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LINDA MAHER v. QUEST DIAGNOSTICS,
INC., ET AL.
(SC 17001)

Borden, Norcott, Palmer, Vertefeuille and Zarella, Js.

Argued January 8—officially released May 25, 2004

Eugene A. Cooney, for the appellants (defendant Ian M. Cohen et al.).

R. J. Weber III, for the appellee (plaintiff).

Opinion

NORCOTT, J. The defendants, Ian M. Cohen, a physician, and his employer, Associated Women's Health Specialists, P.C. (Associated Women's Health),¹ appeal² from the judgment of the trial court in favor of the plaintiff, Linda Maher, following a jury trial. The defendants claim that the trial court improperly: (1) permitted the plaintiff's expert witness to testify regarding the issue of causation in violation of § 7-4 (b) of the Connecticut Code of Evidence³ and our opinion in *State v. Porter*, 241 Conn. 57, 698 A.2d 739 (1997), cert. denied, 523 U.S. 1058, 118 S. Ct. 1384, 140 L. Ed. 2d 645 (1998); (2) concluded that the evidence presented by the plaintiff at trial was sufficient to support a jury verdict that the defendants had breached the applicable standard of care; and (3) failed to instruct the jury that its disbelief of a witness' testimony did not permit it to conclude the opposite of that testimony to be true in the absence of other evidence to support the finding of fact. We conclude that the trial court, on this record, improperly admitted the causation testimony of the plaintiff's expert witness. We further conclude, however, that the plaintiff offered sufficient evidence from which the jury reasonably could have found that the defendants had breached the applicable standard of care. Accordingly, we reverse the judgment of the trial court and remand the case for a new trial.⁴

The plaintiff commenced this medical malpractice action in 1997, alleging that the defendants' negligence caused a delay in the diagnosis and treatment of her

cervical cancer such that her condition deteriorated, her treatment options were altered negatively, and her likelihood of recovery was impacted adversely.⁵ The jury returned a verdict for the plaintiff, and the trial court, after denying the defendants' motions to set aside the verdict and for judgment notwithstanding the verdict,⁶ rendered judgment thereon. This appeal followed.

The jury reasonably could have found the following facts. Cohen had become the plaintiff's gynecologist in 1978, and he had seen her professionally at various times until January, 1996. The plaintiff visited Cohen for routine annual examinations and also consulted with him periodically regarding various other issues involving her gynecological health. During the plaintiff's annual examinations, Cohen generally performed both a Papanicolaou test (Pap smear), a test commonly used to screen females for cancer of the cervix and endometrium, and a pelvic examination. As a matter of course, during her years of consultation with Cohen, the plaintiff had not been provided with the results of her Pap smears and her "understanding [with regard to such a practice] was [that] no news is good news."

On January 6, 1995, during the plaintiff's annual examination, Cohen performed a Pap smear and pelvic examination. In his notes detailing this examination, Cohen described the appearance of the plaintiff's cervix as "friable."⁷ The January, 1995 examination was the first time in his years of treating the plaintiff that Cohen had used the term "friable" to describe the appearance of her cervix.⁸ It is undisputed that Cohen did not perform a colposcopic examination of the plaintiff's cervix during this January, 1995 visit.⁹

Cohen subsequently forwarded the Pap smear specimen taken from the plaintiff to Quest Diagnostics, Inc. (Quest), for analysis and interpretation. Quest thereafter informed Cohen that the plaintiff's test results were within normal limits. In accordance with his past practice regarding the plaintiff's Pap smear results, Cohen did not inform her as to the normal findings of her Pap smear screening.

During the remaining months of 1995, the plaintiff visited Cohen on several occasions in order to discuss and treat various health-related issues. On January 16, 1996, the plaintiff returned to Cohen for her annual gynecological examination. While conducting this examination, Cohen removed a polyp that he discovered in the plaintiff's cervix and ordered a biopsy of the growth. In his notes from this examination, Cohen stated the following: "Friable exocervical polyp with moderate menstrual flow. Unable to Pap today. Cervical polyp removed." After having received the results of the biopsy, Cohen diagnosed the plaintiff with cervical cancer¹⁰ and he made a notation in the plaintiff's records regarding an "enlarged barrel lesion" in the plaintiff's cervix. Cohen informed the plaintiff of the diagnosis

on January 24, 1996.

The plaintiff then was referred by Cohen to Peter E. Schwartz, a physician associated with the Yale University Gynecologic Oncology Center. After examining the plaintiff, Schwartz confirmed the plaintiff's diagnosis and recommended that she undergo a radical hysterectomy. Shortly thereafter, the plaintiff underwent a type III radical hysterectomy, an appendectomy, and a pelvic lymphadenectomy to remove a cancerous lymph node. Following her surgery, the plaintiff underwent a long process of therapy, which involved chemotherapy and radiation treatments, and she also suffered from sundry complications arising out of her surgery, including a significant wound infection and prolonged numbness of her lower extremities, which impacted her ability to walk.

Subsequently, the Pap smear specimen taken from the plaintiff in January, 1995, was reanalyzed by Quest, and it was discovered that the specimen had been misinterpreted and, in fact, the specimen did reveal the suspicious presence of abnormal cells. The plaintiff then commenced this medical malpractice action, alleging that her cervical cancer should have been diagnosed in January, 1995, and that the one year delay in diagnosis and treatment required that she undergo a far more serious course of surgery and treatment with increased complications.

At trial, the plaintiff argued that, notwithstanding Quest's indication to Cohen that her January, 1995 Pap smear had not suggested the unacceptable presence of cellular abnormalities, Cohen should have diagnosed the plaintiff's cervical cancer in January, 1995. In advancing this claim, the plaintiff relied principally upon Cohen's use of the term "friable" in describing the appearance of her cervix in January, 1995, a term that he again used in January, 1996, when the plaintiff's cancer was diagnosed. The plaintiff claimed that Cohen's use of this term, for the first time in his eighteen year professional relationship with her, indicated that he had observed a clinical change in the plaintiff's cervical appearance in January, 1995. Once such a clinical change was observed, the plaintiff claimed, the applicable standard of care required that Cohen investigate further by means of a colposcopic examination. See footnote 9 of this opinion. Although Cohen determinedly disagreed with the plaintiff's assertion that he had observed a clinical change in her cervical appearance on January 6, 1995, at trial Cohen conceded that, had he performed a colposcopy at that time, he likely would have been able to recognize the abnormality present in the plaintiff's cervical cells and may have been able to diagnose her cancer.

At the conclusion of the trial, the jury returned a verdict for the plaintiff. The trial court accepted the jury's verdict, denied the defendants' motion to set aside

the verdict and for judgment notwithstanding the verdict, and rendered judgment in accordance with the verdict. This appeal followed.

I

The defendants first claim that the trial court improperly admitted the plaintiff's expert witness testimony of Robert Swan, a board certified gynecologic oncologist, on the issue of causation. Specifically, the defendants contend that the trial court improperly concluded that: (1) pursuant to § 7-4 (b) of the Connecticut Code of Evidence, the plaintiff had met her burden of demonstrating that the facts forming the basis of Swan's testimony were "of a type customarily relied on by experts in the particular field in forming opinions on the subject"; and (2) Swan's testimony satisfied the threshold requirements for the admissibility of scientific evidence as set forth in § 7-2 of the Connecticut Code of Evidence,¹¹ and as articulated in *State v. Porter*, supra, 241 Conn. 57.

The plaintiff claims, to the contrary, that the trial court properly admitted Swan's testimony because: (1) as an expert qualified in the field of gynecology and oncology, Swan reviewed the relevant medical literature on the subject of cancer growth rates, as well as the plaintiff's medical records, drew conclusions therefrom regarding the evolution of the plaintiff's cancer, and that the facts underlying Swan's opinion testimony were therefore "of a type customarily relied on by experts in the particular field in forming opinions on the subject" and satisfied the requirements of § 7-4 (b) of the Connecticut Code of Evidence; (2) Swan's testimony did not implicate the standard in *Porter* for the admissibility of certain scientific evidence because the testimony was not based on novel or innovative scientific methodology and, therefore, was admissible upon a showing of relevance; and (3) even if a *Porter* analysis was required prior to the admission of Swan's testimony, the trial court properly admitted the evidence after its consideration of the various factors articulated in *Porter* as bearing on the admissibility of scientific evidence. We conclude that Swan's testimony is the type of scientific evidence that requires an individualized *Porter* inquiry as to its underlying scientific validity prior to being admitted into evidence. We further conclude that, on the basis of the record before it at the time that it ruled upon the admissibility of the testimony, the trial court abused its discretion in admitting Swan's testimony into evidence.¹²

The following additional facts guide our resolution of the defendants' claim. At trial, the plaintiff presented, as her sole witness on the issue of causation, the expert testimony of Swan.¹³ In summary, Swan testified as to the degree of difference between the nature of the plaintiff's cancer in January, 1996, when her cancer ultimately was diagnosed, and her cancer as it would have

been in January, 1995, when the plaintiff claimed that her cancer should have been diagnosed. When the plaintiff's cancer was diagnosed in January, 1996, it was categorized at the level of stage IB, meaning the most severe form of malignancy was confined to the cervix. See footnote 5 of this opinion. According to Swan, the plaintiff's medical records also demonstrated that the growth rate of her cancer was particularly aggressive.¹⁴ Swan further indicated that the starting point for his calculations as to the size of the plaintiff's cancer in January, 1995, was Schwartz' clinical estimate, taken just prior to her hysterectomy in early 1996, of the plaintiff's cervical lesion as approximately 3 centimeters by 2.5 centimeters in size.

On the basis of these characteristics of the plaintiff's cancer as it existed in January, 1996, Swan testified that he could determine the relevant "doubling time"¹⁵ of the her cancer and formulate an expert opinion as to the likely stage of the cancer in January, 1995. In this instance, given the aggressive nature of the plaintiff's cancer, Swan stated that the relevant doubling time period for her cancer was either thirty or sixty days. This period meant simply that the plaintiff's cancer would double in volume once every thirty or sixty days or, when working backwards in time, would have been one half its volume for each prior thirty or sixty day period. On the basis of these calculations, Swan opined that the plaintiff's cancer as of January, 1995, would have been either preinvasive, ranging from mild to severe dysplasia, or, at worst, would have been a stage IA1 invasive cancer with "very, very early microinvasion, [consisting of] maybe one or two cells at most invading under [the stromal] lining." See footnote 5 of this opinion. The appropriate surgical response for a stage IA1 cancer, Swan opined, would have been a conservative hysterectomy, far less serious and with fewer concomitant potential complications than the radical hysterectomy that the plaintiff ultimately underwent in early 1996. During his direct examination, Swan testified that his conclusion was based generally on his education, his experience and his review of the plaintiff's medical records.

On cross-examination, the defendants vigorously contested the reliability of Swan's scientific evidence. In particular, Swan testified that he had not performed a literature search for scientific texts on the subject of doubling time in connection with the formulation of his opinion regarding the plaintiff's cancer, and that he previously had not published scientific articles on the subject of doubling times.¹⁶

In point of fact, Swan made it clear in his testimony that the entire basis for his knowledge on the issue of doubling time was acquired during his prior, noncase specific review of the medical literature on the subject while keeping informed of various issues related to

gynecology. Specifically, Swan indicated that: (1) at some point in the past, he had seen articles related to cervical cancer doubling time periods but that he was unaware of “good” doubling time statistical analyses on cervical cancer growth; (2) the relevant medical literature did not indicate that there is a quantifiable difference among doubling time periods for cancers located in different organs; (3) his opinion as to the growth rate of the plaintiff’s cervical cancer was based on the “more established” statistics regarding breast cancer doubling time; (4) he had not performed any independent analysis as to the reliability of breast cancer doubling time when applied to cervical cancer growth rate; and (5) all of his knowledge regarding breast cancer doubling time came from his general review of the relevant medical literature over the course of his career. Although at various points in his testimony Swan indicated that the support for these propositions could be found in the relevant medical literature, he was unable to reference a particular journal, article or author in support of his statements.

At the conclusion of Swan’s testimony, the defendants filed written objections to the admission of the evidence, claiming in part that the testimony failed to meet the basic threshold admissibility test for scientific evidence under *State v. Porter*, supra, 241 Conn. 57. The defendants also objected to the admission of Swan’s testimony on the grounds that his calculations were inaccurate and his opinions, which were drawn from his reliance on unidentified scientific sources, constituted inadmissible hearsay.

After conducting a *Porter* hearing, the trial court overruled the defendants’ objections and admitted Swan’s testimony into evidence. In so doing, the trial court concluded that Swan was qualified in the field of gynecology and oncology and that such expertise afforded Swan the ability to survey the relevant scientific literature, review the pertinent medical records of the plaintiff, apply the principles derived from the literature to the specific facts presented in the plaintiff’s case, and formulate conclusions from such application. After concluding that Swan was qualified as an expert, the trial court found that: (1) other jurisdictions had determined scientific evidence regarding doubling time to be admissible; (2) this use of doubling time by other courts, as well as the “thousands” of scientific articles that use the term, demonstrated that doubling time widely was regarded as scientifically reliable;¹⁷ (3) Swan’s testimony indicated that breast cancer statistics were a reliable indicator of cervical cancer doubling time and that doubling time in general was reliable scientifically; (4) Swan presented his opinion in a reasonably understandable manner that would be of assistance to the jury; and (5) the concept of doubling time had not been developed solely for the purposes of litigation. Consequently, the trial court concluded that Swan’s testimony

regarding doubling time was admissible scientific evidence.¹⁸

“[W]e set forth the standard by which we review the trial court’s determinations concerning the [admissibility] of [expert testimonial] evidence. . . . [T]he trial court has wide discretion in ruling on the admissibility of expert testimony and, unless that discretion has been abused or the ruling involves a clear misconception of the law, the trial court’s decision will not be disturbed. . . . Expert testimony should be admitted when: (1) the witness has a special skill or knowledge directly applicable to a matter in issue, (2) that skill or knowledge is not common to the average person, and (3) the testimony would be helpful to the court or jury in considering the issues.” (Internal quotation marks omitted.) *Hayes v. Decker*, 263 Conn. 677, 683, 822 A.2d 228 (2003).

Beyond these general requirements regarding the admissibility of expert testimony, “[t]here is a further hurdle to the admissibility of expert testimony when that testimony is based on . . . scientific [evidence]. In those situations, the scientific evidence that forms the basis for the expert’s opinion must undergo a validity assessment to ensure reliability. *State v. Porter*, supra, 241 Conn. 68–69. In *Porter*, this court followed the United States Supreme Court’s decision in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S. Ct. 2786, 125 L. Ed. 2d 469 (1993), and held that scientific evidence should be subjected to a flexible test, with differing factors that are applied on a case-by-case basis, to determine the reliability of the scientific evidence.” (Internal quotation marks omitted.) *Hayes v. Decker*, supra, 263 Conn. 683–84.¹⁹ Following *State v. Porter*, supra, 81–84, scientific evidence, and expert testimony based thereon, usually is to be evaluated under a threshold admissibility standard assessing the reliability of the methodology underlying the evidence and whether the evidence at issue “is, in fact, derived from and based upon that methodology”; *id.*, 83; which has been referred to as the “‘fit’” requirement.²⁰ *Id.*

A

The mere fact that “scientific evidence” is sought to be admitted into evidence, however, does not require necessarily that a *Porter* inquiry be conducted as to the threshold admissibility of the evidence. As we have recognized, “some scientific principles have become so well established that [a threshold admissibility] analysis is not necessary for admission of evidence thereunder. . . . Evidence derived from such principles would clearly withstand [such an] analysis, and thus may be admitted simply on a showing of relevance.” (Internal quotation marks omitted.) *State v. Reid*, 254 Conn. 540, 546, 757 A.2d 482 (2000). Thus, we exclude from the *Porter* standard the “very few scientific principles [that] are so firmly established as to have attained the status of

scientific law . . . [and] properly are subject to judicial notice.” (Internal quotation marks omitted.) *State v. Porter*, supra, 241 Conn. 85 n.30. Consequently, our initial inquiry is whether “the [evidence] at issue in the present case . . . is the *type* of evidence contemplated by *Porter*.” (Emphasis added; internal quotation marks omitted.) *State v. Kirsch*, 263 Conn. 390, 403, 820 A.2d 236 (2003).

The plaintiff claims that Swan’s testimony does not implicate our *Porter* standard, and is admissible simply upon a showing of relevance, because: (1) the phrase “doubling time” has been used in multitudinous scientific articles, as revealed by a search of the Medline database that resulted in “thousands of medical journal articles containing the words ‘doubling times’”;²¹ (2) doubling time evidence has been admitted in a number of cancer cases from other jurisdictions; and (3) the doubling time methodology is neither illogical nor unscientific. We disagree with the plaintiff and conclude that the principles underlying Swan’s testimony are not so well established as to obviate the need for a reliability assessment pursuant to *Porter*.

A review of the recent cases in which we have concluded that certain forms of scientific evidence have become so well established that a formal *Porter* inquiry is rendered unnecessary is particularly instructive in our consideration of the plaintiff’s suggestion that doubling time fits within this jurisprudence.²² In *State v. Kirsch*, supra, 263 Conn. 398, 403–404, we concluded that no *Porter* hearing was required with regard to the results of a hospital blood test performed in order to screen for the presence of alcohol in a patient’s bloodstream. As a basis for our decision, we recognized that the scientific evidence at issue, a blood alcohol test using an enzyme method of alcohol dehydrogenase,²³ was universally recognized as reliable and was actually the predominate method of blood alcohol testing in the clinical setting. *Id.*, 403–405. After reviewing leading treatises on scientific evidence, certain state regulations, and the treatment of such evidence in other jurisdictions, we concluded that this degree of acceptance rendered unnecessary a *Porter* inquiry into the reliability of the evidence. *Id.*, 404–405.

More recently, in *Hayes v. Decker*, supra, 263 Conn. 687–89, we concluded that scientific evidence regarding the effects of the discontinuation of blood pressure medication should have been admitted at trial upon a showing of relevance, without the need for a separate *Porter* inquiry into reliability. At trial, the plaintiff in *Hayes* had attempted to introduce the testimony of a physician who was to testify that, although the defendant physician’s decision that the plaintiff discontinue use of his blood pressure medication did not cause the plaintiff’s subsequent heart attack, the defendant’s decision did cause the plaintiff’s blood pressure to rise

and resulted in more tissue damage when the plaintiff did suffer a heart attack than otherwise would have occurred if the plaintiff had not discontinued use of his blood pressure medication. *Id.*, 680. We determined that this scientific evidence essentially reduced to three basic principles, “namely that (1) an increase in blood pressure causes an increase in the heart’s demand for oxygen; (2) oxygen deprivation to the heart causes heart tissue death; and (3) increased blood pressure during a heart attack causes increased heart tissue damage.” *Id.*, 688–89. With no serious debate within the medical community as to their scientific reliability, we concluded that the principles were “well established principles of the scientific community to which *Porter* simply does not apply” and should have been admitted into evidence upon a showing of relevance. *Id.*, 689.

As these cases demonstrate, our exclusion of scientific evidence from the ambit of *Porter* when such evidence, and its underlying methodology, is “well established” is reserved for those scientific principles that are considered so reliable within the relevant medical community that there is little or no real debate as to their validity and it may be presumed as a matter of judicial notice. As we stated in *State v. Porter*, supra, 241 Conn. 85 n.30, “[w]e . . . acknowledge . . . that *a very few scientific principles* ‘are so firmly established as to have attained the status of scientific law, such as the laws of thermodynamics, [and that such principles] properly are subject to judicial notice’”

With this background in mind, we conclude that the concept of doubling time, within the context of cervical cancer, has not been so well accepted within the relevant scientific communities that reliability may be presumed.²⁴ Our conclusion does not mean that cervical cancer doubling time evidence is unreliable per se; it simply means that the reliability of cervical cancer doubling time evidence must be assessed on a case-by-case basis in accordance with our *Porter* standard.

The methodology of doubling time, far from being well accepted in the relevant scientific field, did not pass through even this litigation unchallenged. The defendants’ expert witness, Stephen L. Curry, a physician board certified in obstetrics and gynecology as well as gynecologic oncology, testified that, in his years of experience, he had never seen any article or study that provided a doubling time period for cancer of the cervix. To the contrary, Curry testified that, because individual cancers grow at vastly different rates ranging from slow to exceedingly fast, the concept of doubling time has no clinical application with regard to any one patient or any one cancer. This debate, we believe, indicates that doubling time has not been accepted as a well established principle within the relevant community of gynecology or oncology.

The plaintiff, however, advances three bases for her suggestion that doubling time is a principle so well established in the relevant scientific community that a *Porter* hearing was unnecessary. First, the plaintiff suggests that a Medline database search revealed “thousands of medical journal articles containing the words ‘doubling times.’” On this record, this justification is without merit. The plaintiff has not proffered, either before the trial court or this court, any evidence whatsoever as to the *substance* of the articles purportedly contained within the Medline database. More specifically, the record reveals no basis on which to conclude either that these articles substantively focus on doubling time, as opposed to a mere passing reference to the term, or, most importantly, that these articles evince that doubling time is well established within the relevant scientific community. Reliance merely on the existence of scientific texts containing certain terms cannot, by itself, establish that a particular principle is well established, in the absence of a showing that the *substance* of such texts supports the proposition. See *State v. Kirsch*, supra, 263 Conn. 398, 403–404 (reviewing substance of various leading treatises on issue of scientific evidence and blood testing).

Second, the plaintiff relies upon case law from several jurisdictions in which doubling time evidence has been admitted at trial. We similarly are not persuaded that these authorities support the plaintiff’s suggestion that doubling time is a well established scientific principle in the relevant scientific communities such that individualized reliability inquiries are unnecessary. In her brief, the plaintiff cites, as examples in which courts have admitted doubling time evidence, the following: *Short v. United States*, 908 F. Sup. 227, 233–34 (D. Vt. 1995) (in malpractice action arising out of alleged delayed diagnosis of prostate cancer, crediting expert witness testimony that doubling time of plaintiff’s cancer was approximately 2.86 months); *Owens Corning v. Baurman*, 125 Md. App. 454, 491–92, 726 A.2d 745 (1999) (concluding that, notwithstanding less than definitive use of doubling times to determine growth rate of mesothelioma, evidence regarding growth rates properly is subject to “battle of the experts”); *Sacco v. Roupelian*, 409 Mass. 25, 28–29, 564 N.E.2d 386 (1990) (concluding that it was harmful error for trial court to exclude expert witness testimony of physician who would testify that, based on his observations of patient and her cancer in June, 1983, he could estimate size of her tumor in January, 1982, and determine whether it should have been diagnosed at that time); *Nussbaum v. Gibstein*, 138 App. Div. 2d 193, 199, 531 N.Y.S.2d 276 (1988) (referring to expert testimony of defense witnesses that breast cancer tumor rates have doubling times between 20 and 209 days).²⁵

Although it is true that various courts have taken into

consideration, and credited, scientific evidence regarding doubling time, we note that none of these cases lends support to Swan's use of doubling time in the present case. All of these cases involved the use of doubling time in connection with mesothelioma or breast, lung, or prostate cancer; none of these cases involved the application of doubling time to cervical cancer. Moreover, in each of these cases, the scientific evidence regarding doubling time was presented with regard to the same organ that was involved in the litigation; none of the cases involved the application of doubling time statistics derived from analyses of cancer located in one organ to the growth rate of cancer in another organ. Finally, these cases demonstrate a wide variety of doubling time periods; none of the cases indicate the use of the same doubling time period as that employed by Swan, namely, thirty or sixty days.

In addition, we also note a number of other cases from other jurisdictions in which the reliability of doubling time, in the context of its application to a particular patient or a particular cancer, has been assailed. See *Keir v. United States*, 853 F.2d 398, 403 (6th Cir. 1988) (expert witness testimony that doubling time for intraocular cancer is "elusive, as some grow quickly and others grow slowly"); *Waffen v. United States Dept. of Health & Human Services*, 799 F.2d 911, 922 (4th Cir. 1986) (plaintiff's expert conceded that lung cancer doubling time was not recognized generally by medical community as method for determining prognosis or modality of treatment; defendant's expert indicated that doubling time was "widely unaccepted for prognosis because it was speculative and had essentially no clinical data to validate its application to any one individual"); *Crane v. Scribner*, 369 Md. 369, 381–82, 800 A.2d 727 (2002) (plaintiff's expert testified that doubling times could be used to give theoretical estimate as to date tumor begins growth but that such estimate was not "exact science" because "many cancers are not truly spherical and . . . doubling times may not be constant throughout the process"); *Hebert v. Parker*, 796 So. 2d 19, 31 (La. App. 2001) (plaintiff's expert testified that doubling time theory is problematic in that it presupposes that tumors are all homogenous cell type with same growth rate while in reality tumors are heterogeneous with different growth propensities); *Thor v. Boska*, 38 Cal. App. 3d 558, 562–63, 113 Cal. Rptr. 296 (1974) (expert witness testimony that doubling time theory for plaintiff's breast cancer was unreliable "in any single human case" because many different factors affect growth rate of cancer). Again, this internal debate within the relevant scientific community buttresses our conclusion that the reliability of doubling time has not been so well accepted that an individualized *Porter* inquiry is unnecessary.

The plaintiff's third claim, namely, that doubling time is neither illogical nor unscientific, may be rejected

summarily as it has little bearing on the question as to whether doubling time is a well established principle of the scientific community. On the basis of these considerations, we therefore conclude that doubling time is not a well established principle of the scientific community such that an individualized *Porter* inquiry was rendered unnecessary. We reiterate, however, that this conclusion does not foreclose the possibility that, within the context of a *Porter* inquiry, doubling time may be demonstrated to be sufficiently reliable such that it may be admitted into evidence upon satisfaction of the *Porter* standard.

B

Having concluded that Swan's testimony is the type of scientific evidence that triggers the need for a *Porter* inquiry into its threshold admissibility, we now turn to an analysis of Swan's testimony under *Porter*. The defendants claim that the trial court improperly admitted Swan's testimony because the plaintiff presented no evidence on any of the various factors articulated in *Porter* as bearing upon the reliability, and threshold admissibility, of scientific evidence. Specifically, the defendants claim that the plaintiff adduced no evidence on whether Swan's methodology: (1) can be, and has been, tested; (2) has been subjected to peer review; (3) has a known or potential rate of error; and (4) has garnered general acceptance in the relevant scientific community.

In response, the plaintiff contends that the trial court properly considered various *Porter* factors and concluded that such considerations weighed in favor of the threshold admissibility of Swan's testimony. In particular, the plaintiff claims that the trial court properly admitted Swan's testimony because the evidence satisfied the threshold admissibility standard set forth in *Porter* in that: (1) the number of scientific articles using the term doubling time and the number of cases from other jurisdictions in which doubling time evidence has been considered demonstrate that doubling time is generally accepted in the relevant scientific community; (2) the methodology of doubling time has not been developed solely for litigation purposes; and (3) Swan possessed sufficient background and prestige in the area of gynecologic oncology such that he appropriately was permitted to express an opinion as to the use of doubling time within that field. We conclude that, on this record, there was an insufficient evidentiary basis as to Swan's methodology such that the trial court could assess properly the reliability and threshold admissibility of the scientific evidence at issue. Accordingly, in the absence of a sufficient demonstration of the methodology underlying the scientific evidence, the trial court improperly admitted the testimony of Swan.

Again, we note that "[t]he trial court [generally] has wide discretion in ruling on the . . . admissibility of

[expert witness] opinions. . . . [Furthermore] [t]he court's decision is not to be disturbed unless [its] discretion has been abused, or the error is clear and involves a misconception of the law." (Internal quotation marks omitted.) *Grondin v. Curi*, 262 Conn. 637, 648, 817 A.2d 61 (2003).

In *State v. Porter*, supra, 241 Conn. 78–80, we expressly recognized that, because the term “scientific evidence” houses such a large and diverse variety of topics, the formulation of a mechanical evidentiary standard of admissibility designed to apply universally to the many forms scientific evidence may take is an unworkable concept. Rather, the better formulation is a “general, overarching approach to the threshold admissibility of scientific evidence” *Id.*, 80. In accordance with this philosophy, we set forth in *Porter* a number of different factors, nonexclusive and whose application to a particular set of circumstances could vary, as relevant in the determination of the threshold admissibility of scientific evidence. *Id.*, 84–86. In particular, we recognized the following considerations: general acceptance in the relevant scientific community;²⁶ whether the methodology underlying the scientific evidence has been tested and subjected to peer review; the known or potential rate of error; the prestige and background of the expert witness supporting the evidence; the extent to which the technique at issue relies upon subjective judgments made by the expert rather than on objectively verifiable criteria; whether the expert can present and explain the data and methodology underlying the testimony in a manner that assists the jury in drawing conclusions therefrom; and whether the technique or methodology was developed solely for purposes of litigation. *Id.*

Moreover, *Porter* also set forth, as did *Daubert*, a “‘fit’” requirement for scientific evidence. *Id.*, 65, 83. We stated that “proposed scientific testimony must be demonstrably relevant to the facts of the particular case in which it is offered, and not simply be valid in the abstract.” *Id.*, 65. Put another way, the proponent of scientific evidence must “establish that the specific scientific testimony at issue is, in fact, derived from and based upon [the scientifically reliable] methodology.” *Id.*, 83. “[A]lthough some conclusions can be reasonably inferred from the methodology employed, others cannot.” (Internal quotation marks omitted.) *Id.* Thereafter, in *State v. Kirsch*, supra, 263 Conn. 407, we indicated that “[t]his [fit] inquiry considers whether the methodology is being utilized in a novel way for which it was not developed originally . . . or whether it is scientifically reliable for one purpose, but not another.” (Citation omitted; internal quotation marks omitted.)

Additionally, we recognized in *Porter* that, “[t]he actual operation of each [*Porter*] factor, as is the determination of which factors should be considered at all,

depends greatly on the specific context of each case in which each particular [threshold admissibility] analysis is conducted.” *State v. Porter*, supra, 241 Conn. 86–87. There is, however, a critical postulate that underlies the *Porter* factors and indeed underlies the entire *Porter* analysis: in order for the trial court, in the performance of its role as the gatekeeper for scientific evidence, properly to assess the threshold admissibility of scientific evidence, the proponent of the evidence must provide a sufficient articulation of the methodology underlying the scientific evidence. Without such an articulation, the trial court is entirely ill-equipped to determine if the scientific evidence is reliable upon consideration of the various *Porter* factors. Furthermore, without a clear understanding as to the methodology and its workings, the trial court also cannot properly undertake its analysis under the “fit” requirement of *Porter*, ensuring that the proffered scientific evidence, in fact, is based upon the reliable methodology articulated.

In this matter, the record reveals an inadequate articulation as to the methodology that formed the basis for Swan’s testimony as to doubling time. In essence, Swan’s testimony was based on at least three principles, namely, that: (1) cervical cancer grows in an exponential, structured and calculable fashion; (2) the doubling time of a particular cancer in a particular organ is a fungible statistic in that the same doubling time may be applied in evaluating the growth rate of a cancer located in another organ; and (3) the appropriate doubling time for an aggressive cervical cancer like the plaintiff’s, based upon statistics derived from breast cancer studies, is thirty or sixty days. Beyond a vague statement that the relevant “literature” supported these propositions, no evidence was produced as to the reliability of these propositions or, indeed, to confirm that these propositions have any support in the scientific community whatsoever.

The trial court, however, in admitting Swan’s testimony, expressly stated that it had credited his testimony that doubling time is scientifically reliable and that breast cancer growth statistics are reliable indicators as to the growth rates of cervical cancer. Moreover, by admitting the evidence, the trial court also implicitly credited Swan’s testimony that the appropriate doubling time for the plaintiff’s form of cancer was thirty or sixty days.

The construction of the gatekeeper function in *Porter* was, in part, a conclusion that trial courts have a role in assessing the reliability of scientific evidence beyond mere reliance on an expert witness’ belief that a methodology is reliable. Here, Swan testified that the sole foundation for his opinion was his review of the literature, but he was unable to support this opinion with confirmatory references. The trial court therefore was

unable to conduct an independent analysis of the reliability of Swan's methodology and was left with bare reliance on his testimony that the literature confirmed his opinion as to the plaintiff's doubling time.

We note that this is not an instance in which an expert witness seeks to express an opinion, based on practical experience, a review of the relevant literature or otherwise, in which the trial court is able to probe the methodology underlying the opinion in a manner that affords the trial court the ability to make an independent assessment of the reliability of the methodology and the threshold admissibility of the evidence. Here, there was no independent assessment as to reliability because the trial court was presented with nothing more than Swan's testimony on the subject.²⁷ We conclude, therefore, that, on this record, the trial court abused its discretion in admitting Swan's testimony into evidence. This conclusion requires a new trial.

II

The defendants next claim that the trial court improperly denied their motion for judgment notwithstanding the verdict because the plaintiff failed to adduce sufficient evidence at trial that Cohen had deviated from the standard of care in connection with his January, 1995 examination of the plaintiff. More specifically, the defendants contend that the only evidence presented that Cohen had failed to investigate a clinically observable change in the plaintiff's cervical appearance on January 6, 1995, was Cohen's use of the term "friable" in his notes detailing that visit. The defendants claim that Cohen had used the term "friable" to convey that the plaintiff's cervix had "bled easily" during her Pap smear, not, as the plaintiff claimed, an observed abnormality. In the defendants' view, to define the term "friable" as an indication of an abnormal appearance was rank speculation and an insufficient basis from which the jury could have concluded that the relevant standard of care had been breached.²⁸

In response, the plaintiff contends that the evidence presented at trial as to the breach of the standard of care was sufficient. In particular, the plaintiff points to the testimony of Joseph Finkelstein, the plaintiff's expert witness on the issue of the standard of care and qualified as an expert in the field of gynecology, and claims that, as a qualified expert, Finkelstein was entitled to testify that, in his experience, the term "friable" is used to describe abnormal appearing tissue with a necrotic component that may break off easily. Further, as a qualified expert, Finkelstein also could testify that the applicable standard of care for gynecologists demanded that, once such an abnormal observation was made, a physician perform a colposcopy. We agree with the plaintiff.

"[O]ur review of a trial court's refusal to direct a

verdict or to render judgment notwithstanding the verdict takes place within carefully defined parameters. We must consider the evidence, including reasonable inferences which may be drawn therefrom, in the light most favorable to the parties who were successful at trial . . . giving particular weight to the concurrence of the judgments of the judge and the jury, who saw the witnesses and heard the testimony The verdict will be set aside and judgment directed only if we find that the jury could not reasonably and legally have reached their conclusion.” (Citation omitted; internal quotation marks omitted.) *Cohen v. Yale-New Haven Hospital*, 260 Conn. 747, 761, 800 A.2d 499 (2002).

We set forth the following additional facts as relevant to our resolution of this claim. At trial, the plaintiff presented the expert testimony of Finkelstein, a physician board certified in both obstetrics and gynecology. Finkelstein testified that the plaintiff’s medical records revealed that Cohen consistently had noted that the plaintiff’s cervix presented an ectropion or eversion during his prior examinations, and that such a finding is indicative of a normal cervix. See footnote 8 of this opinion. A finding of “friability,” however, was abnormal and especially irregular given Cohen’s long history with the plaintiff and the fact that such a finding represented a substantial change in the appearance of her cervix. In the field of gynecology, Finkelstein indicated that the term “friable” is used to refer to tissue with a necrotic appearance in which components of the tissue may crumble or break apart. In Finkelstein’s expert opinion, the gynecological standard of care required, in this situation, that Cohen perform a colposcopy and that his failure to do so constituted a breach of that standard of care.

In rebutting the plaintiff’s allegation of negligence, Cohen testified that he had not observed such a clinical change in the appearance of the plaintiff’s cervix during his January, 1995 examination. Moreover, Cohen testified that he did not use the term “friable” in his January, 1995 notes to express a finding of an abnormal or necrotic cervical appearance, but instead used the term to convey that the plaintiff’s columnar epithelium had “bled easily” when her Pap smear was performed. Cohen further indicated that this finding of “friability,” in the sense that he had used the term, was not unusual either for the plaintiff specifically or for individuals with ectropions or eversions in general. See footnote 8 of this opinion.

In addition, the defendants also presented the expert testimony of Curry on the issue of the standard of care. Curry testified that the relevant standard of care for gynecologists requires that a colposcopy be performed only if Pap smear results are abnormal or when a clinical observer becomes suspicious at the appearance of a cervix. Curry also testified that, on the basis of his

review of the plaintiff's medical records, there was no reason for Cohen to perform a colposcopy in January, 1995.

We conclude that the plaintiff presented sufficient, although not overwhelming, evidence at trial from which the jury reasonably could have concluded that the defendants had breached the applicable standard of care. In particular, we are not persuaded that Finkelstein's testimony regarding Cohen's initial notation regarding friability, which was made years after his professional involvement with the plaintiff had begun, and Finkelstein's testimony as to the common meaning assigned to the term "friable" in the field of gynecology, was speculative evidence that the standard of care had been breached. In addition to Finkelstein's testimony, the jury also was aware that Cohen used the term "friable" a second time in the plaintiff's records: in his notes from the plaintiff's January, 1996 examination, in which Cohen had removed the exocervical polyp from the plaintiff, that ultimately led to her cancer diagnosis. From such evidence, the jury reasonably could have found that Cohen had observed a cervical abnormality in January, 1995. Furthermore, as experts for both the plaintiff and the defendants testified, if such an abnormality had been observed and no further investigation had been conducted, such a failure would constitute a breach of the relevant standard of care. The verdict of the jury as to the breach of the standard of care therefore had both logical and legal support.

We disagree with the defendants' contention that the plaintiff's evidence regarding the meaning of the term "friable" is speculative because it was not based upon the standard dictionary definition of the term. As the defendant points out, medical dictionaries define the term "friable" as "easily pulverized or crumbled" or "bleeds easily." R. Sloane, Sloane-Dorland Annotated Medical-Legal Dictionary (1987) p. 302; see footnote 7 of this opinion. Finkelstein, however, when asked for his opinion as to the meaning of the term "friable," testified, "[w]ell, I'm not gonna give you a dictionary definition, but as a gynecologist, when we talk about friable tissue, we're talking about tissue that—that has sort of a necrotic component to it, so that, when you touch it, it can literally break off. . . . This is an abnormal type of presentation . . . that is—the adjective friable, as used, at least, in . . . gynecological terms." Finkelstein further indicated that "an ectropion, which can be a very delicate-appearing tissue, is not friable. It doesn't, when you touch it, have components where it can crumble or fall off, which is what friability means, from the point of view of . . . when a gynecologist evaluates tissue." We do not view this evidence as speculative given Finkelstein's unchallenged qualifications in the field of gynecology and his express qualification that his definition of the term was not its "dictionary definition," but was how the term is used in practice

amongst gynecologists. The defendants were entitled to cross-examine Finkelstein regarding the dictionary meaning of the term, but it was the province of the jury to weigh the competing definitions.

The judgment is reversed and the case is remanded to the trial court for a new trial.

In this opinion the other justices concurred.

¹ In her original complaint, the plaintiff, Linda Maher, also had named as defendants Quest Diagnostics, Inc. (Quest), Metpath New England, Inc. (Metpath), and Corning Clinical Laboratories (Corning). Prior to trial, the plaintiff withdrew her claims against Quest, Metpath and Corning, thereby leaving Cohen and Associated Women's Health as the only remaining defendants. We refer herein to the individual defendants by name and to Cohen and Associated Women's Health collectively as the defendants.

² The defendants appealed from the judgment of the trial court to the Appellate Court. We then granted the defendants' motion to transfer the appeal to this court pursuant to General Statutes § 51-199 (c) and Practice Book § 65-2.

³ Section 7-4 (b) of the Connecticut Code of Evidence provides: "The facts in the particular case upon which an expert bases an opinion may be those perceived by or made known to the expert at or before the proceeding. The facts need not be admissible in evidence if of a type customarily relied on by experts in the particular field in forming opinions on the subject. The facts relied on pursuant to this subsection are not substantive evidence, unless otherwise admissible as such evidence."

⁴ Because we agree with the defendants that the trial court improperly admitted into evidence the expert causation testimony presented by the plaintiff, the proper result is a remand of the case for a new trial. See *State v. Skipper*, 228 Conn. 610, 613-14, 637 A.2d 1101 (1994) (concluding that trial court's improper admission of expert scientific testimony warranted new trial).

With regard to the defendants' third claim, namely, that the trial court improperly failed to instruct the jury that it could not make a finding of fact solely on the basis of its disbelief of certain testimony to the contrary, we decline to review the claim because it may not arise during the course of a new trial. See *Godwin v. Danbury Eye Physicians & Surgeons, P.C.*, 254 Conn. 131, 133 n.2, 757 A.2d 516 (2000); *State v. Oquendo*, 223 Conn. 635, 669 n.24, 613 A.2d 1300 (1992).

⁵ In order properly to provide a basic understanding of the plaintiff's delayed diagnosis claim, and the evidence in support thereof, we provide a scientific foundation explaining the development and progression of cervical cancer. Cervical cancer generally begins as an abnormality within the cells of the outside layer of the cervix, the epithelium. 2 *Gale Encyclopedia of Medicine* (D. Olendorf et al. eds. 1999), p. 640. Abnormal cellular changes occurring entirely within the epithelium are referred to as the "preinvasive" stage of cervical cancer. *Id.*, 640-41. This preinvasive stage of cancer is further divided into the following subcategories: mild dysplasia, involving up to approximately one quarter of the epithelial lining; moderate dysplasia, involving approximately one half of the epithelial lining; or severe dysplasia, involving almost all of the epithelial lining.

Over time, as the cellular abnormalities propagate, the tissue underlying the epithelium, the stroma, is invaded by the malignancy. Once the stroma has been impacted, the cancer is referred to as "invasive." Invasive cervical cancer is compartmentalized into several "stages," indicating the relative progression of the cancer in the cervix and beyond. All stage I cervical cancers are cancers that have not metastasized and are confined to the cervix. Federation of International Gynecologists and Obstetricians, *Cervical Cancer Staging System*, Table 2 (1994). Within stage I cervical cancer, there are several subcategories of progression: stage IA1; stage IA2; and stage IB. Once the cancer spreads beyond the cervix, the cancer becomes classified as a stage II.

⁶ The trial court also granted several postverdict motions filed by the parties that impacted the amount of damages awarded to the plaintiff. These motions are not before us in this appeal.

⁷ "Friable" is defined as "easily pulverized or crumbled" and may be used to refer to tissue that "bled easily." R. Sloane, *Sloane-Dorland Annotated Medical-Legal Dictionary* (1987) p. 302.

⁸ The plaintiff's medical records do demonstrate, however, that Cohen

consistently had referred to the plaintiff's cervix as presenting an "eversion" or a cervical "ectropion." The terms "ectropion" and "eversion" both are defined medically as a turning or rolling outward in appearance. T. Stedman, *Medical Dictionary* (27th Ed. 2000) pp. 566, 627.

⁹ A colposcopy is a process in which magnifying equipment is used to enhance the capacity of a physician to visualize cervical tissue, and the cells therein, to determine if an abnormality is present. 2 *Gale Encyclopedia of Medicine* (D. Olendorf et al. eds. 1999) p. 641. If this examination reveals such an abnormality, the relevant area of tissue may be removed, a process known as a colposcopic-directed biopsy, and subjected to further testing.

¹⁰ Specifically, Cohen diagnosed the plaintiff with invasive squamous carcinoma of the cervix.

¹¹ Section 7-2 of the Connecticut Code of Evidence provides: "A witness qualified as an expert by knowledge, skill, experience, training, education or otherwise may testify in the form of an opinion or otherwise concerning scientific, technical or other specialized knowledge, if the testimony will assist the trier of fact in understanding the evidence or in determining a fact in issue."

¹² Because we agree with the defendants that the trial court improperly admitted Swan's testimony under *Porter*, we need not reach the defendants' claim that, pursuant to § 7-4 (b) of the Connecticut Code of Evidence, the plaintiff failed to demonstrate sufficiently that Swan's testimony was based on facts "of a type customarily relied on by experts in the particular field in forming opinions on the subject."

¹³ We note that Swan did not testify in person at trial. Instead, based on an agreement between the parties, Swan's testimony, including both direct examination and cross-examination, was obtained by means of video conferencing, with a videotape and written transcription made thereof.

¹⁴ Swan indicated that the propensity for growth of a particular cancer may be determined with reference to the structural appearance of abnormal cells as well as by the sheer number of abnormal cells present in the cervix. Briefly, the more atypical, or "wild looking," the structure and, in particular, the nucleus of a cell appears, the more uncontrolled the process of cell division and, thereby, the more aggressive the cancer in terms of growth propensity.

¹⁵ The "doubling time" of a tumor is defined as "[a] parameter used to determine tumor aggressiveness, serving to prognosticate, objectively measure therapeutic success, quantify growth kinetics and [the] growth rate of a malignancy." J.C. Seger, *Dictionary of Modern Medicine* (1992) p. 179. Put simply, the "doubling time" of a tumor is the amount of time it takes a tumor, through the process of cell division and propagation, to double in volume. In this instance, Swan used the notion of doubling time, not to project the evolution of the plaintiff's cancer after January, 1996, but instead to use reverse chronology in order to estimate the state of the plaintiff's cancer on January 6, 1995. In so doing, Swan applied the relevant "doubling time" for the plaintiff's cancer and halved the size of her cancer in January, 1996, for each such period until arriving at his conclusion regarding the size of the tumor in January, 1995.

¹⁶ Swan, however, did acknowledge prior personal participation, in the form of forwarding information culled from his gynecological practice, in the research of others involving tumor doubling time.

¹⁷ See footnote 21 of this opinion and the accompanying text.

¹⁸ On appeal, the defendants claim that the trial court may have misapplied the burden of proof regarding the admissibility of Swan's testimony. On two occasions during the *Porter* hearing, the trial court made a statement in which the court appeared to have placed a burden on the defendants, the opponent of the evidence, to demonstrate the *unreliability* of Swan's testimony, instead of placing the burden on the plaintiff, the proponent of the evidence, to demonstrate its reliability and, therefore, its admissibility. Specifically, the trial court, during the *Porter* hearing, posited: "Well, where in the transcript [of Swan's testimony] would I see some evidence, some testimony, that [doubling time] is not customarily relied upon [by experts in the field when forming opinions]?" Thereafter, in concluding that Swan's testimony was admissible, the court indicated that it "finds that it has not been demonstrated that the methodology underlying [the] evidence is sufficiently invalid to render the evidence incapable of assisting the trier of fact to determine the issues in dispute." Notwithstanding these isolated statements that appear to advance an incorrect proposition of law, our review of the entire record of the *Porter* hearing persuades us that the trial court properly placed the burden of demonstrating admissibility upon

the plaintiff.

¹⁹ As noted, one of the plaintiff's claims on appeal is that a *Porter* analysis of Swan's testimony was unnecessary because that evidence was not based on novel or innovative scientific methodology and, therefore, was admissible on a demonstration of relevance. Although we have used, on occasion, loose language that could be read as supporting that claim; see, e.g., *Hayes v. Decker*, supra, 263 Conn. 683–84; we take this opportunity to clarify that *Porter* is not so circumscribed and that the standard articulated in *Porter* applies generally to scientific evidence, unless that scientific evidence is so well established that a threshold admissibility analysis is rendered unnecessary. See part I A of this opinion.

²⁰ In addition, as we recognized in *Porter*, “[e]ven evidence that has met the *Daubert* inquiry into its methodological validity, and thus has been shown to have some probative value, may be excluded for failure to satisfy other evidentiary rules.” *State v. Porter*, supra, 241 Conn. 90.

²¹ “Medline” is a resource database, compiled by the United States National Library of Medicine, that is said to be “the world’s most comprehensive source of life sciences and biomedical bibliographic information . . . [containing] nearly 11 million records from more than 7300 different publications dating from 1965 [through the present].” During the *Porter* hearing before the trial court, the defendants indicated that a search had been performed in this database and that the term “doubling time” had been found in thousands of articles and that the combination of the terms “cervical cancer” and “doubling time” revealed eighteen articles containing both terms.

²² We also note a second line of cases in which we have concluded that certain types of evidence, although ostensibly rooted in scientific principles and presented by expert witnesses with scientific training, are not “scientific” for the purposes of our admissibility standard for scientific evidence, either before or after *Porter*. See, e.g., *State v. Reid*, supra, 254 Conn. 547–49 (concluding that testimony of criminologist regarding visible characteristics of, and similarities between, strands of hair was not “scientific” evidence for *Porter* purposes); *State v. Hasan*, 205 Conn. 485, 490, 534 A.2d 877 (1987) (concluding that testimony of podiatrist as to likelihood that certain pair of sneakers would fit on defendant’s feet was not “scientific” evidence). This line of cases indicates that evidence, neither scientifically obscure nor instilled with “an aura of mystic infallibility”; (internal quotation marks omitted) *State v. Hasan*, supra, 490; which merely places a “jury . . . in a position to weigh the probative value of the testimony without abandoning common sense and sacrificing independent judgment to the expert’s assertions based on his special skill or knowledge”; id., 491; is not the type of scientific evidence within the contemplation of *Porter*; and similarly was not within the ambit of our standard for assessing scientific evidence prior to *Porter*.

Although the plaintiff’s brief relies in part upon our decision in *Reid*, we view this reliance as a mistaken conflation of our distinct lines of cases, namely, when evidence properly is not to be considered “scientific” and when the scientific evidence at issue is so well established that further inquiry into reliability is unnecessary. To the extent, however, that the plaintiff does claim that Swan’s testimony is not “scientific” for *Porter* purposes, we are not persuaded. *Hasan* and *Reid* stand for the proposition that evidence, even evidence with its roots in scientific principles, which is within the comprehension of the average juror and which allows the jury to make its own conclusions based on its independent powers of observation and physical comparison, and without heavy reliance upon the testimony of an expert witness, need not be considered “scientific” in nature for the purposes of evidentiary admissibility. In the present case, Swan’s testimony involved reasoning, including the level of aggression of the plaintiff’s cancer, the appropriate doubling time period for the cancer and the degree of difference between the plaintiff’s cancer as diagnosed in January, 1996, and what it would have been one year earlier, that far exceeded the bounds of independent jury observation and comparison. The rationale of *Hasan* and *Reid* does not apply.

²³ This particular variety of blood alcohol test involves a process by which an enzyme is added to a patient’s blood serum, producing a colorimetric change that is then measured in order to determine the level of alcohol present in the serum. *State v. Kirsch*, supra, 263 Conn. 403–404.

²⁴ We recognize the disagreement between the parties as to the “methodology” at issue in this case. In her brief, the plaintiff appears to focus on the “methodology” of “doubling time” in a generally broad sense that transcends specific varieties of cancer and particular doubling time periods. To the

contrary, the defendants contend that “doubling time” is simply a label used to express the rate of growth for a cancer, and that the “methodology” at issue in Swan’s testimony revolves around the determinations he made with regard to the appropriate number of days in the plaintiff’s doubling time period and the use of breast cancer statistics in a cervical cancer case. We agree with the defendants. “Methodology” is defined as “a body of methods, procedures, working concepts, rules, and postulates employed by a science, art, or discipline” and “the processes, techniques or approaches employed in the solution of a problem or in doing something.” Webster’s Third New International Dictionary (1993). As we recognized in *State v. Porter*, supra, 241 Conn. 63–64, 81–82, the “methodology” of scientific evidence refers to the reasoning and principles that underlie a particular scientific opinion or conclusion. Accordingly, in this instance, Swan’s methodology refers to the array of principles he employed in reaching his ultimate conclusion that the plaintiff’s cancer was at a level of stage IA1 in January, 1995. Included within this methodology are the reasons related to: (1) Swan’s determination that the plaintiff’s cancer was aggressive; (2) Swan’s determination as to the size of the plaintiff’s cancer in January, 1996; (3) Swan’s conclusion that the appropriate doubling time for the plaintiff’s cancer was thirty or sixty days and, connectedly, his rejection of a ninety day doubling time; and (4) Swan’s utilization of mathematics in order to determine the volume of the plaintiff’s tumor in January, 1995.

²⁵ Our own research has revealed several other cases in which courts have admitted expert witness testimony regarding cancer doubling time. See *National Bank of Commerce v. Associated Milk Producers, Inc.*, 22 F. Sup. 2d 942, 975 (E.D. Ark. 1998) (in dispute between plaintiff’s scientific evidence, which indicated cancer doubling time of fifty-eight days, and defendant’s expert, who testified as to 100 day doubling time, trial court concluded that it could not exclude possibility that plaintiff’s cancer began while working for defendant but that dispute between experts as to appropriate time frame was “one more negative” for plaintiff in proving causation), aff’d, 191 F.3d 858 (8th Cir. 1999); *Borgren v. United States*, 716 F. Sup. 1378, 1381 (D. Kan. 1989) (in medical malpractice claim arising out of delayed diagnosis of breast cancer, trial court credited expert witness testimony estimating doubling time of plaintiff’s tumor as between 80 and 210 days); *Chudson v. Ratra*, 76 Md. App. 753, 762, 548 A.2d 172 (1988) (referencing expert testimony that breast cancers vary widely as to their growth rates but that “a range of doubling times of approximately fifteen days to about seventy-five days would encompass about 85 or 90 percent of breast cancers in [cases such as the plaintiff’s]”); *Roses v. Feldman*, 257 N.J. Super. 214, 218, 608 A.2d 383 (1992) (concluding that expert witness testimony regarding doubling time for lung tumor, although unable to pinpoint precise time of metastasization, sufficiently indicated increased risk of delayed diagnosis and thereby supported jury verdict for plaintiff); *Baer v. Regents of the University of California*, 126 N.M. 508, 515, 972 P.2d 9 (1998) (The court affirmed a directed verdict for the defendant in a malpractice action based upon a failure to perform diagnostic tests that allegedly would have diagnosed the plaintiff’s lung cancer earlier because, although “doubling-time evidence can be useful, and in fact was elicited at trial from [the] [p]laintiff’s expert . . . the expert in [the] [p]laintiff’s case was unable to connect that doubling time evidence to an opinion, to a reasonable medical probability, that the tumor would have been of detectable size in 1989 when the x-ray was omitted. In fact, [the] [p]laintiff’s expert conceded such a conclusion in this case would be speculation.”).

²⁶ Although general acceptance was “no longer an absolute prerequisite to the admission of scientific evidence, it should, in fact, be an important factor in a trial judge’s assessment. Indeed, [w]e suspect that general acceptance in the relevant scientific community will continue to be the most significant, and often the only, issue.” (Internal quotation marks omitted.) *State v. Porter*, supra, 241 Conn. 84–85.

²⁷ Of course, the trial court was also presented with evidence in the form of references to doubling time in scientific texts as well as other cases involving doubling time evidence. As discussed in part I A of this opinion, however, the trial court was not presented with any detail as to the *substance* of the articles from the Medline database. Furthermore, with regard to the case law involving doubling time, we again note that none of the cases focused on either the use of doubling time within the context of cervical cancer or the fungible use of doubling time statistics between and among different forms of cancer in different parts of the body.

²⁸ We review this claim because, if the defendants were to prevail on it,

a new trial would not be warranted.
