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Criminal omissions, causality, probability, counterfactuals: Medical-surgical activity

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1. *The emergence of a new consensus on the way of understanding omissive causation: the distinction between general causation and specific or individual causation. Professional diseases.* – Is a new consensus emerging on the way of understanding omissive causation? The question assumes the existence of an old consensus, something which, in fact, occurred, starting from the eighties, in our case law concerning medical-surgical activity within the theory of the “serious and appreciable probabilities of success” (probabilities sometimes indicated at less than 50%) ⁽¹⁾ and in our case law on professional diseases following the theory of the “capability” of human conduct to do harm and that of the increase or lack of decrease in risk ⁽²⁾.

¹ See, amongst others, III Civil Section, Cassation, 13th May 1982, no. 3013 in FIORI-BOTTONE-D’ALESSANDRO, *Forty Years of Jurisprudence of the Court of Cassation on Medical Liability*, Milan, 2000, p. 260 ss.; Criminal section IV Cass., 12th May 1983, no. 4320, *ivi*, p. 302 ss.; Penal sect. IV Cass., 10th July 1987, no. 8290, *ivi*, p. 515 ss.; Penal sect. IV Cass., 27th August 1987, no. 9410, *ivi*, p. 527 ss.; Penal sect. IV Cass., 12th May 1989, no. 7118, *ivi*, p. 606 ss.; Penal sect. IV Cass., 13th June 1990, *ivi* 1991, p. 588; Penal sect. IV Cass., 10th August 1990, no. 11389, *ivi*, p. 665 ss.; Penal sect. IV Cass., 23rd November 1990, no. 15565, *ivi*, p. 677 ss.; Penal sect. IV Cass., 17th January 1992, no. 371, *ivi*, p. 702 ss.; Penal sect. IV Cass., 7th July 1993, n. 6683, *ivi*, p. 733 ss.; Civil sect. III Cass., 16th November 1993, n. 11287, *ivi*, p. 750 ss.; Penal IV sect. Cass., 11th November 1994, in *Cass. Pen.* 1996, p. 1442; Penal IV sect. Cass., 7th December 1999, in *Giur. it.* 2001, p. 572 ss; Penal sect. IV Cass., 18th October 1990, in *Cass. Pen.*, 1992, p. 2102; Penal sect. IV Cass., 7th March 1989, in *Riv. pen.*, 1990, p. 119

² See opinions mentioned in F. STELLA, *Giustizia e modernità*, Milan, 3rd ed. 2003, p. 246 ss.

The old consensus did not survive in the whole: the Full Bench of the Supreme Court (Sezioni unite della Corte Suprema di Cassazione) condemned the well-known criterion of the “indefinite, changeable probability coefficients that can be manipulated by the interpreter” and the criterion of the increase or lack of decrease in risk ⁽³⁾. Unfortunately, the old consensus has not yet been replaced by a new one: the bases on which it will rest are, however, emerging.

The distinction between **general causation** and **specific causation** is one of the main positions taken by these bases: this is a distinction that has burst into the juridical world in recent decades thanks to young sciences such as epidemiology and animal biology or more noble sciences such as medicine; it expresses very strongly the need not to confuse the forecast of what we “generally” expect to happen in the future for the populations under investigation or for classes or abstract types of individuals, with that which has really happened in the individual specific case, i.e. on the ground of individual causation. The *ex ante* capability of an active or omissive conduct to result in a certain damage, *ex ante* probabilities associated to it, the increase or lack of decrease of the risk that can be attributed to them, the increase or decrease of “chances” of safety are equivalent notions that all define the sphere of general causation: they cannot tell us *ex post* what caused an individual harmful event, they do not allow us to identify the conduct that has really caused the event or to prove on an individual basis the cause of specific or individual events ⁽⁴⁾.

There is a fairly wide-spread consensus in our jurisprudence on this distinction relating to professional diseases ⁽⁵⁾; however, there is failure on the part of the Supreme Court to agree **explicitly** about this, which explains the reasons why consensus on the new way of understanding omissive causation has not yet made any headway in the jurisprudence of the Supreme Court. To find out what would have happened if the omitted proper conduct had occurred, the Supreme Court often **continues** to use general causation ⁽⁶⁾,

³ See Cass. sect. un. pen., 10.7-11.9.2002, in *Riv. it. dir. proc. pen.* 2002, p. 1133 ss.

⁴ The distinction between general causation and specific or individual causation is illustrated in detail in F. STELLA, *Giustizia e modernità*, cit., p. 231 ss., 237 ss., 245 ss., 253 ss., 294 ss., 308 ss., 327 ss., 350 ss.

⁵ See, amongst others, Venice Court, 22.10.2001 in *Cass. pen.* 2003, p. 267 ss. for which, on the basis of epidemiological tests “there is no possibility of distinguishing in case of exposure a subject who would not have become sick if he had not been exposed from another who would have become sick in any case”. The Court emphasizes the importance of the quoted distinction: “causation is general when a substance is capable of causing a damage or a disease in a particular situation, while causation is specific when it has caused damage to the individual person”; see also request for filing of the Prosecution Office at the Court of Brindisi, 4.5.2004, unpublished, in which, in the investigation relating to the carcinogenic effects of vinyl chloride “general causation at the most can be considered a starting point, but certainly not an arrival point”, i.e. the demonstration of individual causation through “the causal process that leads to the occurrence of the carcinogenic pathology”; Milan Court, pen. sect. IX, 13.2.2003, unpublished (the content of which is referred to by STELLA, *L'allergia alle prove della causalità individuale* (Allergy towards proof of individual causation), in *Riv. it. dir. proc. pen.* 2004, p. 412 ss.) for which there is no point in raising the problem of the causal relationship if general causation is not proven.

⁶ See the opinions commented by F. STELLA, *L'allergia alle prove della causalità individuale*, quoted p. 394 ss. (cases Macola, Trioni, Giacomelli, Monti, Piessevaux, Eva).

without realising that only specific causation, the *ex post* explanation of the individual harmful event, can inform us on the omitted prevention of the event.

What is most regrettable is that many Supreme Court Justices are not willing to surrender to this point of view and while underlying “the difference between general and specific causation”, pointing out that “the capability of a substance to cause specific consequences does not mean that it did cause them in the individual case”, do not hesitate to hold that general causation itself can also “result in a statement of liability”, as in the case of pleural mesothelioma for which “it now seems to be scientifically proven that it is caused almost exclusively (in the sense that other unknown causes may be actually ascertained and excluded) by exposure to or inhalation of asbestos fibres”⁽⁷⁾. But the strength of scientific evidence will get rid of every prejudice: I have already had occasion to demonstrate that, on the basis of the most recent scientific research, it is **impossible** to distinguish a mesothelioma due to occupational exposure from a mesothelioma due to other causes⁽⁸⁾.

When all is said and done, I believe there are sufficiently strong and firm bases for a **widening** of the consensus to all Italian case law. Even the Supreme Court will presumably be forced to reduce the weight and explicative power of probabilities identified by epidemiological research.

I have illustrated these bases in detail in “*Justice and Modernity*” and in the paper “*The allergy in proof of individual causation*”. An adequate synthesis could be given here with the words of the epidemiologist VINEIS:

“The paradigm of epidemiology may be defined as the ‘**black box**’ method, because the aim of epidemiological research is usually that of finding a causal relationship between any external event (‘exposure’) and the risk of disease, **without going into pathogenetic mechanisms**. The epidemiology of chronic diseases does not require a “strong” assumption about the causal relationship: by cause we mean any exposure that precedes the onset of the disease, **compatible with a period of biological induction** and that **increases the probability** of contracting the disease. On the one hand, there is an obvious rejection of the deterministic concept of cause (or at least of the necessary cause); on the other hand, historically, epidemiology of chronic diseases has not been very interested either in defining ‘injuries’ as the anatomical substratum of the causal relationship (for example, at the study of **interim events** in the pathogenetic sequence of carcinogenesis) or in classifying problems. Actually, the classification of a group of diseases such as cancer continues to rely on a **morphological basis** – i.e. to be founded on the microscopic aspect – **rather than on a aetiologic basis** like infectious diseases. This happens for the simple reason that one type of cancer has multiple causes, and that cases due to one particular kind of exposure cannot be materially distinguished, on the morphological level, from those due to another type of exposure”⁽⁹⁾.

⁷ Brusco, *Il vizio di motivazione nella valutazione della prova scientifica*, in *Dir. pen. proc.* 11/2004, p. 1415. The unusual interpretation given by Justice Brusco to the *Daubert* verdict should also be mentioned “the criteria identified in the *Daubert* case” would actually constitute “in fact, norms or rules of experience” (p. 1414). In the analysis of the immense amount of literature on the *Daubert* case, I had never seen the most important stance taken by the American Supreme Court on the scientific method and on the topic of the reliability of the laws of science downgraded to a stance on banal norms of experience, by definition and by a current commonly accepted opinion, very far from the dignity of scientific enunciations. On the *Daubert* verdict see F. STELLA, *Giustizia e modernità*, p. 458 ss.

⁸ F. STELLA, *L’allergia alle prove della causalità individuale*, cit., p. 414 ss.

⁹ P. VINEIS, *L’interpretazione causale degli studi epidemiologici* (The causal interpretation of epidemiologic studies, in *Causalità tra diritto e medicina* (Causation between Law and Medicine), Atti del Convegno nazionale di Medicina Legale, Pavia, 1992, p. 47 ss.

The probabilistic nature of causal inference in epidemiology (exposure increased the probabilities of contracting the disease) is therefore beyond dispute; and one of the most obvious implications of this nature is the impossibility of identifying *ex post* workers who would not have fallen sick without exposure and those that would have fallen sick anyway: “all epidemiological inferences, VINEIS points out, are drawn from studies on populations and refer exclusively to populations”; that’s the reason of “the conflict between the individual and population level: it can be stated that in a group of people exposed to asbestos, the risk of contracting lung cancer is higher than in a group of non-exposed people, without this statement being valid for **individuals**”⁽¹⁰⁾. In the same way, the epidemiologist Berrino states:

“When we say that a certain percent of cancers is due to professional causes, the population numbers (expected cases) do not derive from a census of cases that **have been proved to be caused** by exposure, but from the difference between the cases observed in exposed people and the number of cases that would have been expected if the incidence in the people exposed was equal to that of the people that were not exposed”... There is no possibility of distinguishing, in exposed cases, those who would not have fallen sick in any case... In order to state that an exposed person would not have fallen sick in the absence of exposure, the judge would have to draw lots”⁽¹¹⁾.

This way of thinking is shared by epidemiologist and industrial hygienists all over the world ⁽¹²⁾ and it is difficult therefore to understand why there is not a new consensus extended to our case law in the whole, including that of the Supreme Court.

2. Omission in medical-surgical activity: the distinction between *ex ante* probability and *ex post* concrete proof (particularistic proof). – Considerable difficulties in forming the new consensus have arisen, however, in the area of medical-surgical activity; and it is on this type of activity that I will now focus my remarks.

The distinction between *ex ante* probability and *ex post* proof is under discussion: the former are **abstract** probabilities, that refer to **abstract types** or **classes** of conditions and events that do not constitute proof of **what really happened** on a particular occasion, or of what would have happened in the past had there been no omission; *ex ante* probabilities are useful when we are trying to see what we expect to happen in the future, but they do not constitute an adequate basis for an *ex post* explanation. Concrete proofs, proofs relating to the individual particular case (the so-called **particularistic proof**) that give us information on individual causation ⁽¹³⁾ are necessary for this explanation.

¹⁰ P. VINEIS, *op.loc. cit.*

¹¹ BERRINO, *Candido atteggiamento o denuncia di comportamenti inadeguati?*, in *La medicina del lavoro*, 1988, p. 167.

¹² See on this point the long list of epidemiologists, industrial hygienists, forensic doctors and legal scholars quoted in F. STELLA, *Giustizia e modernità*, p. 296 ss.

¹³ See, for all, R. W. WRIGHT, *Causation, Responsibility, Risk, Probability, Naked Statistics, and Proof: Pruning the Bramble Bush in Clarifying the Concepts*, in *73 Iowa L. Rev.*, 1988, p.

The example of “a throw of the dice” is sufficient to illustrate, with the words of a well-known American opinion, the difference between *ex ante* probabilities and particularistic proof: “quantitative probability (*ex ante*) expresses in any case only the most probable result, it does not constitute proof nor the probatory elements of the proposition that must be proven; the fact that in a throw of the dice there is a quantitative probability (*ex ante*) or a greater probability that a number lower than six may appear on the side of the dice pointing upwards, is not proof of the fact that in a given throw of the dice this is what actually happened. Without something more, the actual result of the throw would be totally unknown. The smallest concrete (particularistic) proof that the six actually appeared on the upper side of the dice would, on the other hand, have more weight than all the *ex ante* probabilities calculated in another way”⁽¹⁴⁾.

This is the true essence of the thought of the Full Bench of the Corte di Cassazione, expressed with the well-known verdict of 2002 (Franzese opinion) when it rejects, as extraneous to our judiciary, the criterion of the increase or the lack of decrease of risk, and when it rejects the idea that omissive causation can be considered to exist in the hypothesis in which omitted proper conduct would have had “serious and appreciable probabilities of success”. The Full Bench agrees on what has just been illustrated: *ex ante* probabilities are not able to offer the *ex post* causal explanation which is necessary in the area of omission too⁽¹⁵⁾.

For the Full Bench of the Supreme Court also, the *ex post* causal explanation needs particularistic proof. And in fact, after stating the cornerstone of its own thought, the need to resort to a covering law “an antecedent can be considered a necessary condition only if it falls within the list of those which, on the basis of a regular succession, comply with a generalized rule of experience or with a law possessing scientific validity, a ‘covering law’, and leads to events ‘of the same type’ as the one that actually occurred”), the Full Bench indicates its second cornerstone in **particularistic proof**: “it remains the unavoidable duty of judicial knowledge to establish if the postulated nomological connection is actually pertinent”. After ascertaining this, research into the “available evidence” relating to specific elements of the actual case that excludes any reasonable doubt “on the real conditioning efficacy of individual omissive conduct within the causation web is equally unavoidable”. In other words, “it is not allowed to deduce automatically from the probability coefficient expressed by statistical law..... confirmation or lack of confirmation of the accusatory hypothesis concerning the existence of the causal relationship”; and it is not allowed because it is “**the circumstances of**

1001, 1077, translated in F. STELLA, *I saperi del giudice. La Causalità e il ragionevole dubbio*, Milano, 2004, p. 139 ss.

¹⁴ *Day vs Boston & Me R.R.*, (1902) Me 207, 52 A 771 quoted in R. WRIGHT, *op:cit.*, p. 1052.

¹⁵ Cass.Sez.Un.Pen 10.7.2002, in *Riv. It. Dir. Proc. Pen.*, 2002, p. 1133 ss. On the matter M. Donini recently affirmed that “after twenty years of convictions, a certain convergence would seem to have been reached (the conditional form is unavoidable) on the unlawfulness of the substitution (hermeneutically) of omissive causation required by law with imputation parameters founded on the mere increase in risk”. DONINI, *Il volto attuale dell'illecito penale. La democrazia penale tra differenziazione e sussidiarietà*, Milan, 2004, 2004 p. 122 s.

the fact and the available evidence” which – “on the result of the probatory reasoning that has also excluded the interference of alternative factors” – must indicate if we can reach the conclusion that the omissive conduct is procedurally certain ...and was a necessary condition for the harmful event”.

3. Ex ante probability and medical-surgical activity. – A brief review of some Italian opinions on medical-surgical activity will now confirm that *ex ante* probabilities cannot give us any information about what would happen if the omitted conduct had been realised.

In a recent important trial, some executives of a chemical plant had been accused by the Public Prosecutor of having made it impossible to make an early diagnosis of some liver cancers contracted by workmen exposed to a certain chemical substance, thus preventing the transplant and resection of the liver and therefore causing their premature death.

From the cross-examination of experts, the crucial nature of the distinction between *ex ante* and *ex post* probability emerged; according to the experts, the real great limitation of transplantology, in treating liver, is that the factors on the basis of which the transplant or resection is decided are **predictive** factors, in the sense that they predict if the patient will live or die following the transplant or resection, and therefore they are limited to indicating *ex ante* probabilities; after resection, and therefore *a posteriori*, the surgeon may notice that the tumour was too aggressive, and that therefore the operation should not have taken place because, by performing it, the patient's life had been shortened rather than lengthened.

The truth is that early diagnosis of tumoral diseases – this is still the opinion of the experts – gives an **artificial** increase in survival: *ex ante* probabilities can indicate survival of one year after resection; *ex post*, the surgeon notices that, even without resection, the patient would have survived for a year. Survival after the resection of liver cancers caused by cirrhosis can even reach 20 or 30% of early identified cases, but that means that in 70, 80% of cases, the operation reveals itself to be inefficacious *ex post* ⁽¹⁶⁾.

Therefore the serious error to be found in the prosecution's hypothesis is clear: it relied on *ex ante* probabilities, on predictive factors that **are unable** to tell us anything about what would have happened if early diagnosis had been carried out.

The situation does not change if, from transplants and resections of the liver we go on to the resection of lung tumours. Here also, we come up against *ex ante* probabilities that predict what would have happened in the case of immediate diagnosis and surgery.

Again, this has nothing to do with what actually happened or what would have really happened: from an *ex post* investigation it would appear that the patient who underwent immediate lung resection did not survive the operation, or died immediately after it because of complications such as myocardial

¹⁶ Court of Venice, 22.10.2002 hearing 18.5.99, cross examination of Prof. Colombo that can be consulted on the web site www.petrochimico.it.

infarction, lung failure, pneumonia, pulmonary embolism, renal failure and so forth.

The available data in the sector confirm our statement. To begin with, in one study conducted in the United States in 2004 (¹⁷), out of **55** patients diagnosed with tumours, also on the basis of computerised tomography (CAT), in **10** patients the diagnosis was found to be wrong *ex post*: instead of cancer, a benign disease was found. What is to be said about *ex ante* probability here?

There are many other examples I can quote. As to the mortality rate during the first **30** days after the operation, in a Spanish 1997 study, out of **605** patients who underwent thoractomy due to bronchogenic carcinoma, **40** patients died after surgery for causes due, above all, to respiratory failure (¹⁸); in a Swiss study carried out in 1999, out of **621** patients who underwent lung resection due to lung cancer, **19** died, within 30 days from surgery, due to cardio-vascular complications, haemorrhages, sepsis and acute damage to the lungs (¹⁹); according to a subsequent Swiss study in 2002, out of **193** patients who underwent pneumonectomy, the mortality frequency at **30** days after surgery was equal to **9.3%** and was mainly co-related to haemorrhages, pneumonia, bronchopulmonary and hemipulmonary fistulae, arrhythmia and pulmonary embolisms (²⁰); according to a Norwegian study of 2004, out of **2,528** patients who underwent pulmonary resection, **188** died within **60** days due to respiratory failure, pneumonia, haemorrhages, broncho-pleural fistulae, myocardium infarction or other complications (²¹).

According to an Italian study conducted by the National Research Council and by the Ministry of Education in 2003, post-operative mortality is **2-9%**, correlated to pneumonia, ARDS (Acute Respiratory Distress Syndrome), atelectasis, respiratory failure, pulmonary embolism, pulmonary oedema, myocardium infarction, arrhythmia, heart failure, haemorrhagic gastritis, parenchymal fistulae, bronchial fistulae, infection of the surgical wound, haemothorax (²²).

The question is once more: what must we say about *ex ante* probabilities? In plain words, to exclude that if the proper omitted conduct (**early** diagnosis and **immediate** surgery) had been observed the patient would not have died following resection, due to myocardium infarction, pneumonia, pulmonary oedema, respiratory failure, haemorrhage, kidney failure or other complications, is simply **impossible**. It is impossible to give

¹⁷ CRESTARELLO *et al.*, *Thoracic Surgical Operations in Patients Enrolled in a Computer Tomographic Screening Trial*, in *The Journal of Thoracic and Cardiovascular Surgery*, 2004, p. 254 ss.

¹⁸ DUQUE *et al.*, *Early Complications in Surgical Treatment of Lung Cancer: A Prospective Multicenter Study*, in *The Annals of Thoracic Surgery*, 1997, p. 944-950.

¹⁹ LICKER *et al.*, *Perioperative Mortality and Major Cardiopulmonary Complications after Lung Surgery for Non-small Cell Carcinoma*, in *European Journal of Cardio-Thoracic Surgery*, 1999, p. 314-319.

²⁰ LICKER *et al.*, *Risk Factors for Early Mortality and Major Complications Following Pneumonectomy for Non-small Cell Carcinoma of the Lung*, in *Chest*, 2002, p. 1890-1897.

²¹ ROSTAND, NEALSUND, JACOBSTEIN *et al.*, *Causes of Postoperative Mortality after Lung Cancer Surgery*, in *Tidsskr Nor Laegeforen*, 2004, p. 982 ss.

²² CNR-MIUR oncological project, *I tumori del polmone*, 24.11.2003, p. 2-39.

particularistic proof and to identify the *ex post* probabilities associated to it, as we should do in order to formulate a causal statement that explains what would actually have happened.

The impossibility is even more obvious if we consider the deaths of patients where a timely diagnosis was made of a small nodule. In a study carried out in 2002 and published on the authoritative journal *New England Journal of Medicine* ⁽²³⁾ we read the following: “however, the size of the nodule at diagnosis does not necessarily correlate with the clinical outcome. It cannot be assumed that the biologic conduct of lung cancer, the result of a variety of genetic changes, parallels anatomical size. **In fact, there are currently no data to confirm** that a primary **5-mm** lung tumour has a significantly better prognosis than a 10-mm tumour or even a **30-mm** tumour. In a recent study on **510** patients with T1M0M0 disease (tumours less than 3 cm in diameter), there was no statistical correlation between small size at diagnosis and survival. **Patients with 3-cm masses had the same outcomes as those with nodules less than 1 cm. in diameter.** The assumptions that tumors size correlates with biologic conduct and that small lesions are equivalent to early-stage disease **have not been confirmed** for lung cancer. In some studies, about **60%** of patients with clinical (detected through x-rays) stage 1 disease (tumours less than 3 cm in diameter) died from lung cancer within 5 years, despite appropriate therapy. This suggests that a high percentage of patients have disseminated, occult disease at the time of presentation”.

And here is the situation for gastro-intestinal tumours: according to an American study of 2000, out of **4,711** patients who underwent colectomy as a result of cancer of the colon, death within 30 days occurred in **335** cases (**5.7%**): mortality frequency was significantly higher (equal to 50%) in patients with complications compared with those without, i.e. in cases of post-surgical coma, cardiac arrest, kidney failure, lung embolism or infection of the urinary tract ⁽²⁴⁾; in a Hungarian study of 2002, out of **161** patients who had undergone a gastrectomy operation, **61** had suffered complications (anastomotic leak, septic complications, intraluminal haemorrhage, post-surgical pancreatitis, intra-abdominal haemorrhage, pancreatic fistulae, obstructions of the small intestine, complications of the cardio-respiratory system) and **8** patients died during the post-surgical period ⁽²⁵⁾; in a Canadian study of 2003, out of **19,511** people that had undergone oesophagectomy or resection of the colon or rectum, the mortality rate in **30** days following the operations varied from **3.8%** for resection of the colon or rectum to **13.4%** for oesophagectomy ⁽²⁶⁾; in an American study of 2004, out of **22,633** patients who underwent surgical resection, for colorectal cancer, mortality at **30** days as a result of the

²³ PATZ *et al.*, Screening for Lung Cancer, in NEJM, vol. 343, n.22.

²⁴ LONGO *et al.*, *Risk Factors for Morbidity and Mortality after Colectomy for Colon Cancer*, in *Dis. Colon Rectum* 2000, p. 83-89.

²⁵ SZUCS *et al.*, *Effect of Extending the Resection on Postoperative Complications of Total Gastrectomies: Experience with 161 Operations*, in *Magy Seb*, 2002 p. 362-68.

²⁶ URBACH *et al.*, *Differences in Operative Mortality between High-and-low-volume Hospitals in Ontario for 5 Major Surgical Procedures: Estimating the Number of Lives Potentially Saved Through Regionalization*, in CMAJ, 2003, p. 1049-14.

operation was equal to 2.8% in patients under 65 years of age with cancer of the colon, while it was **5.6%** in patients of over 65 years of age (²⁷).

Here again, what about *ex ante* probabilities? How would the judge possibly exclude that the patient would have died as well from post-surgical coma, kidney failure, pulmonary embolism, cardiac arrest, haemorrhage, post-surgical pancreatitis or other complications?

And what about myocardium infarction?

According to an American study of the early Nineties, out of **200** patients hospitalised with diagnosis of acute infarction of the lower myocardium, at the time of admission to hospital **22** patients (**11%**) had had a cardiogenic shock. **38** patients died (**19%**) and **94** patients had serious complications during hospitalisation, including cardiogenic shock, ventricular fibrillation, tachycardia, myocardium rupture, third degree atrioventricular blockage, chronic bradycardia and re-infarction: most of these complications occurred in the 24 hours immediately following hospitalisation. In this period of time, **13** patients died due to cardiac causes (**7%**) and **58** patients had more serious complications (²⁸); according to another American study carried out in 1999, out of **9,076** hospitalised patients an overall incidence of **7.1%** of cardiogenic shock cases was registered for the whole study period considered: the analysis also showed that patients with acute infarction in which cardiogenic shock had occurred had a significantly higher mortality incidence during hospitalisation than those in whom cardiogenic shock had not occurred (**71.1%** compared with **12.0%**). Mortality during the hospitalisation of patients with cardiogenic shock remained constant over the years, equal to approximately **77%** (²⁹); according to a multi-centric American study of 2002, out of **5,065** patients who underwent coronary bypass surgery, **165** patients died during hospitalisation (**3.2%**) and **812** (**16%**) had cardiac, cerebral, renal or gastro-intestinal complications. **100%** of these deaths were associated to one or more adverse ischemic events. **43** patients died in the **48** hours immediately after the operation (and **291** had had complications that were not fatal in this period). In **121** cases, death occurred in the **48** hours following revascularisation (³⁰); according to an Italian study of 2004, from **10** to **15%** of hospitalised patients died because of acute cardiogenic shock (³¹).

At this point we know the question we should ask: since we know that the *ex ante* probabilities of survival are certainly higher in the event of immediate hospitalisation, compared with cases of non-hospitalisation, how can we know *ex post* if the patient with myocardial infarction who was not

²⁷ RABENECK *et al.*, *Outcomes in Elderly Patients Following Surgery for Colorectal Cancer in the Veterans Affairs Health Care System*, in *Aliment Pharmacol. Ther.*, 2004, p. 1115-24.

²⁸ ZEHENDER *et al.*, *Right Ventricular Infarction as an Independent Predictor of Prognosis after Acute Inferior Myocardial Infarction*, in *The New England Journal of Medicine*, 1993, p. 981-88.

²⁹ GOLDBERG *et al.*, *Temporal Trends in Cardiogenic Shock Complicating Acute Myocardial Infarction*, in *The New England Journal of Medicine*, 1999, p. 1162-68.

³⁰ MANGANO *et al.*, *Aspirin and Mortality from Coronary Bypass Surgery*, in *The New England Journal of Medicine*, 2002, p. 1309-1317.

³¹ VITALI *et al.*, *Surgical Treatment of Acute Myocardial Infarction*, in *Italian Heart J.*, 2004 (Suppl. 6), p. 92-96.

hospitalised immediately, would have died from cardiogenic shock or not, in the case of immediate hospitalisation? There is no way to know this, which means that the judge is not able to exhibit particularistic proof with associated *ex post* probabilities that the proper omitted conduct would have prevented the harmful event.

The problems linked to *ex ante* diagnosis-prognosis and to the *ex post* explanation of individual events in clinical medicine are also quite significant.

Clinical diagnosis *tout court* aims at knowing as much as possible about the patient's current situation and the therapy to be implemented in the disease is inferred from this knowledge: it "can never be declared true beyond any shadow of a doubt" ⁽³²⁾; the prognosis consists in the "prediction that the doctor, on the basis of the factual elements collected and/or of the suspected diagnosis, formulates on the future course of the morbid phenomena of his patient" ⁽³³⁾. Since the diagnostic judgement of the doctor can be either of the nosographic type (founded on the use of categories) or of the physiopathologic type (characterised by explicative reasoning of a causal nomologic type), the prognosis can also have this dual nature ⁽³⁴⁾.

If the diagnosis is of the nosographic type "the prognosis will be formulated by attributing to the patient a probability of going towards a specific result of the disease equal to the probability assigned to this result in the symptomatologic picture of the disease". For example:

"If we imagine a patient in whom, on the basis of recurring mouth and genital ulcers, the diagnosis of Behcet's Syndrome has been put forward, the doctor knows that in 10-25% of patients affected by this disease, neurological damage exists and that (at least prior to 1970) in subjects with neurological complications, mortality is 40%; he also knows that 50% of these patients suffer from arthropathies or actual arthritis. On the basis of the probabilities deduced from literature, the doctor will state that this patient has a 0.10-0.25 probability of suffering a neuropathy and that, if neurological changes are present, he will have a 0.04-0.10 probability of dieing. Finally, he will be able to predict that his patient will have an approximately 0.50 probability of suffering from problems in the joints. These prognostic judgements have an obvious inductive basis and constitute cases of '**individual predictive inference**'"⁽³⁵⁾

Physiopathological prognosis is based on the prediction that the initial conditions of the *explanandum* will occur with regularities indicated by physiological laws: "it is clear that since the prognosis is based on an event that has still to occur, it is less certain than the diagnosis; in fact, in prognostic judgement, a further element is added to the elements of uncertainty present in the diagnostic judgement, linked to the possibility that certain circumstances that are decisive for the course of the disease, may actually occur or not occur (often the backing laws that the doctor uses in formulating a prognosis are not referred to explicitly, so that we could say that elliptical prognoses are made)" ⁽³⁶⁾.

³² G. FEDERSPIL, *Logica clinica. I principi del metodo in medicina*, (Clinical Logic.), Milan, 2004, p. 250-251.

³³ G. FEDERSPIL, *op. cit.* p. 253.

³⁴ G. FEDERSPIL, *op. cit.* p. 239.

³⁵ G. FEDERSPIL, *op.cit.* p. 253-254.

³⁶ G. FEDERSPIL, *op. cit.* p. 254 ss.

The *ex post* investigation of the doctor can, on the other hand, give rise to the explanation. To explain a clinical case “means completely reconstructing the pathogenetic sequence that has occurred in a patient”.

Moreover, “very few diseases have been really explained to date. On the contrary, we can state that in many fields of medicine, as research progresses, an increasingly rich, articulate and complex causal process is developing, so that a complete explanation of morbid phenomena seems to become an increasingly distant objective. On one hand, the concept of gene has shown itself to be much more articulate than was thought up to the last decades of the twentieth-century. On the other hand, several pathogenetic sequences that were thought to constitute apparently unitary pathologies have been found. Diabetes mellitus of second type, obesity and ischemic cardiopathy all represent examples of morbid processes considered unitary, that today are determined by numerous pathogenetic sequences that are very different from each other, so that it becomes increasingly difficult to maintain the idea of a single causal process similar to the one introduced by the microbiological paradigm”³⁷).

With things in this way, it is clear that (1) *ex ante* probabilities associated to diagnosis and prognosis are not able to give any information on what really happened, and that (2) very often this information cannot be given even from the explanation itself because “very few diseases have been truly explained to date”.

In this situation, it is even pointless to ask if it is possible to know what would have happened if the omitted proper conduct had taken place, i.e. if a correct diagnosis and prognosis had been made.

4. Omission in medical-surgical activity and the impossibility of eliminating the plurality of causes. – An initial conclusion is emerging that may appear a surprising novelty for those who adopted the traditional concept of omissive causation: very often the intervention of “other causes” cannot be excluded with certainty, as the Full Bench of the Supreme Court would like, when we wonder if the omitted proper conduct would have prevented the occurrence of the harmful event.

Let us suppose to have a patient who died from a lung tumour that was not resected immediately. To assert the causal importance of the omitted conduct (immediate surgery) the judge would have to have proof that the patient would not have died if the diagnosis and surgical operation had not been carried out too late. This proof, however, **cannot be reached**: the judge will never be able to demonstrate that, if immediate intervention had taken place, the patient would not have died from pneumonia, pulmonary embolism, respiratory failure, haemorrhage, myocardium infarction, arrhythmia, heart failure, kidney failure, infection of the surgical wound or broncho-pleural fistulae.

Similarly, the judge will never be able to demonstrate that the patient would not have died *in any case* even if immediate resection of the liver or the gastro-intestinal tumour had occurred (up to exclude death from post-surgical coma, kidney failure, pulmonary embolism, cardiac arrest, haemorrhage, post-surgical pancreatitis and other complications) or if the patient had received

³⁷ G. FEDERSPIL, *op. cit.*, p. 286-287.

appropriate therapy for myocardium infarction following immediate hospitalisation.

The reasons for the impossibility of proof must be sought in a peculiarity of omissive causation: the judge must not search for information about what really happened, but information about **what would have happened** if the omitted conduct had been carried out. What is before the eyes of the judge, however, is an unmistakable and exclusively hypothetical counterfactual world and the information that can be deduced from the real world is wholly inadequate to make what **would have happened** clear.

This is a very important remark for the theory of omissive causation; it demonstrates that, when we talk about omitted proper conduct, it is often **totally impossible to pose** the problem of the plurality of causes: in the hypothetical world which the judge must deal with, information on what would have happened if precautionary rules had been observed cannot be traced.

5. Ex post probabilities associated to particularistic proof necessary for affirming the existence of the causal relationship in a criminal trial. – Ex post probabilities however are decisive in order to verify what actually happened or what might have happened.

As Richard Wright puts it: “In the dice throwing hypothetical, there are two possible generalization statements: ‘throwing a dice causes six spots to fall uppermost one-sixth of the time’ and ‘throwing a dice causes fewer than six spots to fall uppermost five-sixths of the time’”. The *ex ante* causal probabilities associated to these two generalizations are respectively 17% and 83%, and provide a strong basis for predicting what will happen or for betting that the second generalization is more likely to occur than the first.

Nevertheless, they provide no information at all on which of the two causal generalizations was actually instantiated on this particular occasion. On the other hand, if there is any particularistic **evidence** that a six actually fell uppermost, that would be evidence that the abstract result in the first causal generalization was instantiated and that the abstract result in the second causal generalization was not instantiated. There then would be a greater *ex post* causal probability that the causal law underlying the first causal generalization, rather than the second, was fully instantiated, despite the much greater *ex ante* causal probabilities for the second causal generalization.⁽³⁸⁾

Particularistic evidence is therefore necessary for the causal explanation, i.e. to establish what really happened, because only this type of evidence can confirm or deny the instantiation of the abstract elements of an *ex ante* generalization.

Another example – I have discussed in other papers ⁽³⁹⁾ – can be useful in confirming the accuracy of this conclusion. X fired 99 bullets against V, Y fired only one, one single bullet strikes V and kills him; further to ballistic tests

³⁸ R. W. WRIGHT, *op. cit.*, p. 1052 *et seq.* .

³⁹ See F. STELLA, *Verità, scienza e giustizia: le frequenze medio-basse nella successione di eventi* (Truth, Science and Justice), in *Riv. it. dir. proc. pen.* 2002, p. 1239.

carried out on the weapons of both X and Y, thanks to the marks left on it, the single bullet can be identified as coming from gun Y and not from gun X.

No generalization exists that can explain the murder of V in terms of the ratio of bullets fired by X or Y or vice versa; we can only argue a causal generalization which establishes that firing “a shot at someone” means killing him. We could also argue a generalization of the type “the more bullets one fires at someone, the more likely you are to kill him”. Those who support such a generalization might even argue that a person – X - who fires 99 bullets is almost certain to kill the intended victim, while a different person – Y - who fires only one shot is much less likely to do so.

So, as Wright points out, this generalization seems spurious. A causal generalization must be capable of being instantiated. What particularistic evidence would instantiate the abstract element described as “the more bullets one fires”?(⁴⁰).

The truth is that

“applying standard mathematical probability rules, the *ex ante* causal probability that all ninety-nine of X’s bullets would miss V was at least .37 (.99 to the 99th power). So the *ex ante* causal probability that at least one of X’s ninety-nine bullets would hit V was at most only 63%. There is insufficient data to estimate the effectiveness of Y’s shooting, which might have been highly effective (100%)... In our shooting hypothetical, even if Y is presumed to be as poor a marksman as X, so that the *ex ante* causal probability that Y would kill V was at most one percent while the *ex ante* causal probability that X would kill V was at most 63%, the great disparity in *ex ante* causal probabilities tells us nothing about which possibility *actually occurred* on this particular occasion. To determine what actually occurred, we must determine whether the causal law underlying the causal generalization involving X or the causal law underlying the causal generalization involving Y was fully instantiated on this particular occasion. Only particularistic evidence – and *ex post* causal probabilities based solely on such evidence, are probative on the issue of instantiation”.(⁴¹)

Thus, the probabilities deriving from ballistic tests are *ex post* causal probabilities, based on particularistic evidence with a high probatory value: each gun has unique irregularities on the surface of the barrel and on the breech that make distinctive marks on each bullet that is fired. In our hypothetical, the marks on the particular bullet that killed V were compared with those on the bullets that were fired by X and Y. The marks on the bullets constitute particularistic evidence that the bullet that killed V was fired by gun Y and not gun X.

The probability of error is assessed almost entirely on the basis of the skill of the person who carried out the comparison between the various bullets.

And note that even if we accept the assumption of only 80% accuracy, the ballistics tests on both guns in our hypothetical result in a 94% *ex post* causal probability that the bullet that killed V came from Y’s weapon, compared with a minimal 6% causal probability that it came from X’s.

Wright, who with regard to this point quotes the corresponding opinion of scholars of the importance of GLANVILLE WILLIAMS and JONATHAN COHEN, points out that 94% *ex post* causal probability should be sufficient to

⁴⁰ R. W. WRIGHT, *op. cit.*, p. 1059.

⁴¹ R. W. WRIGHT, *op.cit.*, p. 1060.

justify a finding, based **on the preponderance of the evidence** as required in a civil suit, that Y and not X caused the death of V ⁽⁴²⁾.

Wright's reference to the rule of the civil court is important. It allows us to point out the particularly high value that *ex post* probability associated to particularistic evidence must have, in a *criminal* suit.

In the legal process, scholars of applied mathematics who try to explain the meaning of "proof beyond reasonable doubt" in quantitative terms "generally require an *ex post* probability higher than a threshold very close to 1" ⁽⁴³⁾.

The recent study by FROSINI has showed that

"in so far as different people can give different interpretations of the terms 'very high probabilities', 'practical certainty', 'very low probability' and such like, it would seem, in any case, that we must exclude the possibility of talking about 'practical certainty' if the probability in question is lower than 0.99; on the contrary, it would seem more reasonable to move this probability at least to 0.999... This means, following the opinion of NEYMAN-PEARSON, that probability of error of the first kind (to convict an individual when he is innocent) should be adequately low, for example lower than 0.001 (i.e. 1 in a thousand)" ⁽⁴⁴⁾.

When the stake is very high (the guilt or innocence of the accused), the judgement standard – observed FROSINI – should be based on these very *ex post* probabilities. If the importance of the stake is very high, even in the civil trial practical certainty will be required, i.e. an *ex post* probability of over 99%; thus in order to attribute a DNA profile to a specific person, for the purposes of the legal declaration of natural paternity, according to the Italian Supreme Court, "a degree of probability which, with the yardstick of current scientific knowledge, normally exceeds 99% is necessary" ⁽⁴⁵⁾. For the Court of Appeal of Perugia, if "we reach a probability that approaches mathematical certainty and, moreover, if such results appear to be corroborated by the so-called historical proof (concerning the existence of a stable and long-lasting sentimental relationship between the mother of the minor and the alleged father, the concern of the latter during the pregnancy and birth as well as further relevant important circumstances), then the application for the recognition of natural paternity can certainly be accepted" ⁽⁴⁶⁾. According to a verdict of the Court of Appeal of L'Aquila in 2002, "if the DNA test of the deceased father attributes 99.96% probability of a positive result and a series of unequivocal positive elements are added to this (in this case, the relationship between the alleged father and the mother; knowledge on the part of the friends and relatives of the deceased of the fact that the latter succeeded in having a daughter from the plaintiff through artificial insemination, etc...), the natural paternity of the deceased father can be legally declared" ⁽⁴⁷⁾.

⁴² R. W. WRIGHT, *op. cit.*, p. 1058 ss., 1056 ss.

⁴³ See D. KAYE, *Do We Need a Calculus of Weight to Understand Proof Beyond Reasonable Doubts?* in *Boston U.L. Rev.*, 1986, p. 487-516.

⁴⁴ B. V. FROSINI, *Le prove statistiche nel processo civile e nel processo penale*, Milan, 2002, p.130.

⁴⁵ Cass. Civil sect. I, 9.6.1995 no. 6550, in *Dir. fam.*, 1995, p. 426.

⁴⁶ Perugia Court of Appeal, 17.9.1993, in *Dir. fam.*, 1994, p. 618

⁴⁷ L'Aquila Court of Appeal, 14.3.2002, in *Giur. it.*, 2003, p.87

It is worth adding that the case law of other countries reaches similar findings: for the attribution of paternity, the maximum value of *ex post* probability is **99.73%** in Germany, **99.99%** in the Netherlands and **99.9%** in common law countries, in which the attribution of the DNA profile to a specific person, in a criminal trial, is possible when the error does not exceed 1 out of 10,000 (*ex post* probability of **99.9%**)⁽⁴⁸⁾.

The reference to *ex post* probabilities required in order to attribute a DNA profile to a given person is even more pertinent when we are dealing with the investigation on causation: in fact there is no reason in the world that can explain why the *ex post* probabilities of the individual causal propositions should be lower, in a criminal trial, than the *ex post* probabilities required for the attribution of paternity.

6. *Ex post probabilities associated to particularistic evidence and the support given to them by statistical laws with a frequency very close to 100.* – We must now investigate the hypotheses in which particularistic evidence linked to an *ex post* causal explanation can be associated to an *ex post* probability “very close to 1”, i.e. of 0.999 with an error probability of 1 out of 1,000, if the judge uses statistical laws. Here also we must quote the opinion of scholars of statistics applied to the criminal trial. FROSINI states that an objective *ex post* probability, in order to be close to 1, must derive from a statistical law “with a percentage coefficient very close to 100”. Only in this way, according to the scholar, can we reach practical certainty, i.e. an *ex post* probability approaching 100%. And FROSINI adopts the example of the opinions of the Supreme Court that demands, for the causal explanation, the statistical law with frequency close to 100 (Baltrocchi, Di Cintio, Musto opinions)⁽⁴⁹⁾.

On the same wave-length, among the jurists, WRIGHT, states that “an *ex ante* causal probability can represent evidence of what really happened only if the *ex ante* causal probability is so high that it practically excludes an alternative causal generalization, so that the potentially applicable causal generalization is practically equivalent to a (universal) causal law”⁽⁵⁰⁾.

I, myself, in 1975 in “Scientific laws and causal explanation in criminal law” agreed with HEMPEL’s theory which requires a frequency approaching 100 precisely⁽⁵¹⁾.

On the philosophical level, there are an infinity of quotations. For CARNAP a 5% frequency may offer an unsatisfactory and extremely weak *ex post* explanation, while a 97% frequency offers an adequate explanation⁽⁵²⁾; for HEMPEL, an adequate *ex post* explanation of individual events can be had if the inductive support, represented by the nomologic premises (statistical laws), is very strong, i.e. if the frequency stated by statistical law is very close

⁴⁸ B. V. FROSINI, *op. cit.*, p. 131.

⁴⁹ B. V. FROSINI, *op. cit.*, p.7.

⁵⁰ R. W. WRIGHT, *op. cit.*, p. 1052, n. 278

⁵¹ F. STELLA, *Leggi scientifiche e spiegazione causale nel diritto penale*, cit. p. 307.

⁵² R. CARNAP, *Philosophical Foundations of Physics*, London, 1966, p. 51 *et seq.*

to the 100% of cases: “if probability q is close to 1, a law of this type can be invoked to explain the occurrence of C in a particular given case in which conditions f occurred”. In other words, the frequencies indicated by statistical law can constitute the basis for the causal explanation with an *ex post* probability associated to the particularistic evidence only if the statistical law gives an **overwhelming** *ex ante* probability and it is practically certain that the event occurred due to the instantiation of the statistical law (⁵³); for POPPER, the *ex post* causal explanation for an individual event is only possible if the *explanans* contains “universal laws” together with some singular statements, called initial conditions (⁵⁴); for NAGEL, the *ex post* explanation is causal if the law contained in the *explanans* “is causal because the relationship formulated

⁵³C. HEMPEL, *Philosophy of Natural Science*, Englewood Cliffs, 1966 p. 106 *et seq.*. “It is sometimes said that precisely because of its inductive character, a probabilistic account does not explain the occurrence of an event, since the *explanans* does not logically preclude its non-occurrence. But the important, steadily expanding role that probabilistic laws and theories play in science and its applications, makes it preferable to view accounts based on such principles as affording explanations as well. Take, for example, the radioactive decay of a sample of one milligram polonium. Suppose that what is left of this initial amount after 3.05 minutes is found to have a mass that falls within the interval from 0.499 to 0.501 milligrams. This finding can be explained by the probabilistic law of decay for polonium; for that law, in combination with the principles of mathematical probability, deductively implies that given the huge number of atoms in a milligram of polonium, the probability of the specified outcome is overwhelmingly large, so that in a particular case its occurrence may be expected with “practical certainty”. Or consider the explanation offered by the kinetic theory of gases for an empirically established generalisation called Graham’s law of diffusion. The law states that at fixed temperature and pressure, the rates at which different gases in a container escape, or diffuse, through a thin porous wall are inversely proportional to the square roots of their molecular weights; (...) In view of the very large number of molecules involved, it is **overwhelmingly** probable that at any given time the actual average speeds will have values very close to their probability estimates and that, therefore, it is **practically certain** that they will be, like the latter, inversely proportional to the square roots of their molecular masses. In physical text and treatises, theoretical accounts of this probabilistic kind are indeed very widely referred to as explanations”. (... “The second law of thermodynamics is a statistical law, i.e. a law that is not always valid, but only in the majority of cases. Let us take as an example, a system composed of a vessel containing gas molecules. Let us suppose that, initially, the molecules are all confined by a partition to the left half of the vessel. If we remove the partition, the molecules will tend to spread and to occupy both halves of the vessel. After a while, (...) it is **incomparably** more likely that they will be distributed in more or less equal quantities in both parts (...) There is a probability of 1 against many millions of millions that all the gas molecules will be found in the same half of the vessel, but, as much as this is infinitely improbable, it still remains possible”; S. HAWKING, *The Cambridge Lectures – Life Works*, Dove Books, 1996 p. 76-78: “For example, consider a system of gas molecules in a box... Suppose that initially the molecules are all confined to the left-hand side of the box by a partition. If the partition is then removed, the molecules will tend to spread out and occupy both halves of the box. At some later time they could, by chance, all be in the right half or all be back in the left half. However, it is overwhelmingly more probable that there will be roughly equal numbers in the two halves... The second law is a statistical law – that is, it does not hold always, just in the vast majority of cases. The probability of all the gas molecules in our box being found in one half of the box at a later time is many millions of millions to one, but it could happen”.

⁵⁴ K. POPPER, *The Logic of Scientific Discovery*, New York, 1965, p. 59 *et seq.*

by it is invariable or uniform”⁽⁵⁵⁾; for PASQUINELLI, only “**laws of causal succession** that state the existence of an invariable and uniform relationship, necessary in a physical sense between the facts” can be assumed in support of the *ex post* causal explanation⁽⁵⁶⁾; for AGAZZI, the idea of causation is closely linked to that of necessity and therefore “for the very reason that it admits exceptions, a statistical law already indicates the absence of necessity and the **least that can be demanded** is that it should **be very close to 1**”⁽⁵⁷⁾; for MACKIE, “true universal propositions exist from which the occurrence of E derives, given certain additional singular premises, and the fact that the occurrence of C was real. That the occurrence of C is a necessary condition for the occurrence of E therefore means that true universal propositions exist from which the occurrence of C derives, given certain additional, singular premises”⁽⁵⁸⁾.

What should in any case guide the choice of the statistical laws to be inserted in the *explanans*?

A question of this type can only be resolved if we look at the **context** in which the **practical action** takes place: for the practical action – says HEMPEL – and for the decisions to be adopted if the probabilistic hypotheticals are to be accepted or rejected, on the basis of statistics concerning the observed frequencies, there is the need for **appropriate criteria**.

“The stringency of the chosen standards will normally vary with the **context** (...). Broadly speaking it will depend on the importance which is attached, in the **given context**, to avoiding two kinds of errors that might be made: rejecting the hypothesis under test, although if it is true; and accepting it although it is false. The importance of this point is particularly clear when the acceptance or rejection of the hypothesis is to serve as a basis for the **practical action**. Thus, if the hypothesis concerns the probable effectiveness and **safety of a new vaccine**, then the decision about its acceptance will have to take into account not only how well the statistical tests results accord with the probabilities specified by the hypothesis, but also how serious would be the consequences of accepting the hypothesis and acting on it (i.e. by inoculating children with the vaccine) when in fact it is false”⁽⁵⁹⁾.

This step by Hempel is really crucial; the decisions to be adopted, on the basis of probabilities depend on the context: if the hypothesis of the existence of the causal relationship is based on “medium or low” probabilities, and results to be false, the consequences are devastating (conviction of the innocent), in some way similar to those of inoculation of the vaccine. This is why the *ex ante* probability must be close to 100; only such a probability guarantees that the probability of an error of the first kind (to convict an individual when he is innocent) is adequately low, i.e. lower than 0.001 and

⁵⁵ E. NAGEL, *The Structure of Science*, London, 1971, p. 80 *et seq.*

⁵⁶ PASQUINELLI, *Nuovi principi di epistemologia*, Milan, 1984, repr. 1987, Bologna, p. 122 *et seq.*

⁵⁷ E. AGAZZI, *La spiegazione causale degli eventi individuali (o singoli)*, in *Riv. it. dir. proc. pen.*, 1999, p. 400 *et seq.*

⁵⁸ J. MACKIE, *The Cement of the Universe*, New York, 1980, p. 59 *et seq.*

⁵⁹ C. HEMPEL, *op. cit.*, p. 65.

that i.e. the *ex post* probabilities linked to the particularistic evidence allow at the most an error of 1 out of 1000 (⁶⁰).

7. *Ex post probability and the instantiation of the covering law.* Summing up, we can state that the singular causal proposition, linked to particularistic evidence, must be matched, in the criminal trial, by an *ex post* probability of 99.9% (FROSINI observes however that, in calculating these *ex post* probabilities, some errors may be concealed due to theoretical bias that are not included in the coefficient of confidence and that therefore “a real defence, with respect to errors of the first kind, is never higher than 99%” and “a calculated probability of 99% should be assessed cautiously at around 95%”) (⁶¹).

To arrive at an explanation that has such a high degree of *ex post* probability, particularistic evidence must constitute the instantiation of a causal law, i.e. of a universal law, or of a statistical law with a frequency very close to 100. WRIGHT dedicates many pages to demonstrating that the particularistic evidence of the causal relationship consists “in the complete and actual instantiation, in a particular case, of a causal generalization”:

“In order to prove that a specific condition was the cause of a particular occurrence, we must obviously establish that both the condition and the event actually occurred and that some credible causal generalization links conditions of that type to events of that type. The evidence will be corroborated by the circumstance that the other known conditions, that are part of the causal generalization, also occurred. On the other hand, there will be no evidence of causation if we establish that any one of the conditions requested did not occur. Finally, we must distinguish between all applicable causal generalizations alternatively, disputing them or raising substantial doubts on the instantiation of one or more of the conditions required by the alternative generalization” (⁶²).

8. *Medical science, the paradigm of microbiology and the use of statistical laws for which “given A, B almost necessarily follows”.* – These are the premises that should constitute the basis of the new consensus on liability for the omitted prevention of the event in medical-surgical activity: the counterfactual, aimed at establishing what would have occurred if the omitted conduct had been carried out, must demonstrate that the conduct would have made it possible to offer particularistic evidence linked to the instantiation of a universal law or of a statistical law with a frequency very close to 100. It is on the very ground of medical-surgical activity, in fact, that the considerations made up to now, on the instantiation of a universal or statistical **causal law** with a frequency very close to 100, find a highly convincing confirmation.

The appeal for the need to make use, in the *ex post* reconstruction of what would have occurred if the omitted conduct had taken place, of the “most up-to-date medical-legal criteriology” comes from the United States. The adjective “most up-to-date” assumes a “less up-to-date” criteriology, i.e. that

⁶⁰ B. V. FROSINI, *op. cit.*, p. 7 *et seq.*

⁶¹ B. V. FROSINI, *op. cit.*, p. 131.

⁶² R. W. WRIGHT, *op. cit.*, p. 140 *et seq.*

has not been updated: it is the old criteriology based on the idea that forensic doctors must ascertain not the necessary condition, but the “capability” of a substance or a conduct to produce a certain damage, i.e. in short *ex ante* probabilities.

In Italy, this old criteriology, as I showed in “Justice and Modernity”, has been definitely discredited and has been eliminated both by the intervention of the Full Bench of the Supreme Court and by recent contributions of the current leaders of the forensic medicine movement, BARNI and FIORI: the forensic doctor duty is to ascertain the necessary condition⁽⁶³⁾. The new criteriology – the more up-to-date one – however, has not yet been processed by forensic medicine scholars; and it is for this reason that the basic indications must be sought in the works of medical epistemology scholars, and first of all in the very recent work of FEDERSPIL “Clinical Logic”.

“If we reflect on current medical knowledge, it is easy to establish that in pathology the ideal of cause as a **necessary condition** is still today fundamental⁽⁶⁴⁾; and it became fundamental when microbiology changed **the paradigm of pathology**. While for pre-Pasteurian medicine, an almost infinite series of different factors should be the cause of a disease, with the birth of microbiology and with the coding of **Koch postulates** – i.e. 1) it must be possible to demonstrate the micro-organism in every case of that specific disease; 2) the micro-organism must be cultivated in a pure culture; 3) inoculation of the micro-organism into the culture must reproduce the diseases in susceptible animals; 4) the micro-organism must be re-obtained from the inoculated animals – we have gone on to a different theoretical definition; causation became **necessary** since the finding of a specific micro-organism constituted the *conditio sine qua non* for the development of an infectious disease”⁽⁶⁵⁾.

The example of the paradigm of microbiology is fitting: it allows the doctor and pathologist to go beyond the formulation of hypotheses or diagnostic **conjectures**, and to provide true aetiological diagnoses, since they are founded on controlled hypotheses. FEDERSPIL says again: “imagine a subject who has been in contact with a cholera patient and who has worrying symptoms... The symptoms will be attributed to the cholera vibrio. This situation can actually be checked, by identifying the vibrio in the faeces and possibly by injecting it into an animal”⁽⁶⁶⁾.

The Italian epidemiologist COMBA offers similar indications about the paradigm of microbiology:

“Initially, epidemiologists working on transmittable pathologies relied on the paradigm of microbiology that gave them a scheme of interpretation. In order to say that a micro-organism caused a disease, it was necessary to check that the organism had been re-found in all cases of the disease, it had to be isolated in the patients, cultivated on a Petri dish, then reinoculated in a laboratory animal, to reproduce the disease. This was the precise scheme of causation, that had given excellent results from the end of the last century until after the war”⁽⁶⁷⁾.

⁶³ M. BARNI, *Consulenza medico-legale e responsabilità medica*, Milan, 2002, p. 57 *et seq.*; A. FIORI, *Il nesso causale e la medicina legale: un chiarimento indifferibile*, in *Riv. it. med. leg.* 2002, p. 247 *et seq.*

⁶⁴ G.FEDERSPIL, *Clinical Logic*, cit., p. 221, 233.

⁶⁵ G.FEDERSPIL, *op. loc. citt.*

⁶⁶ G. FEDERSPIL, *I fondamenti del metodo in medicina clinica e sperimentale* (The Foundations of method in clinical and experimental medicine), Padua, 1980, p. 79, quoted in F. STELLA, *Giustizia e modernità*, cit., p. 418.

⁶⁷ Court of Venice, 22.10.2001, cit. hearing 1st July, 1998, p. 142-143.

And if the paradigm of microbiology cannot be used?

When asked this question the only thing we can do is to question **medicine** again, to understand if it has covering laws which, **disregarding** intermediate causal links, connect the “initial” and the “final” event even if they are **not continuous** in time and **not contiguous** in space.

Once again it is FEDERSPIL who gives us the answer: within the sphere of medical knowledge, these laws, used in cases of “**simple, linear causation**” make it possible to identify the cause of a morbid phenomenon in “a very powerful external event, that produces **constantly** or **almost constantly** specific consequences in the organism: a serious gun-shot wound, the action of *yersinia pestis*, the action of *amanita phalloides*, etc”. In certain cases, then in medicine, a covering law indicates that a certain cause **always** produces a specific effect, and that that effect is caused by that cause and **only** by that cause (thus the problem of the plurality of causes disappears): “this causal mode can be simplified by what happens after a burn: a very intense source of heat **always** produces an immediate necrosis of the tissues and that type of necrosis, that appears in a short time, is practically **only** produced by burns”: In short in order to identify the cause, in medicine universal laws can be used (“given A, B necessarily follows”) together with almost universal statistical laws (“given A, B almost necessarily follows”). These kind of laws, introduced into the *explanans* together with the initial conditions, make it possible to identify the necessary condition when **instantiation** is not demonstrated in the individual case.

FEDERSPIL is very clear on this point:

“Causal laws do not only state the existence of an invariable connection of events, but they are laws of **succession**, in the sense that they link events that take place at different times. Examples of these laws can be considered assertions of this type: ‘the application of a stress to an organism always releases adrenocortical hormones’, or ‘the Toh secretion of hypophysis stimulates the release of hormones by the thyroid’. These laws are in fact called **universal laws** and for a long time have represented the **ideal model** of scientific laws. However, not all scientific laws have this universal form. In fact, other **laws** exist that are called probabilistic or statistical, which state that in X% of cases A is followed by B: for example, the assertion ‘rheumatic cardiopathy is followed in X% of cases by a mitral stenosis’”⁽⁶⁸⁾.

The necessary condition for a pathological event in medicine can be identified, therefore, by proving that a statistical law was instantiated in the individual case which, as we have seen, according to FEDERSPIL (and other scholars of medical epistemology), must be almost universal, i.e. a law for which “*given A, B almost necessarily follows*”⁽⁶⁹⁾.

In this way the picture is completed: for medicine also we can say that the *ex post* causal explanation must constitute the instantiation of a universal **causal law** or of a statistical law close to 100: only in this way will it be possible to obtain the particularistic proof to which *ex post* probabilities of around 99.9% are associated.

⁶⁸ G. FEDERSPIL, *Logica clinica*, cit., p. 216 *et seq*

⁶⁹ G. FEDERSPIL, *op. ult. cit.*, p. 222 *et seq*

9. *Counterfactuals and the “similar world”*. – The considerations above, concerning the *ex ante* probabilities, the *ex post* probabilities associated to particularistic proof, the support offered to the latter by universal laws or by statistical laws with a frequency very close to 100, concern commissive causation, but must also be extended to omissive causation..

Let me introduce a short reflection on counterfactuals to see what I mean.

According to the opinion received in the most refined Italian version – i.e. the one developed by PALIERO in the critical analysis of my paper on omission as a static condition: omissive causation is characterised by a “double hypothetical nature” (⁷⁰) – in case of omission, the judge must establish what **would have happened** if the proper omitted conduct had been performed: from this point of view, this has nothing to do with commissive causation, within the sphere of which the judge asks himself if an event in the real world, that has already occurred *hic et nunc*, as the development of a material causal course, subsumible under pertinent covering laws, would have occurred without the action.

To question oneself about “**what would have happened**” means seeking the conditions and events of a **hypothetical world**. But how must this world be built? At the discretion of the judge or on the basis of well identified and predefined indications that are binding for him?

In order to realise the great practical importance of these questions, we just have to think about the problem of the plurality of causes in case of omissions. The sure exclusion of the intervention of other causes is a requirement indicated by studies on logic, by the philosophy of science and now by the Full Bench of the Supreme Court as a basic requisite in ascertaining the causal relationship, both on the ground of commissive causation and on that of omissive causation. But the procedural verification, abstractly possible when the judicial investigation concerns the real world, appears almost always, or very often, impossible to propose when the judge enters a hypothetical world.

In establishing “what would have happened” in this type of world, we come up against an alternative: we can think that, if the omitted conduct had taken place, “**everything would have gone well**”, but we can also imagine that, without the omission “**everything would have gone equally badly**”.

⁷⁰ According to C.E. PALIERO, “Stella is right and, in my opinion, the traditional doctrine wrong: it should be denied that the two heuristic models of conditionalistic form (ommissive and commissive) are different because one has a hypothetical structure and the other an empirical-factual structure... However, I cannot agree fully with Stella’s critique, denying categorically with him that the two causal (commissive and omissive) paradigms are different from any point of view..... In the conditionalistic formula, the heuristic model of omissive causation differs from that of active causation, characterising itself, as we say, as a counterfactual in the second degree The formula of omissive causation is doubly hypothetical” (C.E.PALIERO, *La causalità dell’omissione: formule concettuali e paradigmi prasseologici*, in *Riv. it. med. leg.*, 1992, p. 839 *et seq.*). PALIERO is right, and I agree without doubt with his idea of second degree counterfactuals.

So, in order to state the causal relevance of the omitted conduct, the judge should prove that, without it, “everything would have gone well”; but what could this proof be?

If we exclude the use of fantasy and imagination, the probatory reference point can only be the real world; but the real world actually offers, with an inexhaustible richness, the picture of possible interventions of other causes. This is where the point is: if a certain type of event can be the result of the realization of different **causal** propositions, how will the judge be able to state that “everything would have gone well” in the absence of the omission? How will he be able to affirm that an event of a certain type would not have occurred, had the proper conduct been adopted?

Numerous “cases” can be found in the files of the Italian criminal jurisprudence in which causation in criminal omissions is established, even though the judge finds it impossible to prove that no other causes exist: thus late diagnoses and late surgical operations are considered the cause of the event despite the fact that sound scientific research, as we have already affirmed (see par. 3) shows high mortality rates, due to the most disparate complications that occur in the case of immediate diagnosis and operations or admission to hospital.

Here it is clear that the judge did not even raise the problem of the sure exclusion of other causes and, what counts more, he could not have raised it if he had wanted to reach a verdict, because he would have found himself with impossible evidence: in a hypothetical world, it is only with the imagination that one can fill the vacuum of having “forgotten” mortality rates recorded in the real world.

It is at this point that we need to rethink the topic of counterfactuals in omissive causation hypotheses also.

The counterfactual world is, by definition, a hypothetical world; but there are many hypothetical worlds, so we are forced to identify the counterfactual world to which the judicial investigation must refer. According to the very important work of DAVID LEWIS – a reference point for all investigations into counterfactuals ⁽⁷¹⁾ - in identifying the possible world one must abandon fantasy and construct the most adequate “similar world”.

If this, as it seems to me, is the only feasible approach, the conditions and events that occur in the real world must be introduced into the similar world; and this is so because in the real world, due to the widest range of complications, it happens that immediate diagnoses, surgical operations and hospitalisation do not succeed in preventing the harmful event. This should be taken into account when constructing the similar world. Similarly, in this construction, reference must be made to the impossibility of *ex ante* probabilities to give us information about what would have happened if the omitted conduct had occurred, as reference must also be made to the high level of *ex post* probability (99.9%), that can be reached only by using statistical laws with frequencies very close to 100. In other words, the singular

⁷¹ LEWIS, *Counterfactuals*, Oxford, 1973; p. 72-77. For a criticism of the approach of the “similar world” by LEWIS, see, KIM, *Causes and Counterfactuals*, in *J. Phil.*, 1973, p. 570 *et seq.* reprinted in *Causation and Conditionals*, Oxford, 1975, p. 192 *et seq.*

causal proposition on what would have happened in the absence of omission must be accompanied by the same very high *ex post* probabilities requested for commissive causation.

10. *Manipulation and emptying of the content of the notion of logical probability or rational credibility operated by the Italian case law.* – The concept of logical probability or rational probability has been deeply distorted and unduly manipulated by numerous criminal judges who have used it ⁽⁷²⁾.

This was a notion that made its appearance in Italian criminal law language with my work of 1975: developing the analysis of CARNAP, I emphasized the need to distinguish statistical probability, as a scientific concept that depends on empirical research, from logical probability that is particularly useful in propositions that concern the laws of science. I pointed out then that “when we speak of statistical hypotheses, we refer to hypotheses that express a quantitative relationship between kinds of repeatable events; when we speak of **scientific hypotheses** more or less logically likely, we want, on the other hand, to refer to universal or statistical hypotheses, that enjoy varying **degrees of confirmation**, and that therefore are “**rationally credible**” ⁽⁷³⁾.

Logical probability or rational probability therefore coincided, in the thought of CARNAP and myself, with the **degree of confirmation** of a **law** (scientific hypothesis) offered by its own theoretical support and by controls consisting in observation and experiment, controls that must be numerous and heterogeneous ⁽⁷⁴⁾.

In a similar meaning, I referred the expression “logical probability” to singular causal statements: I emphasized that the singular statement “without the conduct of the agent, the event would not have occurred” must be highly likely or rationally credible in the sense that it must be founded on universal or pertinent statistical laws and on proof that the “relative initial conditions” occurred, i.e., in short, on the demonstrated instantiation, in the case considered by the judge, of a universal causal law or of a statistical law with an “almost 100” frequency ⁽⁷⁵⁾.

But the judges’ opinions reflected many **misunderstandings** and undergone several **manipulations**: the notion of logical probability or rational credibility breaks away from its original meaning, because the reference to the

⁷² See F. STELLA, *Fallacia ed anarchia metodologica in tema di causalità*, in *Riv. it. dir. proc. pen.* 2004, p. 30 *et seq.*

⁷³ F. STELLA, *Leggi scientifiche*, cit., p. 225.

⁷⁴ F. STELLA, *op.ult. cit.*, p. 227. CARNAP was very clear and explicit: logical probability is not like statistical probability “a factual statement expressed in the language of science”, i.e. “an empirical statement”, but a statement according to which “given certain observations and a hypothesis (subform.... of a group of laws)”, we obtain “the degree of confirmation of *h* on the basis of *l*”. In this way, a “statement on a logical relationship between the evidence and the hypothesis considered” is made. CARNAP pointed out that it is not possible to state that a law of science has a higher or lower logical probability unless we specify “**compared to such and such evidence**”, i.e. to the evidence composed of controls carried out through observation and experiment. CARNAP, *op. cit.*, p. 52 *et seq.*

⁷⁵ F. STELLA, *op.ult.cit.*, p. 316 *et seq.*

degree of confirmation of scientific laws, composed of their empirical controls disappears, as does the reference to the *ex post* probabilities associated to particularistic proof, with reference to an universal causal law or to a statistical law with probability very close to 100 (⁷⁶).

Thus logical probability becomes a notion “**hanging in a vacuum**”, the contents of which are filled by the personal and unquestionable opinion of the individual judge: every proposition becomes reasonably credible or logically probable if it appears such to the judge since it is “released from its bases”, necessarily composed of the reference to the controls of scientific laws and by particularistic proof, consisting in the verification that scientific law was instantiated in the particular occasion examined by the judge.

Thus both science and the *ex post* probabilities that must be associated to particularistic proof disappear from the scene: the inscrutable subjective evaluation of the judge remains, in all its “sovereignty”, an expression of the dictum “*auctoritas, non veritas facit iudicium*” (authority, not truth informs the judgement).

In my opinion, these explanations are unavoidable because the conclusions reached on *ex post* probabilities of 99.9% (i.e. that they must, by the very nature of things, be based on the instantiation of causal laws or statistical laws with frequency close to 100) will be inevitably **disattended** as long as our case law does not realize that logical probability or rational credibility does not constitute a concept, the meaning of which can be “invented” by the judge. On the contrary, its logical and epistemological roots have been identified with absolute clarity. And it is this clarity that makes it possible to state that only the singular causal proposition which, *ex post*, has a “statistical” probability of no lower than 99%, deriving from the very high frequency, very close to 100, of the pertinent statistical law, has a high level of logical probability or rational credibility.

Obviously, this applies both to commissive and omissive causation. We should also add that, in the sphere of omissive causation, logical probability or rational credibility will not be able to receive an objective assessment when, in the hypothetical world evoked by the counterfactual, proof based on scientific laws and available evidence of that which would have happened if the proper omitted conduct had taken place, is not possible (⁷⁷).

11. Difficulties in forming the new consensus: some opinions delivered by the Supreme Court. – Going on now to instantiation of the judicial experience, let us try to understand what has happened in Italian Supreme Court criminal case law, especially in recent years (i.e. the years after 2000).

An initial group of sentences did actually follow the Full Bench in considering the *ex ante* probabilities incapable of giving any information on what would have happened in the case of “immediate intervention”, but unfortunately *ex ante* probabilities are replaced with the “vacuum of the

⁷⁶ See F. STELLA, *Fallacia ed anarchia metodologica in tema di causalità* (Fallacy and metodologic anarchy about causation), cit. p. 30 *et seq.*

⁷⁷ See *retro*, par. 4.

subjective and uncontrollable belief of the judge about what “would have happened”.

Let us briefly examine the main 2002-2003 sentences which illustrate this point of view.

1) First case (Orlando case) (⁷⁸).

A doctor fails, negligently, to diagnose a tumour of the intestines in a patient admitted to hospital; due to the failure to make the diagnosis, the patient does not undergo an immediate surgical operation that is carried out during a second period in hospital, just over three months later after the first visit. The metastases, that were not ascertained with certainty at the time of the first visit, spread rapidly in the months immediately preceding the excision operation and despite this the patient survived for more than nine months.

The conviction of the doctor, issued by the district Court and confirmed by the Court of Appeal, was also confirmed by the Supreme Court, Penal Sect. IV, with a verdict that has some peculiarities. The Court clearly dismisses the criterion of *ex ante* probability, quantified by the trial judges at 50% probability of survival at 3 or 5 years in the case of immediate intervention: for the Supreme Court, the *ex ante* probability amounts here to “an increase in risk” and shows “the impossibility, due to the improper omissive causation, of identifying with certainty the omitted conditioning factor which, if carried out, would have prevented the occurrence of the event”. The Court observed conclusively that **there is no judge** who would sentence a person by stating that the same “had **probably** committed the crime”.

At this point, one would have expected the reversal of the sentence; but the judicial resources of judges who wanted a conviction at all costs are infinite, and thus the Supreme Court confirmed the previous sentence by manipulating and misunderstanding the concept of logical probability I talked about. This was in fact the conclusion of the Court: “if the disease had been diagnosed and treated immediately, even in the least favourable hypothesis, it would have allowed the patient to survive during a period of time quantifiable in years”.

It makes me feel like saying: with its language, the Court creates a non-existing reality! One does not have to be an expert in the philosophy of language and does not even have to consult studies in logic to realize that here we are faced by a radical absence of rational credibility considered by the judges as legality. If the probability of a frequentist type of survival of as much as 3 or 5 years, in the case of immediate intervention, was – as the Court admitted – 50%, how can it be logically affirmed that the patient would definitely have survived longer if the doctor had made the omitted diagnosis at the first visit?

It is a real shame that the Court followed this path. It is true that a fundamental role in the causal investigation must be assigned – as the Court recognizes - to the *ex post* investigation based on the evidence available concerning the individual case, but it is equally true that only the *ex post*

⁷⁸ Cass. crim. sect. IV, 10.6.2002, in *Riv. pen.*, 2002, p. 671 *et seq.*

investigation should tell us, on the basis of the acquisitions of medical science, what are the reasons for affirming that the case of the patient who underwent excision operations does not fall within 50% of the cases of patients to whom an immediate operation did not guarantee a survival of as much as 3 or 5 years.

The roots of this distortion of the concept of logical probability must however be sought in the premises from which the Judge moves: “frequently universal scientific laws or simply statistical laws suitable for solving the case brought to the examination of the judge do not exist and sometimes – as subsequent research confirms – are false – therefore the judge is obliged to resort to simple rules of empirical rationality, as long as they are plausible”⁽⁷⁹⁾.

Simple rules of empirical rationality with undefined content and detached from the laws of science would therefore represent an “expedient” used by the Supreme Court to confirm the conviction.

It is in this way that the process of forming the consensus on the new way of understanding omissive causation was unexpectedly blocked.

2) Second case (Albissini case)⁽⁸⁰⁾.

With a sentence following the teachings of the Full Bench of 10.7.2002, the IV pen. sect. of the Supreme Court confirmed the jail sentence of a doctor who had omitted to describe, in the radiological report on the thorax, the presence of an oval opacity of medium intensity, measuring approximately 1-1.5 cm, which later turned out to be a neoplastic pulmonary formation (after about one and a half years the measurements were approximately 4 cm.). By not suggesting further and more detailed investigations, even of a tomographic and stratigraphic type, the doctor was supposed to have prevented early diagnosis of the disease and the implementation of immediate surgical operations, thus causing the death of the patient three years later, following the formation of brain and liver metastases.

The Court so held: the diagnosis of the pulmonary pathology, if and as made at the time the x-ray was executed, “would **quite probably** have allowed - resorting to immediate surgical and therapeutic remedies, such as pulmonary resection - a survival of 5 years, greater therefore compared with that of 3 years which actually happened”. The expression “quite probably” – continues the Court – also fully satisfies the demand of the result of the counterfactual: it is in fact “a rule of experience, as well as a scientific rule, that the efficacy of a tumoral diagnosis, for the purposes of longer survival, can be linked directly to its immediacy and precocity”. Longer survival would have been statistically indicated by the board of experts “in 48% of cases with reference to a period of time of as much as 5 years”.

We are dealing again with *ex ante* probabilities: this is in short the criterion that supports the counterfactual, indicating how things would have gone in the event of immediate intervention. And yet, the same Court had expressed its agreement with the teaching of the Full Bench, according to

⁷⁹ See F. STELLA, *op. cit.*, p. 29 *et seq.*

⁸⁰ Cass. pen. sect.IV, 15.11.2002, n. 38334, in *Riv. pen.* 2003, p. 110.

which “it is not allowed to deduce automatically from the probability expressed by the statistical law confirmation or refutation of the prosecutor hypothesis on the existence of the causal relationship”.

In fact the *ex post* investigation was carried out and it did show up metastases, first in the brain and then in the liver, that led to the patient’s death; but the problem was to identify the *ex post* probabilities relating to survival for more than three years, in the hypothesis in which surgical intervention had been immediate, with reference to mortality rates in immediate operations and to the demonstrated irrelevance of the size of the nodule of 1-1.5 cm. compared with the nodule of 3 cm and more ⁽⁸¹⁾. The opinion has nothing to say about these probabilities and cannot do better than refer to the 48% of *ex ante* probability.

When all is said and done, the Supreme Court does not move very far from the less recent orientation for which “even only small probabilities of success” (sect. IV. no. 4320/83), “serious and appreciable probabilities of success” also represented by 30% (sect. IV, no. 371/92), “the high level of possibility” consisting in 75% probability of survival (sect. IV, no. 1126/2000) are sufficient.

Here the marks left by the Orlando sentence are clearly visible: it does not matter that the *ex ante* probabilities of survival at 5 years (therefore higher than the actual survival of 3 years) was 48%: the arguments of the District Court appear “completely reasonable, rigorously anchored to the trial findings”, logically explained by “the proclaimed deterioration of the neoplastic pathology towards processes of gradual metastatisation and therefore towards the fall in the vital balances of the organism”.

As we can see, this opinion too does not give us any information on the reasons why the patient should not fall within the 52% of cases that would not have survived as long as 5 years in any case even in the case of an immediate operation. In those 52% of cases, metastases constitute a normal evolution of the tumoral disease.

3) Third case (Amato case) ⁽⁸²⁾

Again, in the period following the Franzese sentence, the IV penal section of the Supreme Court confirmed the conviction of the assistant surgeon who was accused of failing to issue an immediate diagnosis of a testicular pathology (twisting of the testicle) from which a patient was suffering, wrongly diagnosing colic in the right kidney, without prescribing any appropriate instrumental tests and without submitting the patient to an immediate surgical operation.

The district Court sentence referred to by the Supreme Court, stated that, at the time of the visit “there was still an approximately 40% possibility that the surgical operation would have been successful”. But, in the opinion of the Supreme Court, this circumstance was irrelevant, given that “the harmful event took place - with a causal link that was considered unavoidable and was

⁸¹ See *retro*, par. 3

⁸² Cass. Pen. sect.IV., 22.11.2002, no. 39637, in *Riv. pen.*, 2003, p. 110 ss.

ascertained with certainty – due to the wrong diagnosis, failure to ascertain the pathology and the lack of the order to proceed with further, necessary tests”.

Once again, the Court forgets that logic and science are not optional: if *ex ante* probabilities are 40%, how can it be affirmed that the causal relationship was proven with certainty?

Of all the sentences considered, this is surely the most peculiar due to the obvious incompatibility showed by two propositions with an antithetical meaning: if there were 60 *ex ante* probabilities that an immediate surgical operation would not have been successful, the least we could expect from a conviction was an explanation of why, on the basis of the evidence available *ex post*, the considered case should fall within the 40% of success of the immediate operation.

Once again, we can see the far-reaching effect of the Orlando verdict: recourse to *ex ante* probabilities and to science is wrong and must be replaced with no better identified criteria of empirical rationality or with no better defined generalizations of common sense.

4) Fourth case (Guida Case) ⁽⁸³⁾.

This is, perhaps, the most clamorous breach of the law by the Supreme Court.

A patient suffering from a psychotic depressive syndrome was admitted to a clinic and committed suicide by jumping out of a window in a place outside the clinic, after obtaining the permission of her doctor to leave the clinic with a person to accompany her. The latter was not informed about the mental state of the patient nor about her previous attempts to commit suicide by jumping out of a window.

The Supreme Court confirms the conviction. This sentence is a paradigmatic case of an only apparent motivation: not only did it state the commissive causation relationship linked to the permission to leave the clinic in a circumstance of “**increased risk**” but, from the point of view of omissive causation, it did not utter a word about a fundamental circumstance, pointed out by the defence on appeal: according to the Prosecutor’s psychiatric expert, there was “the **same probability** that the woman would have committed suicide inside the clinic” perhaps “by hanging herself from the toilet shutter box....The depressed patient is one of the most difficult patients to treat, because suicide is possible even when they are within the hospital system, despite all the precautions that are taken. For example, it has even happened that a brother, who was the only relative, was asked to stay in hospital with a patient during the most intense period of her depression, to help look after this person. Then, when the drugs started working, this person was less depressed and was given a minimum amount of freedom. On the day she committed suicide. Her brother had been with her from 2 o’clock in the

⁸³ Cass. Crim. sect. IV., 6.11.2003, no. 1442, in *Cass. Pen.*, 2004, with a note by M. Zanchetti. *Tra l’incudine e il martello. La responsabilità penale dello psichiatra per i suicidio della paziente in una recente pronunzia della Cassazione*, p. 924 et seq.

afternoon until 7 o'clock in the evening. At 7 o'clock it was dinner time and all the relatives left: the woman said 'I am going to the toilet for a minute', at 7.15 she had not come out, at 7.20 they went into the toilet and found her hanging from the toilet shutter box. This situation was unforeseeable, not expected and completely without warning.... So, sometimes the depressed patient may carry out self-harming gestures in a completely unpredictable way and **without there being any possibility** for the staff to intervene".

The opinion of the Prosecution expert was fully confirmed by psychiatric science: "according to psychiatry, patients who really intend killing themselves will succeed in doing so. No amount of **physical containment**, careful observation and clinical ability can stop a patient who is really determined to kill itself. One of these patients was placed in an isolation room with nothing but a mattress. All his clothes and his possessions were removed and he was checked regularly every fifteen minutes. In the space between controls and every quarter of an hour, the patient started jumping on the mattress with such force that he managed to bang his head against the ceiling, until he broke his neck" ⁽⁸⁴⁾.

Auctoritas, non veritas, non lex facit iudicium: (authority, not truth, not law informs the judgement) as ancient Roman law put it: this is the most kind comment one can make at the opinion of the Supreme Court. An authority that sees in the search for the truth not the duty of the criminal trial, but an academic whim; and an authority that puts itself above the law and the same Constitution: even the constitutional principle on the right to defend oneself can be considered an academic whim!

Obviously, these "axioms" must in some way be hidden, but how can they be hidden? Nothing is easier: with reference to the empty formula of logical probability or rational credibility, understood as probability and credibility considered by the judge according to his inscrutable opinion. The ghost of the Orlando is still hanging around; and in fact, for the Supreme Court, in the Guida case, "the judgement of responsibility can and must be given when the finding that the incriminating conduct was a necessary condition of the harmful event with a high degree of rational probability or logical credibility is justified and procedurally certain".

A further remark has to be made: according to the jurisprudence Review of the Supreme Court, issued by the Office of the Digest of Case Law of the Supreme Court of Cassazione, the Guida opinion represents "a particular case of deviation from the dictum of the Full Bench", characterised only by "a formal deference to the teaching of the quoted Franzese pronouncement" ⁽⁸⁵⁾. We have here therefore the most authoritative confirmation of the existence of a trend which, in open rebellion against the Full Bench, acknowledges the "emptiness" of the subjective and uncontrollable opinion of the judge in establishing, in cases of omissive causation, "what would have happened".

⁸⁴ GABBARD, *Psichiatria psicomodinamica*, Milan, 1995, p. 226 et seq.

⁸⁵ CORTE SUPREMA DI CASSAZIONE, *Rassegna della giurisprudenza di legittimità: la giurisprudenza delle Sezioni Unite penali della Corte di Cassazione (2002-2004)*, Rome, 15.1.2005.

12. *The new consensus and the opinions of the Supreme Court anchored to statistical laws with frequencies close to 100 and to particularistic proof associated to ex post probability of 99.9%.* –This trend is however opposed by another: the Supreme Court opinions, held by penal section IV, consider the finding unjustified when, on the basis of the laws of medical science, the judge cannot affirm that, if the omitted conduct had taken place, a statistical law with a frequency close to 100 would not have been instantiated.

Let us look briefly at these sentences.

1) First case (Baltrocchi case) ⁽⁸⁶⁾.

Baltrocchi was a doctor on duty at the emergency department of a hospital. A patient had felt ill and the doctor had diagnosed chronic bronchitis and a hypertensive crisis in a patient who was known to have been hospitalised on previous occasions, to have suffered a myocardial infarction and to be undergoing pharmacological therapy. Following the diagnosis, the doctor considered that it was not necessary to admit the patient and sent him home, prescribing aerosol therapy and a visit to a specialist to be made the following day. After returning home, the patient died the same night. The doctor at the emergency department was prosecuted for not having hospitalised and therefore for not having kept the patient under observation, even though the haemogas test had shown hypoxia, hypercapnia and metabolic alkalosis, so that after being sent home the patient was left without any therapy to prevent and cope with the cardio-respiratory crisis from which he died. The district Court acquitted the doctor, holding that there were no elements that allowed the judges to state, with a sufficient degree of certainty, the causal relationship between the death and the alleged omissive conduct. Doubts remained about the suitability of the alternative hypothetical treatments to prevent the death of the patient, or, in any case, to decrease the danger of death at a relevant percentage. The Court of Appeal, on the other hand, delivered its reversing opinion based on the remark that *ex ante* probabilities of survival, in the case of immediate treatment, were lower than 50%, but were not irrelevant, even if very limited. According to the district Court, the causal relationship between the omissive conduct and the fatal event could be affirmed only if the omitted conduct had serious and appreciable possibilities of success. The Supreme Court, crim. sec. IV, reversed holding that *ex ante* probabilities lower than 50% do not give any information on what really happened and that, in the case at hand, it was impossible to exclude that the event would have occurred even if the omitted proper conduct had been carried out. *Ex ante* probabilities of 50% and 28% (on which the experts agreed in reconstructing the two different hypotheticals) “are a long way from being ‘close to 100’, as required by science, logic and as, consequently, required by the law. They are very far, therefore, from constituting, for the

⁸⁶ Cass. Crim. sec. IV., no. 1688, in *Riv. it. dir. proc. pen.*, 2001, with a note by F. CENTONZE, *Causalità attiva e causalità omissiva: tre rivoluzionarie sentenze della Corte di Cassazione* (Active causation and omissive causation: three revolutionary opinions of jurisprudence of the Supreme Court), p. 277 *et seq.*

judge, the covering law he needs in order to state the causation relationship in scientific and therefore penally satisfactory terms". The counterfactual – the Court goes on to say – aimed at identifying the necessary condition, is impossible due to "the impossibility of knowing if the patient died due to that lack of treatment or, on the other hand, due to the residual 50% of causes, which, despite the treatment, could have led to his death in any case". In other words, if "the event can have been caused by a certain conduct", but "may also have not", it must be excluded that the omissive conduct can be defined as the necessary condition for the event. The truth is – the Court concluded – that "'perhaps' lays in the reign of the 'possible', 'perhaps' is not probability close to certainty, and does not represent a percentage of cases **close to 100**", a lot more is needed for a sentence, i.e. *ex post* demonstration of the instantiation of a covering law with frequency close to 100.

2) Second case (Musto case) ⁽⁸⁷⁾.

A woman who had been receiving treatment for recurring attacks of tachycardia since she was a child, was diagnosed by her GP as having "Wolf Parkinson White's syndrome", consisting in "the presence of accessory anatomical connections – actual bridges between the atrium and the ventricle – composed of myocardial fibres parallel to the normal atrium ventricle conduction system". This syndrome, over the years, had been controlled with pharmacological treatment, until Dr. Musto, in July 1993, had suggested to the patient, obtaining her consent, to resolve the pathology once and for all by ablation treatment of the so-called "anomalous section". However, the ablation treatment was not successful; on the contrary it resulted in a small lesion along the coronary cavity. The patient went into a coma due to serious brain damage caused by cerebral anoxia and died following a cardio-surgical operation. The Court of Appeal confirmed the sentence of the Naples trial Court, holding that "the causal relationship can be affirmed even when the doctor's work, if correctly and immediately carried out, led not to certainty, but only to serious and appreciable possibilities of success, so that the patient's life, with a certain probability, would have been saved The statistic data offered by the expert, concerning similar cases in which patients were saved, make it possible to state that an immediate diagnosis and immediate actions to remedy the cardiac tamponage, would have prevented the cerebral anoxia that caused the patient's death". Crim. sect. IV of the Supreme Court reversed the conviction and sent the case back to the Court of Appeal, affirming doubtlessly wrong the statement on the sufficiency of serious and appreciable probabilities of success and observing that reference to the expert's statistics represents an undemonstrated statement. Those statistics were not specified and subjected to critical scrutiny: "in fact it is only by knowing these statistics that we can understand if it was ascertained that, with a probability close to certainty, with a probability close to 100, that conduct was the necessary cause of the event as it occurred *hic et nunc*".

⁸⁷ Cass.Crim. sec. IV, 29.11.2000, no. 2139, in *Riv. it. dir. proc.pen.*, cit., with a note by F. CENTONZE.

In short, *ex ante* probabilities must be quantified because, if they are not, the judge is not able to verify, *ex post*, if the conduct and event constitute the instantiation of the chain of typical conducts–events indicated by a covering law with frequency close to 100.

3) Third case (Di Cintio case) ⁽⁸⁸⁾.

The doctor on duty at the emergency department of a hospital, called out to the home of a patient, did not ask for the patient to be admitted to hospital, even though at the time of the visit “the latter had a neurological situation characterised by loss of consciousness and loss of urine”. When the patient was hospitalised the following day, a myocardial infarction was diagnosed. The delay in hospitalisation made therapy unfeasible and the patient died “due to acute myocardial infarction complicated by bilateral pneumonia, ischemic lesions in the area of the right cerebral artery, atrial fibrillation, congestive cardiac decompensation with pulmonary oedema and acute respiratory failure with bradyarrhythmia and with terminal cardiogenic shock”. The Court of Appeal convicted the doctor for failure to ask for hospitalisation of the patient in a medical situation “clearly indicated by loss of consciousness, even if temporary, and by loss of urine”, observing that if the patient had been hospitalised immediately, he would almost certainly have been saved. Crim. sect. IV of the Supreme Court confirmed, observing that “from the juridical point of view, the causal relationship is affirmed not in terms of a scientifically unachievable certainty, but in terms of almost certainty, not in terms of a percentage **equal** to 100, but in terms of coefficient percentages close to 100, **a little less than 100**”. To say that the patient would almost certainly have been saved means making a statement equivalent to that of a probability close to 100%.

Perhaps we should criticize the trial judgement reached by the Court of Appeal on this matter. In fact it is difficult to give credit to the idea that the patient could almost certainly have been saved if he had been hospitalised immediately. In the debate, the expert affirmed that at the time it occurred “the infarction was already at the second or third stage”, i.e. it was a very extensive infarction and that the complications that arose during hospitalisation, directly proportional to the infarction area, “once they had occurred, were difficult to control”. As we have seen, however (prev. par. 3) a high percentage of patients hospitalised immediately for myocardial infarction die as a result of acute cardiogenic shock. Therefore, to support the conviction there should have been proof (impossible) that the patient certainly or almost certainly would not have died from shock.

13. *The possibility of overcoming the split existing within the Supreme Court.* – In conclusion, we must notice that two opposing trends exist within the jurisprudential sphere of crim. sect. IV of the Supreme Court. For the first one the concept of *ex ante* probabilities must be abandoned and replaced by an

⁸⁸ Cass. Crim. sect. IV., 28.11.2000, n. 2123, in *Riv. it. dir. proc. pen.*, cit., with a note by F. CENTONZE.

indefinite criterion of a logical probability which corresponds to the **inscrutable opinion** of the judge; for the second, the specific causal statement must have a very high *ex post* probability (as we have seen, 0.999) of being instantiated, a probability that can only be reached if it is supported by a statistical law with a frequency close to 100.

This “split” within the jurisprudence of the IV crim. sect. is still preventing the raising of a new consensus; nevertheless it is not unreasonable to forecast that the split will soon be eliminated, since those who reject the idea of the instantiation of a statistical law with a frequency close to 100 have no arguments to support their point of view. There are, on the contrary, many convincing arguments to support the other trend.

This means that criminal trials for omission, on the part of the doctor, of the proper necessary conduct, are destined to decrease drastically because very often it is impossible to prove that, if the omitted proper conduct had been carried out, the harmful event would not have occurred with an *ex post* probability of 99.9 following the application of a statistical law with frequency close to 100.

However, in our country too, the idea that we must take the path of **civil liability** has to replace the old penal practice, especially because the penalty of compensation of damage is certainly better equipped with higher profiles of deterrence than the criminal penalty. (Think to the “punitive damages” of American civil jurisprudence).

Once this path has been taken, it will be possible to create a civil jurisprudence based on the concept of the “lost chances”: the causal relationship, that in many cases can not be demonstrated in the criminal trial, will on the other hand be easy to verify by identifying the damage not in the harmful event itself, but in the decrease of “possibilities of survival or recovery” linked to the omitted proper conduct (⁸⁹).

14. *Particularistic proof on what really happened and the elimination of the problem of omissive causation.* – On the other hand, sometimes consideration of what really happened can allow us to understand that the problem of omissive causation has been **misplaced**.

I can remember, here, amongst others, two recent cases (⁹⁰). The first concerns the charge against a team of doctors for having made a late diagnosis of intestinal infarction: the *ex ante* probabilities of a successful operation were around 10-30%, but the particularistic proof offered by the operating journal and by the description of the patient’s situation made by the pathologist had shown not only that these *ex ante* probabilities were not

⁸⁹ See, in American case law, R. W. WRIGHT, *op. cit.*, p. 1067 *et seq.*; for Italian case law, Cass. Civ. sect. III., 11.12.2003-4.3.2004, no. 4440, in *Cass. pen.* 2004 with a note by F. D’ALESSANDRO. *La perdita di chances secondo la Cassazione civile: una tutela della vittima effettiva e praticabile*, p. 2537 *et seq.*

⁹⁰ Milan Court, 4.6.2001 and Milan Court, 18.2.2000 in *Riv. it. med. leg.*, 2002, p. 1272 *et seq.*, 1279 *et seq.* with a note by R. PALAVERA, *Verso una “costruzione giuridica della scienza”. Riflessi dell’oltre il ragionevole dubbio e della recente giurisprudenza di Cassazione sulle decisioni dei Tribunali di merito.*

instantiated but that, if it had really been late, the diagnosis would have had the effect of prolonging the patient's life rather than shortening it.

The second case concerns the charge against a heart surgeon for having implanted a faulty cardiac valve in a patient; if the omitted proper conduct had been carried out, and the quality of the valve had been controlled before the operation, death some months later due to breakage of the valve, would not have occurred. Here again the *ex ante* probability of a successful operation with a faultless valve appears high; but here too the particularistic proof shows, through a careful and accurate check made by the judge's experts, that those *ex ante* probabilities were not instantiated because breakage of the valve turned out to be due to the violent cardiac massage carried out in the hospital's emergency department where the patient had been admitted after feeling ill.

In both cases, the *ex post* probabilities associated to the particularistic proof were clearly higher than a threshold "very close to 1".

Perhaps we should illustrate in detail the reasons for acquittal at both trials.

First case: a patient is admitted to hospital and is defined "at dramatic risk" having had four strokes, one heart attack, a bypass operation, an aneurysm of the abdominal aorta, serious kidney failure, a peripheral arteropathy of the limbs, a stenosis of the subclavian artery and hypertension. A whole medical team was prosecuted because – according to the Prosecution – a late diagnosis had been made of an intestinal infarction in the patient while he was in hospital: the delay in diagnosis was supposed to have caused a delay in surgery that did not manage to save the patient's life.

The Prosecutor focused on the delayed diagnosis: the symptoms shown by the patient, (first constipation, then diarrhoea, fever, leucocytosis and pain at palpation) were supposedly wrongly interpreted by the medical team which, for several days, did not suspect intestinal infarction, thus making impossible an immediate operation that would have given the patient a probability of between 10 to 30% of survival.

The patient died following surgery. Result of the post-mortem: death due to multi-organic failure caused by the thrombotic occlusion of the mesentery, complicated by gangrenous intestinal necrosis, toxic-infectious state, shock and pneumonia. All of this – according to the Prosecution – would not have happened if the operation had been carried out immediately.

What happened? The Prosecution expert had failed to analyse the post mortem results and above all had completely neglected to examine the operating diary. In the debate, the pathologist had clearly explained, also by means of photographs, that occlusion of the lumen of the mesenteric artery by a fibrinoleucocytarous thrombus was **recent** and dated back to only just a **few hours before** the patient's death, and had also indicated the serious drop in pressure which the patient suffered, at a certain moment during the operation.

But the operating diary revealed astonishing details: it appeared from this diary that the large intestinal infarction, ascertained during the post-mortem, had developed after the operation, following the so-called "low range syndrome", while what the surgeon had operated on was a very small infarction.

In conclusion: the cause of the patient's death was not the thrombotic occlusion of the vessel, dating back to some hours before, but a break-down in the haemodynamic balances, the result of surgery on a high risk individual. According to the pathologist, the cause of the death was to be found in the generalized arteriopathy that was so extensive and serious that, if the operation had been carried out earlier, it would have accelerated the death of the patient, instead of giving him more chances of survival.

The monocratic Court of Milan considered this situation decisive, irrespective of the consideration that the operation for intestinal infarction is a high mortality event (from 70 to 90%) even in individuals without the pathologies found in the patient.

As we can see, this case proves exactly what we were saying about *ex post* investigations on the basis of available evidence, very strongly quoted by the Full Bench.

From the medium-low frequency of cases of survival, in the case of an immediate operation on a patient with intestinal infarction, of around 10-30% we do not get any information about what would really have happened. In the case presented by the Prosecution, if the operation had been carried out some time before, the patient would have died earlier.

The truth is that in a trial for medical negligence the Prosecutor finds himself in the same situation as the doctor: he must proceed with the inductive method and collect very extensive data; he must put all available evidence "into a state of siege" in order to arrive at a formulation of the hypothesis. What the Prosecutor in the case at hand did not do, was to prompt his experts to observe "all the facts", to formulate the hypothesis and to submit it to attempts of falsification, on the basis of further factual checks ⁽⁹¹⁾.

Second case: an innovative heart valve in pyrolytic carbon was inserted in a man of 44 years of age, suffering from aortic stenosis and with a congenital coronary anomaly, in a skilfully-performed and perfectly successful operation. After some months, the man was taken to the emergency department in cardio-circulatory and respiratory arrest. A prolonged heart massage was carried out in vain but all the doctors could do was to ascertain his death. The Prosecution charged the heart surgeon with manslaughter for having failed to ascertain the composition, resistance and quality of the heart valve: during the post-mortem, faults had been found in the valve that explained why it had broken.

During the debate it appeared that the valve had become distorted, but after the heart massage had been carried out. In fact, if the fracture had occurred previously – according to the Prosecutor's expert - heart failure would have been hyper-acute and the death would have occurred **within just a few minutes**.

Here again, what happened? The Prosecution expert had shown that he did not have full knowledge of the applicable rules and basic technical notions; the examination he carried out had been extremely superficial, the hypothesis he had made following which the death of the patient was due to breakage of the valve had been equally superficial and rash. The experts

⁹¹ G. FEDERSPIL, *Logica clinica*, cit., p. 155 *et seq.*

nominated by the judge, on the other hand, had concluded their report by affirming that the elements collected were “strongly suggestive” of a “mode of death consisting in a ventricular arrhythmia supported by an ischemic substratum”: i.e. by a condition that had resulted in hospitalisation in the emergency department.

And it was actually at the emergency department – as emerged during the debate – that the patient was subjected to a violent and prolonged massage that explains the breakage of the prosthesis. On that occasion, the prosthesis was subjected to strong stress that caused it to break, as a series of lesions of the thorax and subcutaneous bruises established.

These were the conclusions of the Court: “all the experts agree in stating that breakage of the valve would have led to the death of the patient **within a few minutes** and not, as in this case, after an appreciable period of time and not after being admitted to the emergency department;..... therefore, we can safely state that death was not caused by breakage of the valve **before** the patient was admitted to the emergency department”.

As we can see, this is a similar situation to the previous one: the facts, the available evidence were placed “in a state of siege” during the debate, through the examination and cross-examination of experts of the two parties. The Prosecutor relied on the evidence gathered by his pathologist with a technique that one expert of the defence defined as typical of “the Third World”.

This is how disputes on omissive causation often arise: with techniques typical of the Third World.

The moral to be drawn is that very often the omitted proper conduct seems to be on the part of the Prosecution and its experts. And it is here that the reference of the Full Bench to the duty, on the part of the judge, to carry out a rigorous *ex post* verification of all available evidence assumes a very sound significance. Only with this inductive verification the problem of omissive causation is solved at the root. In the latter case, it is *ex post* evidence that shows that we are not faced by an omitted proper conduct (failure to check the quality of the characteristics of the heart valve) but in presence of a hypothesis of active causation that cannot be attributed to the defendant.

Once again the warning of the Justices of the U.S. Supreme Court in the *Daubert* case proves to be true: judges must exercise much greater control over experts than over witnesses, because experts can draw conclusions that are so misleading that they could result in the conviction of innocent individuals⁽⁹²⁾.

⁹² See F. STELLA, *Giustizia e modernità*, cit., p. 439 and note 21.