

# This Week's Citation Classic®

CC/NUMBER 24  
JUNE 16, 1986

Carr D H. Chromosome studies in spontaneous abortions.

*Obstet. Gynecol.* 26:308-26, 1965.

[Department of Anatomy, Faculty of Medicine, University of Western Ontario, London, Ontario, Canada]

Chromosomes were analyzed in cells grown from the tissue of 200 successfully cultured preivable spontaneous abortions. Among these specimens, 44 were found to have a chromosome abnormality, of which half contained one extra chromosome and a quarter lacked a sex chromosome leading to a 45,X chromosome anomaly. Nine of the 44 specimens had 69 chromosomes or triploidy, and two others had 92 chromosomes or tetraploidy. [The SCI® indicates that this paper has been cited in over 200 publications, making it one of the most-cited papers for this journal.]

David H. Carr

Department of Anatomy  
Faculty of Health Sciences  
McMaster University  
Hamilton, Ontario L8N 3Z5  
Canada

April 14, 1986

In 1958 I made the massive jump from general family practice to an academic career in the department of Murray L. Barr at the University of Western Ontario in London, Ontario. At that time, Barr was involved in sex chromatin studies of individuals in institutions for the mentally retarded. My research experience began as part of this study. Following the publication in 1959 of the first studies of chromosome anomalies in humans, our own first successful culture of human chromosomes occurred the following year. In that same year, two publications appeared in the same edition of *Lancet* describing the findings of an extra D-group chromosome and an extra E-group chromosome in infants who died shortly after birth.<sup>1,2</sup> I suggested to Barr that, if these anomalies were so immediately lethal, then surely spontaneous abortions would be a source of even more lethal anomalies. This belief was further reinforced by the publica-

tion in 1961 of the finding of triploidy (69 chromosomes) in two spontaneous abortions cultured at the Galton Laboratory.<sup>3,4</sup>

The first successful culture of tissue from a spontaneous abortion occurred late in 1962, and, on January 5, 1963, a very macerated embryo was received and the tissue from the sac of this abortus produced cells with a 45,X chromosome complement, identical to that seen in live-born infants with Turner's syndrome. In the same month, a second embryo was received that proved to have an extra chromosome in group D. When news spread of these two chromosome abnormalities, the gynecologists in the city became more and more cooperative in saving fresh spontaneous abortion material for me. The paper quoted was the result of studies using this material carried out over the next two-and-a-half years.

Material was collected mainly from one hospital in the city, with a smaller amount coming from a second hospital, and the message that we were interested in this material seemed to have been well disseminated. However, about a year into the project one of the gynecologists said to me, "You're not interested in specimens with just an empty sac, are you?" In actual fact, these were the specimens with the highest frequency of chromosome anomalies, and I knew immediately that I must have missed some interesting specimens along the way.

This was the first report of a series of spontaneous abortions in which chromosome studies were made, which presumably accounts for the frequent citation of the article. Later, my study was dwarfed by very large collections coming from several major centres.<sup>5</sup> In addition, it became clear that my estimate of a 22 percent frequency for chromosome anomalies in spontaneous abortions was about half the actual level, which is now believed to be between 45 and 50 percent. Although some of this error was probably due to the failure of gynecologists to realize the importance of saving specimens that contain no embryonic material, this study also preceded the liberalization of abortion laws in Canada, and there was undoubtedly a mixture of induced with spontaneous abortions.

1. Edwards J H, Harnden I G, Cameron A H, Crosse V M & Wolff O H. A new trisomic syndrome. *Lancet* 1:787-90, 1960. (Cited 350 times.)
2. Patau K, Smith D W, Therman E, Inhorn S L & Wagner H P. Multiple congenital anomaly caused by an extra autosome. *Lancet* 1:790-3, 1960. [See also: Inhorn S L. Citation Classic. *Current Contents* (48):15, 27 November 1978.]
3. Penrose L S & Delhanty J D A. Triploid cell cultures from a macerated fetus. *Lancet* 1:1261-3, 1961. (Cited 105 times.)
4. Delhanty J D, Ellis J R & Rowley P T. Triploid cells in a human embryo. *Lancet* 1:1286, 1961. (Cited 75 times.)
5. Boue A, Boue J & Groff A. Cytogenetics of pregnancy wastage. *Advan. Hum. Genet.* 14:1-57, 1985.