abusive Head Trauma, and Actual Innocence: Getting It Right*,
16 __ HOUSTON J. HEALTH POLICY __ (2012) (forthcoming soon) (“We now know . . . it is
17 no longer valid to reason backwards from the triad to a diagnosis of trauma or abuse.”);
18 Turkheimer, *supra*, at 10-11 (App. Tab 57) (“As a categorical matter, the science of SBS
19 can no longer support a finding of proof beyond a reasonable doubt in triad-only cases”);
20 Goudge, INQUIRY INTO PEDIATRIC FORENSIC PATHOLOGY IN ONTARIO – REPORT, at 528
21 (2008) (App. Tab 43) (“[T]he predominant view is no longer that the triad on its own is
22 diagnostic of SBS.”); Crown Prosecution Service, *Non-Accidental Head Injury Cases*
23 *(NAHI, formerly referred to as Shaken Baby Syndrome) -- Prosecution Approach* (Mar.
24 24, 2011) (“it is unlikely that a charge for a homicide . . . could be justified where the only
25 evidence available is the triad of pathological features”); Ex. 4, Guthkelch Dec. ¶ 7 (“A
26 diagnosis of non-accidental death, such as ‘shaken baby syndrome’, is not justified when
27 the only evidence of abuse is the triad (subdural hematoma, cerebral edema and retinal
28 hemorrhages.”); Ex. 1, Barnes Dec. ¶ 5 (“Simply put, doctors cannot assume a non-

1 accidental cause of brain injury based on the medicine alone.”); Ex. 6, Mosley Dec. ¶ 8
2 (“There is now no longer consensus in the medical community that the findings I reported
3 in my autopsy report are reliable proof of SBS or child abuse.”).

4 SBS has become so controversial -- to the point where its very existence is in doubt
5 -- for the following four primary reasons.

6 **a. Many Other Causes of the Triad Have Come**
7 **to Light During the Past Decade**

8 In 2002, the PCH physicians and Dr. Mosley testified that the SBS triad of findings
9 was nearly unique to SBS. Today, as a result of improved imaging techniques and
10 subsequent research, the list of diseases and conditions known to cause the same findings
11 previously attributed to violent shaking -- and which by and large *were not even*
12 *considered* by the PCH doctors or medical examiner in 2000 -- is long and growing. *See,*
13 *e.g.,* Lloyd, et al., *Biomechanical Evaluation of Head Kinematics During Infant Shaking*
14 *Versus Pediatric Activities of Daily Living*, 2 J. FORENSIC BIOMECHANICS 1, 7 (2011)
15 (App. Tab 5) (setting forth a long list of known mimics for the SBS symptoms); Ex. 1 at ¶
16 5 (Dr. Barnes, neuroradiologist and leading author re SBS mimics, explains that the list of
17 “mimics” continues to grow and cites several articles re such mimics); Ex. 4 at ¶ 5 (Dr.
18 Guthkelch, neurosurgeon and author of original hypothesis article on SBS: “We know
19 that a number of other conditions -- natural and non-accidental -- may lead to the triad.”);
20 Ex. 7 at ¶ 5 (Dr. Plunkett, forensic pathologist: “It is now generally understood that the
21 triad of injuries -- retinal hemorrhage, subdural hemorrhage, and brain swelling -- occurs
22 secondary to a variety of natural events, particularly with respect to children under one
23 year of age.”); Findlay, *supra* p. 33 (“By 2006, it was widely recognized by supporters of
24 the [SBS] hypothesis that there are many ‘mimics’ of [SBS], including accidental causes
25 and a variety of illnesses and medical conditions, ranging from birth trauma to childhood
26 stroke.”); Squier, *The “Shaken Baby” Syndrome: Pathology and Mechanisms*, ACTA
27 NEUROPATHOL. 1, 3 (2011) (“The differential diagnosis of a baby with the triad is wide . .
28 . .”) (App. 56).

1 In other words, we now know that many other medical conditions and non-abusive
2 events can cause the triad of clinical findings previously believed (without scientific
3 validation) to be unique markers of abuse, while there is tremendous debate and
4 uncertainty about whether those findings can even be caused by shaking.

5 **b. The Assumptions About How Shaking**
6 **Caused the Triad Were Wrong**

7 Research and studies appear to confirm that *all* the fundamental assumptions about
8 *how* shaking causes the triad were wrong. In short, “the scientific underpinnings of SBS
9 have crumbled.” Tuerkheimer, *The Next Innocence Project: Shaken Baby Syndrome and*
10 *the Criminal Courts*, 87 WASH. U.L. REV. 1, 11 (2009) (App. Tab 57.)

11 The SBS hypothesis was that shaking caused subdural bleeding by causing
12 bridging veins to tear. Today, even “the most ardent SBS believers now generally
13 concede that the prior theory that shaking caused subdural hemorrhage by causing
14 bridging veins to tear or rupture was likely incorrect.” Ex. 5, Lloyd Dec. ¶ 14 (citing
15 relevant literature); *accord* Findlay, *supra*, at 3 (“We now know, however, that the triad
16 does not necessarily or generally reflect the tearing of bridging veins”).

17 Similarly, SBS theory was that shaking causes retinal injury by causing capillaries
18 to swell and then burst. But studies have confirmed that retinal hemorrhages are not
19 traumatically caused by shaking and instead are a secondary consequence that occur as a
20 result of intracranial bleeding or pressure in a *wide* variety of non-traumatic and accidental
21 circumstances. *See, e.g.*, Ex. 5, Lloyd Dec. ¶ 8 (“it is now generally accepted by the
22 medical community that . . . retinal hemorrhages indicate nothing more than that the
23 individual is suffering increased intracranial pressure (from whatever cause)”); Ex. 7,
24 Plunkett Dec. ¶¶ 6-13 (“In other words, severe retinal hemorrhages are linked to brain
25 swelling and life support rather than trauma itself.”); Ex. 2, Gardner Dec. ¶¶ 9-12, 22A
26 (“retinal hemorrhages are not a direct result of traumatic head injury but are secondary to
27 intracranial hemorrhage and an increase in intracranial pressure, events which are not at
28

1 all specific to abuse”); (App. Tab 2); Findlay, *supra*, at 31-32 (citing multiple sources for
2 proposition that retinal hemorrhages are not directly caused by shaking).²¹

3 As an example of one recent study that contradicts the SBS hypothesis regarding
4 retinal hemorrhages, the Dallas Medical Examiner’s Office removed and kept eyes from
5 corpses for subsequent evaluation by consulting ophthalmologic pathologists. According
6 to the study, “[f]or many years, the dogma of pediatric forensic pathology was ‘retinal and
7 optic nerve sheath hemorrhages are pathognomonic of abusive head injury,’ including
8 shaken baby syndrome. Growing controversy surrounding the existence of SBS led to
9 questioning of that dogma.” Matshes, *Retinal and Optic Nerve Sheath Hemorrhages Are*
10 *Not Pathognomonic of Abusive Head Injury*, 16 PROC. OF THE AMERICAN ACADEMY OF
11 FORENSIC SCIENCES 272 (2010). The study revealed that retinal hemorrhages are
12 commonly found in natural and accidental deaths, as well as in homicides, and identified a
13 statistically significant relationship between the occurrence of retinal and optic nerve
14 sheath hemorrhage and the restoring of a perfusing cardiac rhythm following advanced
15 life support and brain swelling. In other words, where there is hypoxia, increased
16 intracranial pressure, and prolonged resuscitation efforts, retinal hemorrhages of all kinds
17 follow, regardless of the traumatic or non-traumatic condition that brought about the
18 hypoxia.²² Such hemorrhages are not diagnostic of shaking. The study concluded that eye
19 evaluations are of “limited value” in child death investigations. (*Id.*)²³

21 ²¹ See also Lantz, *Junk Science and Glass Houses*, 114 PEDIATRICS 330 (2004) (App. 48)
22 (stating that the “vested dogma” that the trauma of shaking causes retinal hemorrhages “is
a faith-based assumption, not a scientific fact.”).

23 ²² Other literature is in accord. “An important and almost invariably overlooked part of the
24 clinical history in babies presenting with the triad is a prolonged period of hypoxia, often
30 min or more between the baby being found collapsed and arriving in hospital and
25 receiving advanced resuscitation. . . . Prolonged hypoxia and resuscitation have been
shown to be significantly associated with retinal hemorrhages and may also explain the
26 [brain injury] in babies with the triad.” Squier, *supra*, at 3 (App. 56). Steven, of course,
had a period exceeding 30 minutes of hypoxia and received prolonged advanced
resuscitation prior to anyone observing retinal hemorrhages.

27 ²³ Studies also confirm that physicians check for retinal hemorrhages far more often when
28 they suspect child abuse than when they do not. (*Id.* at 11-12.) For example, there is no
indication during Steven’s weeklong stay at PCH that doctors even once checked his eyes
for retinal hemorrhage.

1 Finally, and perhaps most importantly, the supposition that shaking causes brain
2 damage and accompanying swelling through the shearing of nerve fibers has now all but
3 been abandoned as it has been shown that the damage previously attributed to such
4 shearing actually results from hypoxia -- lack of oxygen -- from whatever cause. *See, e.g.,*
5 Findlay, *supra*, at 14 (summarizing that “it is now widely accepted that the brain swelling
6 seen in allegedly shaken infants is hypoxic-ischemic rather than traumatic in nature”).

7 Those who still support the SBS diagnosis do so even though it has been shown
8 that the premises for the diagnosis have been proven false or, at least, in substantial doubt.

9 **c. SBS Cannot Be Squared With Biomechanics**

10 The 1968 Ommaya biomechanics study provided the “sole source of experimental
11 data from which the initial hypothetical shaking mechanism was drawn.” Uscinski, *supra*,
12 at 58 (App. Tab 58). But this study, like the many biomechanical studies that have
13 attempted and failed to validate the SBS hypothesis since then, does not actually support
14 shaking as a viable mechanism for the triad of clinical findings. In fact, while the findings
15 of biomechanical studies “are consistent with the physical laws of injury biomechanics,”
16 the results “are not, however, consistent with the current clinical SBS experience and are
17 in stark contradiction with the reported rarity of cervical spine injury in children
18 diagnosed with SBS.” Bandak, *supra* fn. 1, at 71 (App. Tab 35).

19 Biomechanical engineers, unlike most medical doctors, study the exertion of forces
20 on the human body and the body’s tolerances to such forces. Two decades of study by
21 biomechanical engineers, often in conjunction with neurosurgeons, has consistently
22 concluded that shaking likely does not generate enough force to cause the triad. Ex. 5,
23 Lloyd Dec. ¶ 10 (“angular accelerations associated with shaking are well below the
24 predicted thresholds for causing subdural hematoma and cerebral edema in an infant.”).
25 “Based on research to date, the current understanding in the biomechanics field is that
26 SBS is not a valid mechanistic explanation for the triad findings in infants.” *Id.; accord,*
27 Squier, *supra*, at 3 (App. Tab 56) (reviewing the biomechanical literature and concluding
28 that it shows that “shaking is no longer a credible mechanism” for the SBS findings).

1 Ironically, biomechanical principles initially were believed to support SBS. The
2 seminal papers²⁴ from the 1970s setting forth the SBS hypothesis cited only Dr.
3 Ommaya's 1968 rhesus monkey whiplash study. But in 2002, Dr. Ommaya, a
4 neurosurgeon, and heavyweight co-authors in the field of biomechanics, published
5 *Biomechanics and Neuropathology of Adult and Paediatric Head Injury*, 16 BRIT. J.
6 NEUROSURG. 220 (App. Tab 54), in which they explained that Dr. Ommaya's earlier
7 whiplash study involved adult rhesus monkeys, not infants. The monkeys had not been
8 shaken, but instead had been strapped in steel collision carts and impacted at various
9 speeds from the rear in an effort to gauge human thresholds to whiplash injury in car
10 accidents. (*Id.* at 221-22.) The authors further explained that the study actually showed
11 that subdural hemorrhage was *not* easily caused by whiplash, and they suggested that the
12 study had been misinterpreted by Drs. Guthkelch and Caffey in citing to it as scientific
13 support for SBS. (*Id.*)

14 Moreover, Dr. Ommaya and his co-authors observed that the forces generated by
15 even violent shaking by an adult were biomechanically insufficient (as little as 1/10th the
16 force generated from an impact to the head after a three-foot fall); accordingly, they would
17 expect to see soft tissue injury to the neck as well as spinal injury in any case where a
18 baby was actually shaken hard enough to cause subdural hemorrhage. (*Id.* at 222.) They
19 noted that such neck findings generally were not reported in the SBS literature. *Id.*²⁵

20 In 2005, Dr. Faris Bandak, a biomechanical engineer, confirmed that the levels of
21 force required to shake a healthy infant hard enough to produce subdural injury would in
22 fact exceed the tolerance of the infant neck, causing near or total neck failure. Bandak,

23 ²⁴ Guthkelch, *Infantile Subdural Haematoma and its Relationship to Whiplash Injuries*, 2
24 BRIT. MED. J. 430 (App. Tab 44); Caffey, *The Whiplash Shaken Infant Syndrome: Manual*
25 *Shaking by the Extremities With Whiplash-Induced Intracranial and Intraocular*
26 *Bleedings, Linked With Permanent Brain Damage and Mental Retardation*, 54
27 PEDIATRICS 396 (1974) (App. Tab 38).

28 ²⁵ Dr. Ommaya's article also expressed doubt that shaking could directly cause retinal
hemorrhage or damage to the eye. (*Id.* at 223) (stating that the "hypothesis" of "retinal
hemorrhage caused by orbital shaking has not been tested experimentally" and the "levels
of force required for . . . shaking to damage the eye directly is biomechanically
improbable.").

1 *supra* n. 28, at 78 (App. Tab 35). His article seriously called into question the assumption
2 that shaking alone could cause the triad of injuries associated with SBS, at least without
3 significant neck or spinal injury. In fact, Dr. Bandak noted that the rhesus monkeys had
4 substantially stronger necks and comparatively smaller heads than infants, which have
5 heavy heads and floppy, weak necks, but the rhesus monkeys studied by Dr. Ommaya all
6 showed neck damage from the whiplash. This finding directly contradicts the SBS-
7 supportive literature and the testimony of the State’s medical experts in this case. *See,*
8 *e.g.*, Teaford TT at 30:4-7, 29:19-25 (App. Tab 29) (testifying that “because of the weak
9 neck muscles and a baby has a relatively large head, the velocity going back and forth
10 tears the bridging veins over the top of the skull, on the bottom of the skull, and on top of
11 the brain”: but “[i]t’s usual not to” see “external signs of trauma” in shaken babies
12 because “[t]he injury is on the inside of the brain, on the inside of the skull.”); Manwaring
13 TT at 8:1-11 (App. Tab 28) (“The infant has a large head proportional to the body,
14 therefore, mechanisms of trauma are more easily manifested in the head. Weak neck
15 muscles; the head can fall forward or backward more easily than the older child, and many
16 of these injuries do not necessarily involve the breaking of bones or external soft tissue
17 bruising, but are revealed by imaging studies of the brain, x-rays, CT scans, MRI scans.”).

18 **d. So-Called Perpetrator Confession Cases Do Not Support**
19 **the SBS Diagnosis; there Is No Known or Knowable Rate**
20 **of Error for an SBS Diagnosis**

21 Seemingly one reason the SBS theory was accepted so quickly without scientific
22 validation was because SBS advocates felt that the hypothesis was proven by perpetrator
23 confessions.²⁶ Indeed, some SBS advocates continue to insist that confessions in the
24 context of police investigations or prosecutions validate the hypothesis. Christian, et al.,
25 *Abusive Head Trauma in Infants and Children*, Committee on Child Abuse and Neglect,
26 NEWS FROM THE FIELD (June 2009) (“Shaking was the most commonly reported

27 ²⁶ At the 2002 trial, Dr. Manwaring testified about supposed “documented, witnessed,
28 admitted descriptions” of children who have retinal hemorrhages with a known cause of
shaking. (App. Tab 28 at 27:6-12.)

1 mechanism of injury described in a series of AHT cases in which perpetrators admitted
2 abuse (68% of 81 cases).”)

3 But when Dr. Jan Leetsma, a neuropathologist at Children’s Memorial Hospital at
4 Northwestern University, closely examined the so-called SBS confession literature, he
5 found that in the vast majority of the “confession” cases there was clear evidence of
6 impact injury to the head -- *i.e.*, the child’s injuries likely had not been caused by shaking
7 at all or, at least, were likely partially attributable to an impact. He found that the
8 confession literature only recorded 11 “pure” shaking cases and several of those were
9 questionable because no details were given about the degree of shaking, for how long, or
10 about the circumstances surrounding the confession. For example in some of the cases
11 where the caretaker admitted shaking the infant, it turns out the “admission” was of
12 bouncing the baby during play or attempts to revive the baby when it was found
13 unconscious. Leestma, *Case Analysis of Brain Injured, Admittedly Shaken Infants: 54*
14 *Cases*, 26 AM. J. FORENSIC MED. PATH. 199 (2005) (App. Tab 50.) Dr. Leestma
15 concluded that “confessions” did not provide an adequate basis to establish the reliability
16 of the SBS diagnosis.²⁷

17 After nearly forty years, the literature still reveals *no* witnessed accounts or video
18 of the shaking of a previously well child resulting in the triad. Nevertheless, the State’s
19 medical experts testified at Drayton’s 2002 trial that their diagnoses were based on a
20 “statistical likelihood” of SBS. *See, e.g.*, Manwaring TT at 23:8-11 and 33:19-21 (App.
21 Tab 28). But the case histories of alleged SBS cases is so deficient that there are no
22 reliable epidemiological studies of SBS that can be used to establish a known rate of error.
23 Leestma, *Case Analysis of Brain-Injured Admittedly Shaken Infants: 54 Cases, 1969-*
24 *2001*, 26 AM. J. FORENSIC MED. PATH. 199, 210 (2005) (App. Tab 50) (finding that the

25 ²⁷ Subsequent literature has only expanded on the reasons why confessions do not
26 scientifically validate SBS. *See, e.g.*, Findlay, *supra* p.33 (explaining the several reasons
27 why confessions do not validate SBS); Squier, *supra*, at 3 (App. Tab 56) (reviewing so-
28 called confession literature); *see also Aleman v. Village of Hanover Park*, 662 F.3d 897,
907 (7th Cir. 2011) (describing a confession of slight shaking in an SBS case where the
father was told the injury must have been caused by shaking as “worthless as evidence,
and as a premise for an arrest.”)

1 “case-based information on allegedly ‘shaken’ infants is often scanty or missing, highly
2 variable in the manner reported, and not systematic in details provided. The case selection
3 methodology employed in most articles is inconsistent, often arbitrary, and individually or
4 collectively of *insufficient numbers to permit robust statistical analysis*, much less
5 declarative supportable statements of how certain injuries are supposed to have
6 occurred.”) (emphasis added).

7 Given the unreliable nature of the case studies, as reported by Dr. Leestma, it is no
8 wonder that “case reports and case studies are universally regarded as an insufficient
9 scientific basis for a conclusion regarding causation because case reports lack controls.”
10 *Hall v. Baxter Healthcare Corp.*, 947 F. Supp. 1387, 1411 (D. Ore. 1996) (citing case
11 law); *see also Siharath v. Sandoz. Pharms. Corp.*, 131 F. Supp. 2d 1347, 1361 (N.D. Ga.
12 2001) (“Case reports are not reliable scientific evidence of causation, because they
13 simply describe[] reported phenomena without comparison to the rate at which the
14 phenomena occur in the general population or in a defined control group; do not isolate
15 and exclude potentially alternative causes; and do not investigate or explain the
16 mechanism of causation.”) (quoting *Casey v. Ohio Medical Prods.*, 877 F. Supp. 1380,
17 1385 (N.D. Cal. 1995)).

18 3. ***SBS Is a Diagnosis For Criminal Prosecution, Not For Medical*** 19 ***Treatment***

20 “[P]eople can maintain an unshakeable faith in any proposition, however
21 absurd, when they are sustained by a community of like-minded
22 individuals.”

22 -- Kahneman, THINKING, FAST AND SLOW 217 (2011).

23 SBS has never been just a medical diagnosis. Instead, it is a diagnosis used
24 primarily for prosecution, not treatment. Even the name signals its broader function. “Of
25 the several hundred syndromes in the medical literature, almost all are named either after
26 their discoverer (e.g., Adie’s Syndrome) or for a prominent clinical feature (e.g., Stiff
27 Man Syndrome).” Guthkelch, *Problems of Infant Retino-Subdural Hemorrhage with*
28 *Minimal External Injury*, __ HOUSTON J. HEALTH & POLICY __ (2012) (forthcoming

1 soon). SBS, by contrast, is a name that focuses on the alleged cause of certain clinical
2 findings. (*Id.*) Tightly tethering the concept of abuse to the triad findings has always
3 been a focus of SBS advocates. That focus persists even now that it is well-accepted that
4 there are many other causes of the triad.

5 For example, the Committee on Child Abuse and Neglect of the American
6 Academy of Pediatrics has long been dominated by staunch SBS advocates. In 2001, that
7 Committee issued a policy statement that not only endorsed SBS, but said that a
8 presumption of abuse should exist whenever a child presented younger than 1 year with
9 intracranial injury and retinal hemorrhages. *Shaken Baby Syndrome: Rotational Cranial*
10 *Injuries--Technical Report*, PEDIATRICS Vol. 108 No. 1 (July 2001). By 2009, however,
11 the shaking hypothesis had become controversial. Yet, instead of revisiting the SBS
12 hypothesis in light of the controversy over the supposedly supporting science, the
13 Committee issued another policy statement suggesting that physicians stop using the term
14 Shaken Baby Syndrome -- ***and instead use the term Abusive Head Trauma.*** Christian, et
15 al., *Abusive Head Trauma in Infants and Children*, Committee on Child Abuse and
16 Neglect, NEWS FROM THE FIELD (June 2009).²⁸ It made this name change not to more
17 accurately reflect scientific discoveries, but rather to help prosecutors to continue to use
18 SBS to obtain criminal convictions despite the mounting criticism of the scientific
19 underpinnings of SBS: “Legal challenges to the term ‘shaken baby syndrome’ can distract
20 from the ***more important questions of accountability of the perpetrator*** and/or the safety
21 of the victim.” (*Id.* emphasis added.)

22
23
24 ²⁸ In 2009, the Committee renamed SBS “Abusive Head Trauma” (“AHT”), but this
25 change was merely a shift in terminology and simply encompassed other mechanisms of
26 abuse; it did not abandon or alter the shaking hypothesis. Whether called AHT or SBS,
27 the hypothesis relied upon by the State in this case remains the same: that a medical
28 doctor can reliably diagnose shaking from three internal findings -- subdural hemorrhage,
retinal hemorrhage, and encephalopathy. See, e.g., Bandak, *Shaken Baby Syndrome: A
Biomechanics Analysis of Injury Mechanisms*, 151 FORENSIC SCI. INT. 71, 73 (2005) (App.
Tab 35) (“While SBS has taken on other labels in the literature, adding or substituting
terms like ‘whiplash’ and ‘impact,’ it still maintains the shaking component as the central
causation substratum of this diagnosis.”).

1 The child abuse protection community has prosecuted SBS for over thirty years.
2 Thousands have been convicted or had their children taken away based on the SBS
3 hypothesis. During that same period, SBS was taught in medical schools not as a
4 hypothesis but as a scientific fact. And so it is perhaps not surprising that, at this point,
5 there are those who zealously resist any challenge to the SBS construct.

6 In particular, there is a National Center on Shaking Baby Syndrome led by a board
7 featuring prosecutors and pediatric physicians who often testify in SBS cases. The Center
8 advocates for SBS' reliability, trains law enforcement officers, and supports prosecutions.
9 See Turkheimer, *supra*, at 29 (App. Tab 57). It also appears to coordinate attacks against
10 physicians who challenge SBS dogma. See, e.g., *Evidence Outweighs Belief*, Letter to the
11 Editor, MINN. MEDICINE (January 2010) (nine doctors, a prosecutor and a police detective,
12 all of whom are associated with the National Center on Shaken Baby Syndrome, invoked
13 the "memory of dead babies" to attack the research of Dr. Plunkett as mere "belief").
14 Every other year, the Center puts on international conferences for physicians, prosecutors
15 and social workers to discuss new SBS developments that are dedicated, ironically, to
16 castigating each new batch of opposing literature as "biased," "misleading" and
17 "unscientific."²⁹ Well-accepted medical diagnoses, of course, do not need international
18 conferences to vouch for their existence.

19 The tethering of medicine and law is also apparent from the SBS literature. For
20 example, there are manuals for prosecuting SBS cases, which contain input from pro-SBS
21 doctors and which are littered with pearls of junk science.³⁰ See, e.g., Holmgren,
22 *Prosecuting the Shaken Infant Case* in THE SHAKEN BABY SYNDROME: A

23
24 ²⁹ According to the Center's website, www.dontshake.org, the Twelfth International
25 Conference on Shaken Baby Syndrome recently occurred. The keynote address was titled:
26 "*While We Argue, Children Die: The Consequences of Misinformation.*" This address
27 supposedly "set the tone for a meeting grounded in science." Other prominent
28 presentations made were about how to respond to *Daubert* challenges and a panel that
discussed the circumstances of perpetrator confessions gathered from around the world.

³⁰ Junk science is "the mirror image of real science, with much of the same form but none
of the same substance." Peter W. Huber, *Galileo's Revenge: Junk Science in the
Courtroom* 1-2 (1993).

1 MULTIDISCIPLINARY APPROACH 307 (2001) (providing prosecutors with ideas for
2 physician testimony such as: the “expert can testify that the forces the child experiences
3 [from shaking] are the equivalent of a 50-60 m.p.h. unrestrained motor vehicle accident,
4 or a fall from 3-4 stories on a hard surface”).³¹ Similarly, pediatricians publish articles and
5 book chapters dealing with legal issues, such as about the *mens rea* of alleged shakers.
6 *See, e.g.,* A. Levin, *Retinal Haemorrhages and Child Abuse*, in 18 RECENT ADVANCES IN
7 PAEDIATRICS 151 (2000) (“we know that the violence which results in SBS injuries is
8 extreme [and] beyond . . . that even the most distraught person would recognize as
9 injurious.”).

10 In sum, SBS is and always has been a diagnosis that is not primarily medical or
11 scientific, but instead one that seeks to intertwine medicine with law and child protection
12 policy. That intertwining may be understandable, but the tendency for the unproven
13 hypothesis to be shaped and perpetuated by forces other than objective science is
14 undeniable and cannot be ignored in determining whether the diagnosis is sufficiently
15 reliable to be admitted in a murder case.

16 **V. The State’s Experts’ SBS Testimony Is Not Based on Scientific or Specialized**
17 **Knowledge that Will Assist the Trier of Fact**

18 *Daubert* recognized that “[e]xpert evidence can be both powerful and quite
19 misleading because of the difficulty in evaluating it.” *Daubert I*, 509 U.S. at 595 (internal
20 quotations omitted). Accordingly, the Supreme Court required that testimony be based on
21 “scientific or specialized knowledge” (not speculation, not conjecture, not controversy, but
22 actual proven fact) and that it assist the trier of fact. *Id.* Here, the State’s experts’
23 testimony fails this test for three reasons. First, the PCH physicians failed to perform a
24 proper differential diagnosis. Second, the PCH experts lack the requisite specialized
25 knowledge in the relevant scientific areas. Third, an expert testifying as to medical

26 ³¹ To be clear, biomechanical testing has proven this type of testimony, which was given
27 by the State’s experts at Drayton’s first trial, to be absolutely false. Indeed, one of our
28 experts has published about a little girl who suffered the triad and eventually died after
falling only 28 inches, the whole incident captured on video. *See* Plunkett, *Fatal Pediatric*
Head Injuries Caused by Short-Distance Falls, 22 AM. J. FORENSIC MED. PATH. 1 (2001).

1 causation -- a key element of the State's burden of proof -- must be able to state his or her
2 opinion to the requisite standard of proof, and the State's experts here concede that SBS
3 cannot be diagnosed in a case like Steven's without resort to speculation. Speculation
4 simply cannot satisfy the State's burden of proving causation beyond a reasonable doubt.

5 **A. The State's Experts' Did Not Perform a Proper Differential Diagnosis**

6 Evidence of scientific knowledge is relevant only if the "reasoning or methodology
7 properly can be applied to the facts in issue." *Schudel v. G.E. Co.*, 120 F.3d 991, 996 (9th
8 Cir. 1997). In other words, there must be a logical nexus between the scientific studies
9 relied upon by the expert and the conclusion reached in the particular case: "Nothing in
10 either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion
11 evidence which is connected to existing data only by the *ipse dixit* of the expert. A court
12 may conclude that there is simply too great an analytical gap between the data and the
13 opinion proffered." *General Electric Co. v. Joiner*, 522 U.S. 136, 146 (1997); *see also*
14 *McClain*, 401 F.3d at 1252 (noting that a prerequisite to reliable cause-and-effect
15 testimony is that "medical science understands the physiological process by which a
16 particular disease or syndrome develops") (quoting *Black v. Food Lion, Inc.*, 171 F.3d
17 308, 314 (5th Cir. 1999)).

18 Accordingly, before expert testimony establishing medical causation may be
19 admitted, *Daubert* requires that the medical expert be able to conclude that the alleged
20 cause is the cause in fact -- here, not merely that shaking can cause the triad of injuries, but
21 that shaking actually caused the triad of clinical findings that led to Steven's death. *See,*
22 *e.g., Daubert II*, 43 F.3d at 1320. To testify that a particular cause was *the* cause of
23 particular injuries, *Daubert* therefore requires that the State's experts conduct what is
24 called a proper "differential diagnosis," also known as "differential etiology." *See, e.g.,*
25 *Clausen*, 339 F.3d at 1057. The case law defines a proper differential diagnosis as a
26 scientific process of elimination whereby the possible causes of a condition or injury are
27
28

1 identified and then, if possible, are ruled out one-by-one until *the* cause is determined. *Id.*;
2 *accord Hendrix*, 609 F.3d at 1195.

3 The PCH physicians cannot so testify. They diagnosed shaking so quickly in 2000
4 that it is difficult even to pretend for argument's sake that they engaged in any serious
5 differential diagnosis. Indeed, both their conduct and their sworn testimony was that they
6 believed the triad of findings could be caused by violent shaking, except with the rarest of
7 exceptions. Thus, other than to review the blood tests for infection and one particular
8 metabolic disorder, they considered no other alternative diagnoses.

9 In any event, the State did not do a proper differential diagnosis, for at least these
10 reasons:

11 ***1. SBS Cannot Reliably Be "Ruled In" as a Cause of the Triad***

12 The first step in a proper differential diagnosis is for the expert to compile a
13 "comprehensive" list of causes that are each *capable* of explaining the clinical findings.
14 *Hendrix*, 609 F.3d at 1195; *Clausen*, 339 F.3d at 1057. Importantly, for each such
15 potential cause the expert "rules in" at this stage, that cause "must actually be capable of
16 causing the injury." *Hendrix*, 609 F.3d at 1195 (quoting *McClain*, 401 F.3d at 1253)
17 (excluding potential cause "ruled in" by expert because it had not yet been established to
18 be a potential cause of the injuries in question); *see also Hall*, 947 F. Supp at 1413
19 ("Testimony regarding specific causation in a given patient is irrelevant unless general
20 causation is established."). "Expert testimony that rules in a potential cause that is *not* so
21 capable is unreliable." *Clausen*, 339 F.3d at 1058 (emphasis added).

22 As explained, SBS has not been proven to be a potential cause of the triad. Indeed,
23 attempts to quantify case studies have shown that there is no statistically relevant sample
24 available. Similarly, attempts to confirm the biomechanics have shown the shaking
25 hypothesis to be "biomechanically improbable." SBS merely is a hypothesis that is being
26 debated, that has not been validated, and that appears to be at odds with science. Any
27 differential diagnosis based upon a potential cause that has not reliably been shown to in
28 fact be capable of causing the injuries in question is, for *Daubert* purposes, flawed and

1 inadmissible.

2 **2. *The State’s Experts Did Not Comprehensively Identify and***
3 ***Consider Alternative Causes***

4 It also is improper under *Daubert* and the differential diagnosis method for an
5 expert to start with one possible cause and deem it to be the cause-in-fact without first
6 comprehensively identifying other potential causes and ruling them out. *Hendrix*, 609
7 F.3d at 1195; *Clausen*, 339 F.3d at 1057; *Leestma, supra*, at 16 (App. Tab 49) (“it is
8 inappropriate to select one mechanism only and ignore the rest of the potential causes”);
9 Ex. 4, Guthkelch Dec. ¶¶ 6-8 (describing the steps of a proper differential diagnosis in
10 SBS cases).

11 The record makes clear that the State’s experts did not do this in 2000 (with the
12 exception of checking for infection and one particular metabolic disorder). Indeed, the
13 State’s experts did not even fully review Steven’s medical history or talk to his prior
14 treating physicians before diagnosing abuse. Even those who today still advocate for SBS
15 recognize that it must be treated as a “rule out” diagnosis -- *i.e.*, it is SBS only if all other
16 potential causes are thoroughly identified, explored and can confidently be ruled out. *See*,
17 *e.g.*, Ex. 1, Barnes Dec. ¶¶ 5, 7; Ex. 4, Guthkelch Dec. ¶¶ 5-7, 10-14. That did not occur
18 here.

19 **3. *The State’s Experts Did Not Reliably Consider and Rule Out***
20 ***Venous Thrombosis***

21 “[E]xpert testimony that neglects to consider a hypothesis that might explain the
22 clinical findings under consideration may also be unreliable.” *Clausen*, 339 F.3d at 1059.
23 Here, venous thrombosis obviously is a potential alternative cause. It was not considered
24 by the State’s experts before reaching their SBS diagnosis, further undermining the
25 reliability of the State’s proffered testimony.

26 **4. *The State Has Not Identified Any Scientifically Valid, Reliable Way***
27 ***To “Rule Out” All Other Causes in a Case Like This***

28 The final step of a proper differential analysis is for the expert to apply the facts of
the patient’s case to each such potential cause in order to form a reliable opinion about the

1 *actual* cause of the patient’s symptoms. *Hendrix*, 609 F.3d at 1197; *Clausen*, 339 F.3d at
2 1058. An “expert must provide reasons for rejecting alternative hypotheses using
3 scientific methods and procedures[,] and the elimination of those hypotheses must be
4 founded on more than subjective beliefs or unsupported speculation.” *Clausen*, 339 F.3d at
5 1058 (internal quotations omitted). If the expert cannot reliably and to the relevant
6 standard of proof exclude all the causes except for one, the expert’s testimony must be
7 precluded.

8 At this point, due to the failure to investigate certain theories and to preserve
9 necessary physical evidence, it is now too late for certain theories to be investigated
10 adequately. *See ex. 8*, Squier Dec. ¶ 4 (noting that at autopsy only 5 samples of the brain
11 were taken and no special stains were done to examine the detailed microscopic changes in
12 the brain); *ex. 2*, Gardner Dec. ¶¶ 14-21 (detailing the myriad ways that a consult in 2000
13 by an ophthalmologist at the hospital, or by an ophthalmic pathologist during the autopsy,
14 or simply an adequate preservation of eye tissue would be of aid in making a proper
15 differential diagnosis.)

16 More fundamentally, the State cannot establish how a reliable differential diagnosis
17 can be done to establish SBS beyond a reasonable doubt in a case like this, where baby
18 Steven had such a confounding medical history, his effusions were of a different age, and
19 there are no other signs of abuse. *See, e.g., ex. 4*, Guthkelch Dec. ¶¶ 10-14. No literature
20 provides clarity, or serves as consensus, as to how a reliable differential diagnosis can be
21 done here, or what the rate of error would be in making such a diagnosis. And regardless
22 of whether the PCH doctors testified consistently with medical belief in 2002, the fact is
23 that today their methodology does not satisfy the requirements of *Daubert*.

24 **B. The Burden of Proof Cuts Against Admitting the SBS Evidence**

25 “Expert evidence can be both powerful and quite misleading because of the
26 difficulty in evaluating it.” *Daubert I*, 509 U.S. at 595 (source omitted.) Under *Daubert*,
27 the party proposing expert testimony on causation “bears the burden of proving
28 admissibility” of that testimony. *Lust v. Merrell Dow Pharmaceuticals*, 89 F.3d 594, 598

1 (9th Cir. 1996); *see also Daubert II*, 43 F.3d at 1316 (9th Cir. 1995). And, importantly,
2 where, as here, the expert testimony constitutes the proponent’s *only* evidence of
3 causation, the Court “determination of relevance must consider the applicable substantive
4 standard.” *Schudel*, 120 F.3d at 996 (because under Washington tort law, a plaintiff must
5 show that the “the act complained of ‘probably’ or ‘more likely than not’ caused the
6 subsequent disability, plaintiffs’ expert’s testimony that it was merely possible that the
7 alleged toxin caused plaintiff’s brain damage was not relevant); *see also Daubert II*, 43
8 F.3d at 1320 (“***plaintiffs must nevertheless carry their traditional burden***; they must
9 prove their injuries were the result of the accused cause and not some independent
10 factor.”) (emphasis added).

11 In a criminal murder case such as this, “the Due Process Clause protects the
12 accused against conviction ***except upon proof beyond a reasonable doubt of every fact***
13 ***necessary*** to constitute the crime with which he is charged.” *In re Winship*, 397 U.S. at
14 364 (emphasis added). The State thus bears the burden of proving that Drayton caused
15 baby Steven’s injuries and death, and the State’s sole causation theory is that Drayton
16 violently shook his sick baby. Because there is no physical or radiologic evidence of
17 abuse -- no bruising, no fractures, no spinal injuries, no eye witness accounts of shaking,
18 no confession, not even any focal lesions on Steven’s brain -- the State’s entire causation
19 case rests upon the causation opinions of the PCH doctors.

20 Proof beyond a reasonable doubt has “traditionally been regarded as the decisive
21 difference between criminal culpability and civil liability.” *Jackson v. Virginia*, 443 U.S.
22 307, 315 (1979). Accordingly, given the absence of other evidence of medical causation,
23 testimony by the PCH doctors that SBS caused Steven’s death to a “reasonable degree of
24 medical certainty,” that is, “more likely than not,” is insufficient to satisfy the State’s
25 burden of proving relevance.

26 Arizona defines “beyond a reasonable doubt” to mean “proof that leaves you firmly
27 convinced of the defendant’s guilt.” *State v. Portillo*, 182 Ariz. 592, 596 (Ariz. 1995).
28 Proof that leaves open a “real possibility” that the defendant “is not guilty” is insufficient

1 to satisfy the State's burden of proof. The State's medical experts testified that their
2 opinions necessarily entailed a certain amount of "conjecture." Their opinions are not
3 reliably connected to the science that supposedly supports the SBS hypothesis, which
4 hypothesis is fueled not by a desire to further science or medicine but rather a desire to
5 hold individuals culpable for the very sad, and poorly understood, deaths of infants. There
6 is no way the State can meet its burden to show that SBS has been sufficiently validated
7 such that it meets this burden.

8 **C. The State's Experts Are Not Qualified in the Relevant Scientific Fields**
9 **To Offer Opinions Regarding SBS**

10 SBS advocates, who are most commonly pediatricians, pediatric nurses, children's
11 hospital doctors, and social workers, routinely urge that courts should defer to their
12 expertise because they regularly treat children. But though they treat children, they do not
13 actually see children being shaken, are not experts in the body's tolerances to particular
14 forces, and have no training at all about what kinds of forces shaking can inflict on the
15 body of an infant. It is well established that an individual "cannot qualify as an expert
16 generally by showing that the expert has specialized knowledge or training which would
17 qualify him or her to opine on some other issue." *In re Diet Drugs*, 2001 WL 454586 at
18 *7 (E.D. Pa. 2001); *see also In re: Diet Drugs*, 2000 WL 962545 at *3 (E.D. Pa. 2000)
19 (testimony outside an expert's area of expertise should be excluded) (citing cases); *Soldo*
20 *v. Sandoz Pharms. Corp.*, 244 F. Supp. 2d. 434, 568 (W.D. Pa. 2003) (excluding plaintiffs'
21 medical causation expert in birth defect litigation because he was not qualified in the fields
22 of epidemiology, statistics, neurology, neuropathology, or obstetrics-gynecology).

23 In addition, as occurred at Drayton's first trial, pro-SBS doctors routinely seek to
24 testify beyond their expertise, such as doctors who are not ophthalmologists or forensic
25 pathologists testifying about what can be gleaned from microscopic bleeding within the
26 eye, and doctors -- for example, Drs. Pollack, Teaford and Manwaring in this case -- who
27 are not epidemiologists but who purport to testify regarding the statistical relevance of
28 case reports. *See, e.g.,* Manwaring TT at 33:19-21 ("[S]tatistically, it is said that about

1 half of children who show a mechanism of cerebral death don't show external injury or
2 have occult injury."); Teaford TT at 29:19-25 (App. Tab 29) ("It's usual not to" see
3 "external signs of trauma" in shaken babies because "[t]he injury is on the inside of the
4 brain, on the inside of the skull.").

5 Due to their lack of specialized knowledge in the relevant scientific and medical
6 subspecialties, the State's experts all gave testimony that was "***flat wrong or grossly***
7 ***overstated.***" Ex. 3, Griest Dec. ¶ 5 (emphasis added); *see also* ex. 2, Gardner Dec. ¶
8 22(A)-(E) (describing obvious errors and misstatements by each of the State's experts with
9 respect to their testimony about what can be gleaned from the eye findings); ex. 5, Lloyd
10 Dec. ¶¶ 13-19 ("[t]he medical testimony presented by the state of Arizona at trial was
11 fraught with what is now known to be inaccurate information about SBS" and describing
12 key false statements by Drs. Emily Pollack, Kim Manwaring, and Patricia Teaford); ex. 7,
13 Plunkett Dec. ¶¶ 14-15 ("[i]n addition to the retinal findings," the State's experts erred in
14 concluding that "Steven's subdural hemorrhage must have been caused by traumatic
15 shaking" because "while shaking would not cause brain injury or subdural hemorrhage, it
16 presumably would cause bruising, fracture or other detectable crush injuries to the infant's
17 chest or arms. Steven had no such injuries.").

18 Some of the State's experts also argued that the bleeding in Steven's cervical spinal
19 canal somehow indicated trauma. Steven's autopsy report, however, noted a "scant
20 amount of upper cervical subdural hemorrhage" and "hemorrhage along the inner surface
21 of the cervical spinal canal." And it is well established that "it is common for intracranial
22 subdural blood to track into the spinal subdural compartment." Squier, *supra*, at 3-5 (App.
23 Tab 56). Such blood is a result of gravity flow and the dying process and does not reflect
24 traumatic injury to the spine or surrounding tissues. (*Id.*)

25 Because the State's experts demonstrably lack specialized knowledge in the
26 relevant fields -- biomechanics, ophthalmology, pediatric pathology, pediatric neurology,
27 statistics, and epidemiology -- these experts are not qualified to give medical causation
28 opinions about SBS, and their testimony is irrelevant under *Daubert*.

1 **VI. Conclusion**

2 Male babies are diagnosed far more often with SBS than are female babies -- by a
3 ratio of nearly 2-1. By a very similar margin, male babies more frequently suffer subdural
4 hemorrhage from natural causes. *See Miller, Overrepresentation of Males in Traumatic*
5 *Brain Injury of Infancy and in Infants with Macrocephaly: Further Evidence that*
6 *Questions the Existence of the Shaken Baby Syndrome*, 31 AM. J. FORENSIC MED. PATH.
7 165 (App. Tab 53). Why is that?

8 After forty years, the literature still does not reveal a single witnessed or videotaped
9 incident of a shaking causing the triad. Why is that?

10 How does shaking cause the triad? How accurate is a diagnosis based only on the
11 triad? How can other causes for Steven's death reliably be excluded?

12 These are the most fundamental questions about SBS, yet the scientific community
13 is not yet in agreement on them. It would be wrong to allow the State to allow experts to
14 come to trial and guess, or speculate, or argue about SBS when it is not yet a scientifically
15 validated entity and cannot reliably establish under the facts of this case that Drayton
16 murdered his son. We ask that testimony about SBS be excluded from trial.

17 Respectfully submitted this 16th day of October, 2012.

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1 The foregoing was electronically filed this
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11 /s/ Carole Hanger
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