THOMSON ROGERS

LAWYERS

DATE: MARCH 25, 2020

TO: DAVID MACDONALD **CC:** STEPHEN BIRMAN

FROM: ZACHARY A. COOPER (3203)

RE: **MISCELLANEOUS – SPECT RESEARCH**
FILE NO. 081573

This memo is to summarize my research findings in relation to SPECT scans. Specifically, it comments on the following:

1. Review of Dr. Daniel Amen's peer reviewed articles and a summary of common criticisms of Dr. Amen
2. Why SPECT scans should be admissible under the "*Daubert*" criteria for admissibility

I have also included an index of relevant cases in both Canada and the United States as an attachment to this memo. I have prepared summaries of all of these cases. The summaries and decisions are included in the Sharefile link but are also attached to this memo for ease of reference.

Using this index as a starting point, it might be a good idea to start a binder (similar to the one created for the CAT decisions) which would include all of the summaries and case printouts. I continue to work remotely at the moment, but would be happy to work with Isha and/or Elaine to put this together once things calm down.

1. Dr. Daniel Amen

A summary of Dr. Daniel Amen's peer reviewed articles on SPECT's utility as a diagnostic tool for psychiatric conditions and traumatic brain injury can be found below.

There are other peer reviewed articles available on Dr. Amen's website: https://www.amenclinics.com/the-science/peer-reviewed-studies/. I have only summarized the articles that fall within the scope of your research interests.

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2018: ***Deficits in Regional Cerebral Blood Flow on Brain SPECT Predict Treatment Resistant Depression***

The study found that subjects who had depression that worsened following treatment had reduced cerebral perfusion compared to full remission in other regions, including the bilateral frontal lobes, right hippocampus, left precuneus, and cerebellar vermis. These differences were observed on both resting and concentration SPECT scans. The study concluded that the *"findings identify imaging-based biomarkers in persons with depression related to treatment response. These findings have implications in understanding both depression to prognosis and its role as a risk factor for dementia*."[1]

2015: ***Functional Neuroimaging Distinguishes Post-traumatic Stress Disorder from Traumatic Brain Injury in Focused and Large Community Datasets***

This study assessed SPECT scans capability to diagnose and diagnose and separate Traumatic Brain Injury (TBI) and Posttraumatic Stress Disorder (PTSD), which are highly heterogeneous conditions that often present similar symptomology.

The study *"demonstrates the ability to separate PTSD and TBI from healthy controls, from each other, and detect their co-occurrence, even in highly comorbid samples, using SPECT. This modality may offer a clinical option for aiding diagnosis and treatment of these conditions*[2]*".*

2014: ***Clinical Comparison of 99mTc exametazime and 123I ioflupane SPECT in Patients with Chronic Mild Traumatic Brain Injury***

This study evaluated clinical interpretations of SPECT in patients with chronic mild traumatic brain injury (TBI).

Twenty-five patients underwent a SPECT scan with both 99mTc exametazime to measure cerebral blood flow and 123I ioflupane to measure dopamine transporter binding. The study found that TBI patients had an average of 6 brain regions with abnormal perfusion compared to the control group who had an average of 2 abnormal regions. Patients with headaches were found to have lower cerebral blood flow in the left frontal lobe and right temporal lobe. This correlated with

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[1] Amen, Daniel G. et al. 'Deficits in Regional Cerebral Blood Flow on Brain SPECT Predict Treatment Resistant Depression'. 1 Jan. 2018 : 529 – 538.

[2] Functional Neuroimaging Distinguishes Posttraumatic Stress Disorder from Traumatic Brain Injury in Focused and Large Community Datasets, Amen DG, Raji CA, Willeumier K, Taylor D, Tarzwell R, et al. (2015) Functional Neuroimaging Distinguishes Posttraumatic Stress Disorder from Traumatic Brain Injury in Focused and Large Community Datasets. PLOS ONE 10(7): e0129659. https://doi.org/10.1371/journal.pone.0129659

poorer reporter physical health. Patients with more depressive symptoms and reporter poorer mental health tended to have higher dopamine transporters.

The study concludes that: *"both scans detected abnormalities in brain function, but appear to reflect different types of physiological processes associated with chronic mild TBI symptoms. Both types of scans might have distinct uses in the evaluation of chronic TBI patients depending on the clinical scenario"*[3].

2014: *Clinical Utility of SPECT in the Diagnosis and Treatment of Traumatic Brain Injury: a Systematic Review*

This study reviewed global literature for SPECT use in TBI. Out of 1600 studies identified, 71 articles, 19 longitudinal and 52 cross-sections studies, met "rigorous inclusion criteria".

100% of the longitudinal studies and 98% of the cross-sectional studies showed SPECT lesion localization that was not detected by CT or MRI. Furthermore, almost 80% of the longitudinal and 81% of the cross-sectional articles showed significant correlation between SPECT and neuropsychological or neurological outcomes.

Ultimately, the study highlights the extensive literature base for using SPECT to evaluate TBI[4].

2013: *Multisite, 6-Month Outcome Study of Complex Psychiatric Patients Evaluated with Addition of Brain SPECT Imaging*.

This study assessed 6-month outcomes for patients at clinics that incorporated brain SPECT in their diagnostic and treatment plans in complex psychiatric cases. *"The Study demonstrated an overall, robust treatment response in a cohort of psychiatric patients with predominately treatment-resistant/complex disorders in which SPECT imaging was used to inform the diagnosis and treatment plan. While more research is clearly warranted, the potential value of SPECT to clinicians include adding neurophysiological data to make more complete diagnoses and help guide treatment."*[5]

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[3] Newberg AB, Serruya M, Gepte A, Intenzo C, Lewis T, Amen DG, Russell D, Wintering N (2014),
Clinical comparison of 99mTc exametazime and 123I ioflupane SPECT in patients with chronic mild traumatic brain injury.

[4] Raji C, Tarzwell R, Pavel D, Schneider H, Uszler J, Thornton J, van Lierop M, Cohen P, Amen DG, Henderson TA (2014), Clinical utility of SPECT in the diagnosis and treatment of traumatic brain injury: A systematic review.

[5] Amen DG, Jourdain M, Taylor DV, Pigott HE, Willeumier K (2013), Multi-site, six month outcome study of complex psychiatric patients evaluated with addition of brain SPECT imaging, at page 15

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Critiques

Dr. Amen has drawn some controversy from the medical community for his use of SPECT in his clinical practice, in particular, for his use in SPECT as an aid for psychiatric diagnosis:

- John Seibyl of the Society of Nuclear Medicine and Molecular Imaging has stated that "SPECT is valuable for diagnosing disorders like epilepsy, dementia and brain tumours…But not for psychiatric disorders like depression. There's no debate here"[6]
- In 2005, the American Psychiatric Association concluded that "the available evidence does not support the use of brain imaging for clinical diagnosis or treatment of psychiatric disorders in children and adolescents."[7]
- Neuroscience researcher Martha Farah an Psychologist S.J. Gillihan, have stated: "[t]he lack of empirical validation has led to widespread condemnation of diagnostic SPECT as premature and unproven"[8]
- Neuroscience professor, Martha Farra, describes Dr. Amen's practice as "profitable but unproven"[9]
- Psychology Professor Irving Kirsch has been critical of Amen, stating: "Before you start promulgating this and marketing it and profiting from it, you should ethically be bound to demonstrate it scientifically in a peer-reviewed, respected journal", otherwise "you're just going down the path of being a snake oil salesman"[10]

2. Admissibility

Regardless of Dr. Amen's critics, we have seen courts accept SPECT scan results as admissible in certain circumstances. For results to be accepted, **experts should address criticisms of the testing head on and not try to hide them from the court.** For instance, in Czombos v. Wawanesa Mutual Insurance Co., [2017] O.F.S.C.D. No. 332, SPECT evidence was accepted when the expert, Dr. John Thornton, acknowledged the following shortcomings with SPECT:

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[6]Bhattacharya, Sanjiv (February 6, 2013). "Dr Daniel Amen interview: The shrink who believes technology will replace the couch". Daily Telegraph.

[7] Council on Children, Adolescents; Their Families (January 2005). "Resource Document on Brain Imaging and Child and Adolescent Psychiatry With Special Emphasis on Single Photon Emission Computed Tomography (SPECT)"

[8] Farah, M.J.; Gillihan, S.J. (2012). "The puzzle of neuroimaging and psychiatric diagnosis: Technology and nosology in an evolving discipline". AJOB Neuroscience. 3 (4): 31–41.

[9] Farah, M.J. (2009). "A picture is worth a thousand dollars". Journal of Cognitive Neuroscience (Editorial). 21 (4): 623–4.

[10] Tucker, Neely (August 9, 2012). "Daniel Amen is the most popular psychiatrist in America. To most researchers and scientists, that's a very bad thing". Washington Post Magazine.

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1. Using SPECT for psychiatric diagnosis is controversial;
2. There are publications, literature, and people in the scientific and non-scientific communities that maintain, "While some physicians insist that they are able to use brain imaging now for psychiatric diagnosis, there is currently no reliable evidence supporting this view. On the contrary, there are many reasons to doubt that imaging will play a role in the psychiatric diagnosis in the near future. As argued here, much psychiatric imaging research remains to be done to achieve sensitivity, specificity, and standardization of imaging protocols"; and

3. That there are those who maintain, "Few top researchers and scientists say that SPECT is anything but a research tool of limited clinical use in identifying strokes, brain injuries and the like. It is helpful in *group* studies to say *broad* things about *groups* of patients but not *specific* things about *individual* patients. And, researchers say, SPECT has largely since been surpassed by technologies such as PET and Functional MRIs, which give images of far greater clarity. It's no longer viewed as cutting edge".[11]

In response, Dr. Thornton's evidence was that:

1. He is not using SPECT for psychiatric diagnosis. **Rather, SPECT is used as an aid in diagnoses and differential diagnoses, and to evaluate regional cerebral perfusion;**

2. **Many critics of SPECT are uninformed, biased, self-designated experts who are not medical doctors and are not themselves doing the SPECT scanning.** Furthermore, their conclusions are based on outdated and unreliable data, and the literature relied on by them is often not peer-reviewed; and

3. SPECT is useful for groups and individual patients.

The key inference to be made here is that **SPECT should be used as an aid in differential diagnoses. It seems unlikely that a court would rely on a SPECT scan alone to conclude that an individual has an ABI, but it can be a persuasive piece of evidence if considered alongside other clinical findings**[12].

[11] Czombos v. Wawanesa Mutual Insurance Co., [2017] O.F.S.C.D. No. 332, at para 146
[12] Ibid, at para 147

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Admissibility of SPECT Scans in the USA

American courts have held that SPECT scan results are admissible as evidence and can satisfy the "*Daubert*" criteria for admissibility.

The state of the law on the admissibility of SPECT is well put in the textbook, *Neuroimaging in Forensic Psychiatry: From the Clinic to the Courtroom*. The authors write:

> **SPECT scans are commonly utilized in so-called toxic tort cases, in which a plaintiff claims brain damage due to chemical exposure, as well as in personal injury litigation, such as in a claim of brain damage following an automobile accident. Many plaintiffs have been successful in introducing SPECT scans into evidence even when admissibility was subject to a Daubert or other scientific evidentiary challenge.[13]**

However, the authors later caution that:

> **Forensic psychiatrists have reviewed the appropriateness of SPECT when used with testimony in TBI cases and have concluded that SPECT used as a sole diagnostic imaging modality lacks scientific merit and may actually breach the ethics of expert testimony when used as a sole instrument for expert opinion that a TBI has occurred[14]. In fact, many forensic psychiatrists cast doubt on the suitability of cerebral SPECT imaging in mild TBI, and cast serious doubt on the evidentiary usefulness and appropriateness of this technology used in a legal context at this time[1516].**

Even though thought leaders in the field have mixed views on SPECT scans, courts have still found them to be admissible.

In the United States, the rule of evidence regarding the admissibility of expert testimony is analyzed under rule 702 of the *Federal Rules of Evidence* and *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993).

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[13] *Neuroimaging in Forensic Psychiatry: From the Clinic to the Courtroom*, at page 12

[14] Wortzel, H.S., Filley, C.M., Anderson, C.A., Oster, T. and Arciniegas, D.B. (2008) Forensic
applications of cerebral single photon emission computed tomography in mild traumatic brain
injury. J. Am. Acad. Psychiatry Law, 36, 310–322. See also, Granacher, R. (2008) Commentary: Applications of functional neuroimaging to civil litigation of mild traumatic brain injury. J. Am. Acad. Psychiatry Law, 36, 323–328.

[15] Ibid

[16] Supra note 8, at page 58

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Rule 702 states that an expert witness may testify if:

> (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
> (b) the testimony is based on sufficient facts or data;
> (c) the testimony is the product of reliable principles and methods; and
> (d) the expert has reliably applied the principles and methods to the facts of the case.

Under *Daubert,* the Supreme Court provided guidelines for determining whether an expert's methodology is valid. The *Daubert* guidelines consist of five factors for consideration:

> (a) whether the theory or technique in question can be and has been tested;
> (b) whether it has been subjected to peer review and publication;
> (c) its known or potential error rate;
> (d) the existence and maintenance of standards controlling its operation; and
> (e) whether it has attracted widespread acceptance within a relevant scientific community.

American courts have found Doctors who have analyzed SPECT scans to satisfy the above tests and have permitted them to testify as a result.

In ***Stewart v Hankins*, 2016 U.S. Dist. LEXIS 183089 (Texas),** the Court was not persuaded by the Defendant's argument that "brain SPECT imaging is not recognized or accepted in the relevant scientific communities as a diagnostic technique". **The court ultimately found that the expert's evidence relating to the SPECT scan was both relevant and admissible.** The Court writes:

> "Defendant also argues that Dr. Schruff's diagnosis is not reliable because "brain SPECT imaging is not recognized or accepted in the relevant scientific communities as a diagnostic technique." (Dkt. # 22, at p. 7) (quoting Blotcher v. Stewart, 45 F. Supp. 3d 1274, 1281 (D. Colo. 2014)). However, on the following page in Blotcher, Judge Jackson writes:
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> > "SPECT imaging has been tested, reviewed, and /s/ Ron Clark determined to be scientifically valid. It has value if used as intended, i.e., used as the clinician deems Ron Clark, United States District Judge appropriate together with other patient information

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> to form a differential and ultimately a final diagnosis of the patient's condition. **I find and conclude that if Dr. Hipskind testifies about brain SPECT imaging in general, the testing that was performed on Ms. Blotcher, the resulting images, his opinion that the images reveal areas of hypoperfusion and thereby abnormalities, and, importantly, that the abnormalities are 'consistent with' . . . a traumatic brain injury, his testimony would meet all requirements for admissibility under Rule 702".**
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> **Similarly, in this case, Dr. Schruff relied on Plaintiffs self-reported symptoms and medical history, in conjunction with the SPECT scan findings, to reach a diagnosis. (Dkt. # 22-3, at p. 2-3. A doctor's opinion as to diagnosis should not be excluded under *Daubert* merely because the doctor relied in part on the patient's self-reported symptoms or medical history.** See, e.g., Cooper v. Carl A. Nelson & Co., 211 F.3d 1008, 1021 (7th Cir. 2000); Tripkovich, 2015 U.S. Dist. LEXIS 80611, 2015 WL 3849392. Moreover, that a SPECT scan may not definitively rule out other diagnoses is no reason to limit Dr. Schruff from testifying about the SPECT scan findings and functions because such ideas affect the weight of Dr. Schruffs opinion rather than its admissibility and should be left for the jury's consideration. See Viterbo v. Dow Chem. Co., 826 F.2d 420, 422 (5th Cir. 1987). **Dr. Schruffs testimony regarding SPECT scans is therefore both reliable and admissible**."

There are other cases (included below and in the Sharefile link) where SPECT has been admissible in the US, but *Stewart* appears to be the most persuasive case on the topic.

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SPECT Case Law Index

Canadian SPECT Decisions

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3. Steinberg v. Wawanesa Mutual Insurance Co., [2018] O.F.S.C.D. No. 15
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14. Stewart v Hankins, 2016 U.S. Dist. LEXIS 183089 (Texas)
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19. Lanter v. Kentucky State Police, 171 S.W.3d 45 (Ky. 2005)
20. Boyd v Bell, 410 F.3d 1173 (9th Cir. 2005)

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Canadian SPECT Decisions

1. Czombos v. Wawanesa Mutual Insurance Co., [2017] O.F.S.C.D. No. 332

At issue was whether the applicant sustained a catastrophic impairment as a result of a motor vehicle accident. The arbitrator found that the applicant had suffered a catastrophic impairment under both the “marked impairment” and “55% whole person impairment” definitions.

The applicant had a complicated history of several motor vehicle accidents and workplace accident; however, the arbitrator determined that the subject accident was of “causative significance” to the applicant’s current condition.

The arbitrator was persuaded by evidence given by Dr. John Thornton, psychiatrist, who made use of a SPECT scan in his report and testimony.

The insurer contented that one of the applicant’s experts, Rod Hare relied on “questionable science” when he used the SPECT scan results to find that the Applicant had a closed head injury to warrant a 14% WPI. The arbitrator found that **Mr. Hare did not rely on questionable science when he used the SPECT scan results.** The arbitrator writes:

141 I am not persuaded that Mr. Hare relied upon questionable science when he used the SPECT scan results to find that the Applicant had a closed head injury to warrant a 14% WPI, as contended by Wawanesa.

142 I am satisfied, based on the weight of the evidence before me, and find, that the **SPECT scan results are sufficiently reliable to support Dr. Thornton's opinion and Mr. Hare's rating of 14% WPI.**

143 The use made by Dr. Thornton of the SPECT scan results in reaching his conclusions has been subjected to peer review and publication. These are relevant, though not dispositive, considerations in assessing the reliability and scientific validity of SPECT scans on which his opinion and that of Mr. Hare are premised, in part. Scrutiny of the scientific community is part of good science, and it increases the probability that substantive flaws in methodology will be identified.

144 Expert evidence that is supported by literature and the professionalism of an expert witness will likely be given more weight by a judge or an arbitrator.

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145 I find that Dr. Thornton was professional and rigorous in his report and in his testimony given in this arbitration proceeding.

146 Dr. Thornton acknowledged that:

4. Using SPECT for psychiatric diagnosis is controversial;
5. There are publications, literature, and people in the scientific and non-scientific communities that maintain, "While some physicians insist that they are able to use brain imaging now for psychiatric diagnosis, there is currently no reliable evidence supporting this view. On the contrary, there are many reasons to doubt that imaging will play a role in the psychiatric diagnosis in the near future. As argued here, much psychiatric imaging research remains to be done to achieve sensitivity, specificity, and standardization of imaging protocols"; and

6. That there are those who maintain, "Few top researchers and scientists say that SPECT is anything but a research tool of limited clinical use in identifying strokes, brain injuries and the like. It is helpful in *group* studies to say *broad* things about *groups* of patients but not *specific* things about *individual* patients. And, researchers say, SPECT has largely since been surpassed by technologies such as PET and Functional MRIs, which give images of far greater clarity. It's no longer viewed as cutting edge".

147 In response, Dr. Thornton's evidence is that:

1. He is not using **SPECT for psychiatric diagnosis. Rather, SPECT is used as an aid in diagnoses and differential diagnoses, and to evaluate regional cerebral perfusion;**
2. **Many critics of SPECT are uninformed, biased, self-designated experts who are not medical doctors and are not themselves doing the SPECT scanning**. Furthermore, their conclusions are based on outdated and unreliable data, and the literature relied on by them is often not peer-reviewed; and
3. **SPECT is useful for groups and individual patients.**

148 Dr. Thornton's evidence is supported by:

*Exhibit 30, an article in Le Patient, Special Edition 2017: Nuclear Medicine, titled "SPECT in Neuroimaging", which states:

- Brain Perfusion Single-Photo Emission Computed Tomography (SPECT) is a nuclear imaging technique performed to evaluate regional cerebral perfusion.

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- **Advantages** -- **Provides a snapshot in time of cerebral blood flow from the precise injection time of the radioactive tracer. This allows professionals to understand brain activity during complex neurological conditions such as seizures. It also allows for analysis of biological activity in highly-specific regions of the brain. The SPECT scan remains lower cost than PET scans and is capable of using tracers with long half-lives.**

…In conclusion, **the current state of literature demonstrates both associative and predictive value of SPECT in the setting of TBI**. This same literature also demonstrates certain advantages of SPECT compared to structural MRI and CT in multiple studies, particularly in mild TBI. SPECT can therefore be used to provide actionable information in the identification and management of TBI.

*Exhibit 13, "Improved Outcomes Using Brain SPECT -- Guided Treatment Versus Treatment -- as -- Usual in Community Psychiatric Outpatients: A Retrospective Case -- Control Study", a peer-reviewed article co-authored by Dr. Thornton, which states:

Brain Single -- Photon Emission Computed Tomography **(SPECT) scans indirectly show functional activity via measurement of regional cerebral blood flow.**

SPECT is well-established nuclear medical imaging technology. 3D SPECT combines the scanning data via thresholding functions to synthesize a 3D model of the brain. This retrospective study showed that 3D brain SPECT scanning improved community psychiatric patient outcome.

I accept Dr. Thornton's evidence and his and Mr. Hare's use of the SPECT scan study of Ms. Czombos in the present case.

The court goes on to write:

187 In his report, dated January 13, 2016, Dr. Thornton said:

…**SPECT scanning has confirmed that there are areas of low blood flow and excessive blood flow which correlate with the cognitive, memory, emotional and other symptomatology with which she presents. There is a radiological evidence suggesting that she has Atlas/axis instability which has the potential to trigger many of the physical and psychological symptoms she has reported above. Because of bad reactions to medication in the past she is unwilling to try more medication for fear it will aggravate her condition as it**

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has done in the past. She remains unable to work and her symptomatology has not responded to any treatment she can tolerate. Without resolution of her physical symptoms it is unlikely her psychiatric symptoms will resolve. At this time she is significantly disabled and her prognosis to recover any further is very poor.

188 I accept this evidence and give it significant weight.

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2. Hornick v. Kochinsky, [2005] O.J. No. 1629

What import, if any, was the SPECT scan in this determination? Very helpful

[123] "…there is documentation that Mr. Hornick suffered amnesia following the accident. The ambulance attendants describe Mr. Hornick as confused and recorded a GCS of 12. The patient's symptoms of anger and irritability are typical of frontal lobe syndromes. **The Spect scan of the brain supports a diagnosis of a brain injury in an area of the brain that is susceptible to damage in acceleration - deceleration injuries, and would account for changes and Mr. Hornick's behavior.**

Short of an autopsy on Hornick, the Spect scan was the only piece of objective evidence of brain damage the court had.

[194]…..Notwithstanding she was aware of Dr. Sweeney's and Dr. Archibald's reports indicating brain trauma, she did not do anything specific to determine right left differences. The Spect scan was an objective test**. She agreed that Spect scan abnormalities may have pre-existed the crash but that it was equally possible that the abnormalities may not have existed before the crash and may only have existed after it and as a result of it.**

[230] Dr. Reid and Dr. Soucy are to be complimented in their approach to the Spect scan evidence and its importance. They disagreed but did so on the basis of the same test results. I prefer the evidence of Dr. Reid as the clinical psychiatric and psychological observations and testing supported his decision and served as a check and balance. Dr. Soucy's evidence, standing alone, and without the support of the neurological testing and consideration of the dynamics of the horrible crash, would be acceptable in its own encapsulated form. It can't be accepted when looked at in the totality of all of the evidence of brain injury.

Was there a brain injury?

[269] **The difficulty with a brain injury was that a person can't feel it, taste it or smell it. It might be able to be seen on a Spect scan**. In order to determine whether there has been a brain injury, the determiner must take into consideration all of the evidence both subjective and objective in order to make the finding on the balance of probabilities. Hornick's pre accident status was that he did not have a brain injury although he may have had some limited cognitive difficulties. However, he was able to function at Duo-Matic and supervise people, put up with whiners and exhibit interpersonal communication skills and be

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responsible. He would not lose his temper and seemed capable of completing his chores satisfactorily. He was a hard worker and seemed to live a normal family life notwithstanding leveling some emotional abuse on his wife.

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3. Steinberg v. Wawanesa Mutual Insurance Co., [2018] O.F.S.C.D. No. 15

At issue in this arbitration was whether the applicant sustained a catastrophic impairment within the meaning of the *schedule* (yes).

Dr. John Thornton's (Psychiatrist) Testimony

64 "**Dr. Thornton's practice focuses on those patients who appear to be normal but who have suffered a subtle brain injury, and cannot sustain any cognitive or mental function moving forward. These types of injuries can be identified by using a "SPECT Scan" which allows the treating physician to recognize where the damaged brain blood flow is in each region of the brain.** The idea is that the injured brain's blood flow patterns are identified and then when compared to the patient's psychiatric symptoms, allows for the right treatment to be provided in order to help a patient return to an improved functional life. **He believes that this is the only objective finding in psychiatry where no guessing is required. The doctor opines that a person can receive a concussion from a severe whiplash."**

67 The doctor described his findings within the **SPECT Scan** via a slide presentation where he opined he could determine that there are 7 indicators of brain trauma present in the Applicant. **The doctor cautioned that this SPECT Scan must be used in conjunction with his psychiatric clinical findings.** The doctor opined that in this case, there is cognitive dysfunction and that therapy will not help the Applicant with this issue. The Applicant's physical realities of brain activities show under-functioning within the identified brain anatomy associated with said dysfunction.

69 With all the information of the Applicant's self-reported symptoms, the previously found physical findings, and the *WHODAS* test results supported by the corresponding SPECT Scan results, the doctor provided impairment ratings for the Applicant with regards to the four spheres in his report which reads as follows:

1. Activities of daily living- Class 5
2. Social Functioning- Class 4
3. Concentration, Pace and Persistency- Class 5
4. Adaptation- Class 5.

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70 Dr. Thornton testified under cross-examination that Mount Sinai Hospital in Toronto did the original SPECT Scan and gave the raw data to him, but refused to magnify the SPECT Scan to the degree he required and was forced to send the raw data to a Boston hospital which provided the SPECT Scan as presented in the Hearing. **The doctor confirmed that the original radiologist reported normal findings in 2D SPECT Scan and no significant findings of the 3D SPECT Scan at a resolution of 50%. The subnormal blood flow in the brain was observed at a higher resolution. The doctor agreed that he was unable to discern if the accident alone accounted for the abnormal blood flow in the Applicant's brain.**

71 Dr. Thornton made it clear that the SPECT Scan does not in itself give any ratings for impairment; it only measures blood flow within identifiable brain anatomy.

Dr. Gary Moddel's (Neurologist) Testimony

Dr. Moddel testified on behalf of the insurer and opined:

75 In his first addendum, the doctor opined that he was not persuaded to change his neurological assessment after reviewing Katherine Chisholm's Occupational Therapist's report. In his second addendum, the doctor was again not persuaded to change his opinion after reviewing Dr. Baird's report and Dr. Mountain's Catastrophic report. **Further Dr. Moddel did not change his mind based on Dr. Thornton's findings and SPECT Scan.**

76 Dr. Moddel deferred any decision on the SPECT Scan to a radiologist who is better at reading this type of Scan images. The doctor opined that these types of scans are in his opinion not specifically enough, in that a variety of etiologies may produce these types of brain images.

77 Dr. Moddel suggests that this SPECT Scan should be used as a secondary tool for any neurological issues as MRIs are the norm.

Decision

The insurer argued that Dr. Thornton’s findings of three class 5 impairment ratings were outliers and inconsistent with other medical evidence.

The arbitrator did not specifically comment on the efficacy of SPECT scans, but agreed with the insurer that Dr. Thornton’s findings were

“extreme”. The arbitrator nonetheless found the applicant to be catastrophically impaired, relying on evidence from another expert (Dr. Mountain). The arbitrator writes:

111 After reviewing all the evidence in the mental, behavioural and physical aspects of this case, I believe that Dr. Mountain's conclusions best fit the Applicant's condition in regards to the two Marked or Class 4 impairment ratings for Concentration, Pace and Persistence, as well as Deterioration or decompensation in work or work like settings.

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4. Marcoccia (Litigation guardian of) v. Gill, [2007] O.J. No. 1333

The Plaintiff was severely injured in a 2000 motor vehicle accident. A jury determined the Defendant was liable and assessed other damages. At issue were damages for the Plaintiff's guardian of property (his mother), compensation for a corporate co-guardian who was yet to be determined, and future legal expenses. The court held that the Plaintiff would not be able to manage his financial and legal affairs in the future, and awarded damages for all of the above.

In the court's summary of the medical evidence to the jury underlying the future guardian and legal expense claims, the Court writes:

[72] …. "Dr. Cooper also confirmed that a third type of diagnostic imaging, a Spect scan, was also done on Robert and it confirmed the findings of brain injury."

In *Marcoccia*, the judge did not go into any detailed analysis on the admissibility and/or probative value of SPECT scans.

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5. Decision No. 353/12, [2013] O.W.S.I.A.T.D. No. 504

In this case, a worker sustained shoulder, back, neck and head injuries when a tree fell on him in 1982.

SPECT imaging showed a decrease in perfusion in the worker's inferior frontal lobes, which in one Doctor's opinion (Dr. Loy-English) could have been related to the worker's head injury when the tree fell on him; however, the Tribunal was persuaded by the tribunals assessor, Dr. Wherrett, who opined, inter alia, that:

> "In my opinion, **SPECT (single photon emission computed tomography) would only be able to detect more advanced disease of various kinds but would not be helpful for diagnosis in this worker. I consider it at best a research tool with marked limitations in spite of the speculations that it might detect abnormalities where other imaging techniques would show no abnormalities.** It requires very strict standardization with a high-resolution machine (5 detectors as opposed to the 3 detectors on machines used in most hospitals). The signal seen on the images represents a difference calculated by comparison with a brain region thought not be affected by the pathology, usually the cerebellum and is normally displayed in slice reconstructions on rather small images. The images are viewed visually and the interpretation is highly subjective. There can be considerable disagreement between observers. Those using it for research obtain the results numerically and results usually involve means in multiple subjects. It has been superseded by MRI both "structural" and "functional", the latter demonstrating blood flow (as does SPECT) and positron emission tomography (PET). For both head injury and neurodegenerative disorders, SPECT is not included in guidelines for standard practice, although it has been widely promoted as an indication. **My own experience from 1994 to the present working in 2 multidisciplinary Memory Disorders Clinics (where patients are seen by a neurologist, a psychiatrist and a geriatrician individually discussed at conference) and having assessed close to 3000 patients not only did I and my colleagues never think that SPECT was indicated, but we never found that it was helpful when it had been performed elsewhere. Indeed it could be misleading. I have been working in a mild head injury clinic for the past 3 years and SPECT is not included in our assessments."**[17]

[17] Decision No. 353/12, [2013] O.W.S.I.A.T.D. No. 504, at para 19

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Ultimately, the Tribunal was not persuaded by Dr. Loy-English's opinion which relied on the SPECT scan as they preferred the evidence of Dr. Wherrett who opined that SPECT scans are not part of the standard practice in diagnosing head injuries. The tribunal writes:

36 While I appreciate Dr. Loy-English's opinion in respect of the head injury effects, she seems to be relying mainly on the SPECT scan, which as Dr. Wherrett suggests, is not part of the standard practice in diagnosing head injuries.

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6. Decision No. 987/10, [2010] O.W.S.I.A.T.D. No. 2670

This WSIAT decision involved a worker who worked for an automobile manufacturer, beginning in January 1984. In September, 1989, the worker experienced numerous symptoms including increasing respiratory difficulty, which he attributed to constant exposure to coolant mists and vapours in his job duties as a machine operator on the V8 crankshaft line, increasing shortness of breath with physical activity, nasal congestion with nasal discharge, and headache. The worker formally filed a claim with the WSIB in 1999. The worker's representative relief on SPECT results to argue the worker's entitlement for brain injury. The Tribunal writes:

42 The worker's representative relies upon a report from Dr. J. Krop, dated December 10, 2001. Dr. **Krop interpreted the SPECT scan to show "decreased blood flow to the cerebral cortex and particular to the pons which is the central part of the brain."** Dr. Krop noted that the worker was exposed to petrochemical products, which in his opinion, "affected his brain as indicated in this scan."

44 The worker was referred to Dr. J. Turnbull, a neurologist at McMaster University, regarding the potential for brain injury. Dr. Turnbull's report, dated February 14, 2003, includes a summary of the worker's social, developmental, and work history, as well as a review of his symptoms. Mental status examination was normal. Dr. Turnbull also reviewed the results of the SPECT scan taken in Montreal and noted:

> This was a perfusion study, and showed some decreased uptake in the pons, decreased uptake in the frontal lobes with some left sided lateralization. I understand that an MRI scan through the head looking for structural causes has been completely normal.

45 Dr. Turnbull gave the following impression:

…. **Although the SPECT scan abnormality is interesting, unfortunately it is rather nonspecific, and given normal structure (i.e. a normal MRI scan), I would tend to downplay its significance.** There are multiple factors that can produce abnormal SPECT scan of this nature, including even such things as migraine headache and mood disturbance. If there are residual concerns, we will undertake a PET scan here. However, I am no worried about the abnormality for the time being, and I think that further investigations would only heighten his sense of apprehension. I suspect it would normalize with time anyway.

47 In summary, there is a lack of evidence that the worker has an actual neurological impairment or brain injury. The worker's subjective

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description that he feels more forgetful does not establish the existence of a condition, in the absence of reliable clinical evidence. **Furthermore, the more reliable medical opinion on file from Dr. Turnbull does not support a conclusion that the SPECT scan findings are either significant or related to occupational exposure.**

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7. Morgan v. Metropolitan Toronto (Municipality), [2006] O.J. No. 4951

In this case, the Plaintiff sued the City of Toronto for damages arising by its negligent administration of hepatitis B vaccine. The Plaintiff submitted that the vaccine had caused brain damage.

90 At a July 14, 1997, visit, Dr. Friedman noted that Lucia [the Plaintiff] had been to see Dr. Hyde. **He had told her a SPECT scan of her brain showed brain damage to her frontal, temporal and prefrontal lobes, the base of her cerebellum and post parietal area (all of which he thought had been caused by the inoculations).**

205 **Counsel for the Defendant submitted and I agree that Dr. Hyde relied excessively on SPECT scans in concluding that Lucia has brain damage. I have given no weight to Dr. Hyde's evidence about the SPECT scans [I rely on Dr. Poser's evidence with respect to her neurological condition and its causes].**

It is important to note that this was not a case where mild TBI occurred as a result of blunt force trauma, but rather it was a case with involving a controversial causal nexus (I.e. vaccinations leading to brain injury).

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8. Decision No. 1645/04, [2006] O.W.S.I.A.T.D. No. 855

In this case, a worker was involved in a second Motor Vehicle Accident (a prior accident occurred while she was not employed by the subject employer) while in the course of her employment as a sales representative. On the date of the accident she complained of headaches, neck pain, back pain left knee pain and left anterior chest wall pain. She was diagnosed with cervical and lumbar strains as well as a contusion to her left knee and left ribs.

Her symptoms complicated, and "Beginning in April 1993, Dr. M.J. Gawel, neurologist, investigated the worker for her headache complaints. In his first report dated April 7, 1993, Dr. Gawel suspected that the worker suffered from post-traumatic headaches and memory problems. He arranged for a SPECT scan and CT scan. **He later reported that the SPECT scan did not reveal any specific cause for her headaches and memory problems"[18].**

A second SPECT scan was reviewed by another physician, Dr. Adams. He "**advised that a brain SPECT scan was conducted in June 1996. He offered the following interpretation and opinion:**

> **... an area of decreased activity in the inferior aspect of the anterior left frontal cortex. This accords well with her neurocognitive examination in which right handed dominance was impaired indicating greater left hemisphere than right pathology, although the brain functions are diffusely affected."[19]**

The tribunal's medical assessor, Dr. Gray, was asked to comment on the "medical significance of the findings of the SPECT scans".

13 With respect to the SPECT scan conducted on the worker, Dr. Gray advised that it did not show any abnormality. He explained that SPECT scans look at defects of the brain which can result from a number of problems including depression, brain injury and stroke. **He advised that the American Academy of Neurology does not recognize SPECT scans as a properly validated diagnostic tool in mild traumatic brain injury** and the organization has recommended that SPECT scans not be used to diagnose such injuries.

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[18] Related decision, Decision No. 1645 04I, [2004] O.W.S.I.A.T.D. No. 2215, at para 39
[19] Ibid, at para 48

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9. Decision No. 557/99, [2000] O.W.S.I.A.T.D. No. 2693

In this appeal case, the injured party was a mining contractor who suffered a head and neck injury when he was struck by a cable reel that fell down a mine shaft.

The Vice-Chair agreed with the opinion of a Tribunal medical assessor, which determined that the most likely cause of the worker's symptoms were psychiatric. A SPECT scan result showed an abnormality, but the Vice-Chair questioned the reliability of the results for mild or subtle change.

70 Much of the evidence and argument in this appeal focused upon the reliability of the SPECT scan results in demonstrating organic brain injury. According to Dr. Wherrett, SPECT gives an assessment of blood flow in regions of the brain. In various circumstances, an abnormality seen on SPECT is evidence of abnormal functioning. However, in Dr. Wherrett's view, **the sensitivity and specificity of changes in SPECT for mild or subtle change is either very low or has not been adequately assessed. He referred to a 1996 report of the sub-committee of the American Academy of Neurology, which concluded that the clinical significance of SPECT abnormality found in head injury months afterwards was uncertain. In addition, Dr. Wherrett noted that an abnormality on SPECT scan must correlate with some appropriate symptom or sign to be considered of significance.**

71 Dr. Wherrett wrote that in a "contra coup" injury, clinical findings that would correlate most with changes in occipital and inferior frontal regions on SPECT would be blindness and behaviourial symptoms. In addition, loss of smell caused by shearing off of olfactory nerves is also commonly seen, although it is always most marked immediately after the injury from and not something noticed months later.

72 In summary, Dr. Wherrett felt that the most likely explanation for the worker's symptoms was psychiatric...

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10. Coulombe (Litigation Guardian of) v. Beard, [1995] O.J. No. 893

In this case, the Plaintiff was involved in a MVC and suffered PTSD, neck pain, headaches and brain function deficiencies. Despite a normal SPECT scan, the court still found that the Plaintiff had sustained a closed head injury and minor brain injury in the accident. With respect to the SPECT scan, the Court states:

19… Dr. Stewart commented on a report from Dr. Franks that Mr. Coulombe's **SPECT scan was normal and stated that that information favours normal brain function and goes against the concept that there might have been some brain injury related or unrelated to the accident of July, 1987. "The demented picture he presents is so severe that I would expect significant pathology evident in SPECT scan, CT and MIR if it was actually present."**

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11. Jardine v. Lend Lease Transportation Ltd., [1989] B.C.J. No. 2464

The Plaintiff was involved in a rear-end collision. She returned to work as a family therapist part-time after the accident. After the birth of her son in 1986, she was unable to return to permanent work outside the home. At issue was whether her cognitive challenges were a result of a brain unjury sustained in the accident or as a result of depression secondary to pain from the accident. Despite normal SPECT results, the Court found that the Plaintiff had suffered subtle brain damage as a result of the accident. With respect to SPECT, the court writes:

11 Finally, Dr. Hurwitz was influenced by the gap between the severity of Ms. Jardine's symptoms and the lack of objective findings of structural brain injury on a neurological examination and three different neuro-imaging techniques. **It is agreed that a normal neurological examination and normal CT, MRI and SPECT imaging are not determinative as to the absence of subtle brain injury.**

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12. Bialkowski v. Banfield, [2011] B.C.J. No. 1462

In this case, the Plaintiffs brought a motion to introduce opinion evidence derived from quantitative electroencephalograph analysis (QEEG) in their personal injury action. The Plaintiff proposed to admit evidence from a neuropsychologist who opined that the Plaintiff suffered a TBI. The Defendant argued that the Plaintiff's expert was unqualified with respect to QEEG and that QEEG evidence was not reliable.

The court was persuaded by the Defendants and held that the expert was not trained and qualified in EEG testing. Furthermore, the court found reviews on QEEG testing to be inconsistent and that it was a novel science warranting special scrutiny, making it insufficiently reliable to be admitted.

[3] Electroencephalography ("EEG") is a means of recording the electrical activity of the brain. Typically, electrical signals are received through 19 electrodes placed on certain areas of the scalp by attaching the electrodes to a cap that fits snugly over the patient's head. The electrical activity is then recorded either on paper, or digitally on a computer. The clinician can then visually examine the recorded data to analyze the patterns of activity.

[4] QEEG is a relatively new neuroimaging technique. It uses computer assisted analysis of EEG tests. The raw EEG data is digitized and analyzed by means of a mathematical algorithm. It is said that the computer analysis is capable of extracting more information from the raw EEG data and enables the clinician to observe more subtle anomalies than can be seen with the eye on standard visual analysis. Using another program the digitized data is then compared to a normative database to determine if the data are consistent with what is normal for a comparable group of individuals…

[58] **While there may be cases where QEEG evidence will be accepted as part of expert opinion in Canadian Courts it should only be through a neurologist who is trained and qualified in EEG testing and analysis. In my view, only a trained electroencephalographer who has the skill, knowledge and training to recognize the potential for error is qualified to give opinion evidence of QEEG analysis.**

[59] **On the evidence presented in this case, I find the QEEG evidence to be novel science and not sufficiently reliable for admission into evidence on the principles established in J.L.J. and Mohan. I conclude it will not assist the trier of fact.** As science progresses this may change and the evidence may meet the test of reliability so as to be

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admissible at some point in the future. As was noted in Seifert, the fact that expert evidence conflicts does not, by itself, make it inadmissible. Coburn, et al, recognize this in the conclusion of their report at p. 23, where it is stated:

> Used cautiously and with appropriate recognition of its limitations, QEEG offers the clinician an accurate laboratory test to aid in the detection and differential diagnosis of several common neuropsychiatric disorders. … Additional uses of QEEG showing promise but not yet sufficiently developed for routine clinical application include the prediction of medication efficacy and the prediction of the clinical cause of a disorder.
>
> **There is nothing in that conclusion to suggest it will become clinically useful in diagnosing traumatic brain injury in the near future; however, it remains open for such evidence to be offered through an appropriate expert if and when it satisfies the evidentiary requirements of Canadian Courts.**

[60] **The evidence of QEEG analysis given by Dr. Malcolm is rejected as not being offered by a qualified expert. QEEG does not meet the requisite reliability threshold and is still novel science.**

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13. S.F.P. v. MacDonald, [1999] A.J. No. 117

The Plaintiff was involved in a minor rear-end collision and claimed that the accident caused a closed head brain injury. Evidence on quantitative EEG analysis and brain mapping was found to be inadmissible.

69 A similar problem afflicts Dr. Flor-Henry's opinion. (In earlier written reasons issued during the trial, I ruled that Dr. Flor-Henry's evidence on quantitative **EEG** analysis and **brain mapping was inadmissible because that evidence did not meet the reliability threshold for new science.** The following comments deal with Dr. Flor-Henry's remaining grounds for diagnosing Ms. S.P. as having a **brain injury**.)

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American Cases

14. Stewart v Hankins, 2016 U.S. Dist. LEXIS 183089 (Texas)

In this case, the Plaintiff was injured in a motor vehicle accident. Ten months later, the Plaintiff was referred to a radiologist who conducted a SPECT scan to evaluate the extent of damage to the Plaintiff's brain. The defendants brought a motion to strike or limitsd the testimony of the radiologist, arguing that their opinions on causation and the SPECT scan are unreliable. The court granted the relief in part. The radiologist was not allowed to testify as to causation, however, **the testimony regarding the SPECT scan was found to be both "reliable and admissible"**. The court writes:

> "Defendant also argues that Dr. Schruff's diagnosis is not reliable because "brain SPECT imaging is not recognized or accepted in the relevant scientific communities as a diagnostic technique." (Dkt. # 22, at p. 7) (quoting Blotcher v. Stewart, 45 F. Supp. 3d 1274, 1281 (D. Colo. 2014)). However, on the following page in Blotcher, Judge Jackson writes:
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> > SPECT imaging has been tested, reviewed, and /s/ Ron Clark determined to be scientifically valid. It has value if used as intended, i.e., used as the clinician deems Ron Clark, United States District Judge appropriate together with other patient information to form a differential and ultimately a final diagnosis of the patient's condition. **I find and conclude that if Dr. Hipskind testifies about brain SPECT imaging in general, the testing that was performed on Ms. Blotcher, the resulting images, his opinion that the images reveal areas of hypoperfusion and thereby abnormalities, and, importantly, that the abnormalities are 'consistent with' . . . a traumatic brain injury, his testimony would meet all requirements for admissibility under Rule 702.**
> >
> > Blotcher, 45 F. Supp. 3d at 1282. Ultimately, Judge Jackson concluded that the expert, who coincidentally, is Dr. Schruffs colleague, could testify regarding the results, finding, and function of the SPECT scan. Id. at 1283.
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> **Similarly, in this case, Dr. Schruff relied on Plaintiffs self-reported symptoms and medical history, in conjunction with the SPECT scan findings, to reach a diagnosis. (Dkt. # 22-3, at p. 2-3. A doctor's opinion as to diagnosis should not be**

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excluded under *Daubert* merely because the doctor relied in part on the patient's self-reported symptoms or medical history. See, e.g., Cooper v. Carl A. Nelson & Co., 211 F.3d 1008, 1021 (7th Cir. 2000); Tripkovich, 2015 U.S. Dist. LEXIS 80611, 2015 WL 3849392, at *3. Moreover, that a SPECT scan may not definitively rule out other diagnoses is no reason to limit Dr. Schruff from testifying about the SPECT scan findings and functions because such ideas affect the weight of Dr. Schruffs opinion rather than its admissibility and should [*7] be left for the jury's consideration. See Viterbo v. Dow Chem. Co., 826 F.2d 420, 422 (5th Cir. 1987). **Dr. Schruffs testimony regarding SPECT scans is therefore both reliable and admissible**."

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15. Rhilinger v. Jancsics, et al, 1998 WL 1182058 (Mass. Super. 1998)

In Rhilinger v. Jancsics et al. **SPECT imaging was admitted into evidence in a case considering whether Ms Rhilinger sustained brain injury after exposure to fumes emanating from chemicals stored in the basement of her apartment building**. The court stated that there was **no dispute that SPECT scans show abnormalities in brain function. Nor is there a dispute that SPECT scans cannot conclusively establish the existence or non-existence of toxic solvent encephalopathy in a patient. The judge emphasized that the plaintiff's experts did not opine that the SPECT scan did, in fact, establish the diagnosis of toxic solvent encephalopathy, but was a tool that could be used to investigate this claim.**[20]

[20] Ibid, at page 12

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16. Fini v General Motors Corp (2003) WL 1861025 (Michigan Super. 2003)

In Fini v. General Motors Corp, et al. the court concluded that the use of SPECT may have important implications for classification and management of patients with mild head trauma, such as closed head injury, providing 'clinical correlation' for the physical examination. **In Ms. Fini's case, SPECT was used to show 'massive frontal lobe brain damage' sustained in a motor vehicle accident.**[21]

[21] Ibid, at page 12

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17. Summers v Missouri Pacific Railroad System (1995) 897 F. Supp. 533 (E.D. Okla. 1995)

In Summers v. Missouri Pacific Railroad System, the court did not admit a SPECT scan into evidence in a Federal Employers Liability Act (FELA) case where plaintiffs were passengers on a train where diesel exhaust fumes entered the cabin of the train. The plaintiffs were diagnosed with an injury to the central nervous and respiratory systems that the physician termed 'chemical sensitivity.' **The court noted a lack of reliable scientific and medical data to support the use of SPECT technology to diagnose neurotoxic exposure and excluded the scan from evidence. This evidentiary exclusion of SPECT was primarily due to the court's skepticism of a related, controversial disease entity termed multiple chemical sensitivity (MCS).**[22]

[22] Ibid, at page 12

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18. Smith v. Mullin, 379 F.3d 919 (2004)

SPECT scans have been used as mitigating evidence in criminal trials for capital murder. In Smith v. Mullin, 379 F.3d 919 (2004), the court ordered a re-sentencing hearing for Mr Smith, a man found guilty and sentenced to death for murdering his wife and her four children from a prior relationship. The court found that the defendant was prejudiced by his counsel's failure to present evidence of his cognitive abilities and brain damage. The court noted that evidence of his brain damage was shown in SPECT scans authorized by the court but not raised by counsel in the original trial. SPECT has also been used in at least one case to prove 'diminished actuality' (similar to diminished capacity) in a California murder tria. Mr Peter Chiesa was a 65-year-old man with multiple medical problems including vascular dementia, epilepsy, strokes and a history of complicated coronary artery bypass surgery. Chiesa called 911 informing police of his plan shortly before he shot and killed two female neighbors in 2002. The defense used a SPECT scan to illustrate to the jury how Mr Chiesa's brain was 'misshapen' and P1: OTA/XYZ P2: ABC JWST137-c01 JWST137-Simpson January 12, 2012 11:15 Printer Name: Yet to Come PET METHODOLOGY 13 'contained holes' to argue against a pre-meditated first-degree murder charge. Despite the evidence of the 911 call, the jury convicted Chiesa of two counts of second-degree murder, rather than first-degree (i.e., premeditated) murder.

****The Above Case Summaries of *Rhilinger*, *Fini, Summers and Smith*, are all taken from *Neuroimaging in Forensic Psychiatry: From the Clinic to the Courtroom*****

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19. Lanter v. Kentucky State Police, 171 S.W.3d 45 (Ky. 2005)

In Lanter, the appellant sustained a head injury during a police training incident and sought workers' compensation benefits. Lanter received partial disability benefits previously, but wanted total disability benefits and underwent numerous brain scans. The test that he needed to satisfy was that his work-related brain injury "caused continuous emotional neurological and behavioural symptoms**". Several scans were admitted as evidence, including MRI, EEG and SPECT scans. Additional SPECT scans were conducted and one expert was of the view that the SCAN "revealed functional defects in the right parietal and left occipital lobes of the claimant's brain"[23].**

Despite the SPECT findings, the court found that the Plaintiff's medical experts did not establish causation. Although SPECT evidence was admissible in this case, it was unreliable (in the court's view).

[23] Lanter, at para 48

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20. Boyd v Bell, 410 F.3d 1173 (9th Cir. 2005)

In this case, a former athlete sustained head injuries while playing sports. **The appellant (Boyd) requested SPECT scans to determine the extent of his brain injury and seek additional disability benefits.**

The radiologist who analyzed the scan confirmed head injuries, but noted that causation was uncertain as there was no way to prove that his psychological symptoms were not caused by injuries he sustained in the past. Thus, the court denied disability benefits.

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