

# Pavel Stepanek

Pavel Štěpánek (b 1931) is a Czech citizen who took part in ESP experiments during the 1960s and proved an unusually successful subject. The experiments took place in Prague, and later in the US in collaboration with American parapsychologists. A brief description in *Nature* brought his work to the attention of sceptics, who dismissed it as trickery; their views in turn were rebutted by researchers.

## Life

Pavel Štěpánek (hereafter, Stepanek) was born in Prague in 1931, an only child, in modest economic circumstances (his father was a street sweeper). After completing secondary education he was employed as an information clerk in banks and a hotel, and later, during the period of the ESP testing, in the Prague Municipal Library.

Stepanek was not a career psychic: his activity in this field was limited to participation in ESP experiments. Prior to the testing he revealed no personal history of psychic ability, except for an incident said to have occurred during World War II when he tried (unsuccessfully) to persuade his family to leave their home shortly before the building was damaged in an air raid.[1](#)

Aged thirty, Stepanek responded to a call by Milan Rýzl (hereafter Ryzl), a Czech parapsychologist, for volunteers to take part in ESP experiments. Ryzl had been hypnotizing subjects in the hope of facilitating psychic abilities, employing a methodology that aimed to encourage consistent results.[2](#)

In terms of personality, Stepanek was said to be friendly, conscientious and intelligent. He also exhibited high levels of anxiety. According to [J. Gaither Pratt](#), an American parapsychologist, his life was governed by a need to avoid social complications and personal dangers, for instance refusing to travel by air and preferring to avoid cars.[3](#)

Stepanek was included in the 1970 *Guinness Book of World Records* for his success as an ESP subject.[4](#)

## Tests

A detailed chronological description of key experiments with Stepanek is given in a 1973 monograph by Pratt.[5](#) A full overview from a critical perspective is given by [Martin Gardner](#).[6](#)

### Early Experiments From 1962

In their initial meetings, Ryzl attempted by means of hypnosis to train Stepanik in ESP performance. The first published experiment was carried out by Ryzl and Ryzl's wife Jirina Ryzlova in 1962.[7](#) Stepanek was presented with cards concealed in opaque envelopes and was able to determine which side was facing up significantly more often than the 50% chance mean.

The cards, coloured black on one side and white on the other, and measuring five inches by three inches, were placed inside larger opaque envelopes made of cardboard and sealed with staples at the sides and paper clips at the two ends. The experiment was double blind, meaning neither experimenter knew which side faced up, and Stepanek was unable to either see or handle each envelope, which was placed on a sheet of cardboard laid across his knees. In 2,000 trials Stepanek scored 1,144 hits where 1,000 would have been expected by chance (57%), a highly significant result.

For the second test, Stepanek was trained to put himself into a light trance and was permitted first to handle the envelopes, then to take them home with him. To guard against cheating, the envelopes were more thoroughly sealed with staples and tape, and as a further precaution also contained strips of unused photographic film, which were later checked and found not to have been exposed to light. Half of the trials were carried out in the presence of Ryzl, the other half by Stepanek alone in his own home. Ryzl wrote:

In those trials carried out with the experimenter present, the subject was allowed to take in his hands the packet he was calling, but there was no possible visual cue nor any other kind of sensory guidance that he could use to detect the color of the top side of the card inside. Moreover, it was obvious to the experimenter that the subject never tried to use either touch or sight. In making his call, he held the packet between his outstretched fingers so that at the most only one square centimeter of the extreme edge of the border was in contact with his fingers. During this time, the packet he was calling was always visible to the experimenter.[8](#)

Here, Ryzl adopted a 'majority vote' approach, in which Stepanek was exposed to the same set of packets in succeeding trials, and correct or incorrect calls were based on the amalgamated responses. The scores of trials carried out with Ryzl were again highly significant, those conducted in his home only slightly so.

Hypnosis was only employed in this first series. In subsequent experiments, Stepanek did not need to go into a hypnotic state to demonstrate ESP.[9](#)

In experiments carried out by Ryzl in collaboration with Pratt and reported in 1962, the hidden cards procedure was again used with success, although the results were somewhat less significant than when Stepanek had worked alone with Ryzl.[10](#)

The next published experiment was with Ryzl alone, testing to see whether the positions of the cards inside the envelopes could be determined with certainty by means of a large number of calls, which again would be added up for a 'majority vote' to determine each card position. For this experiment, the cards were individually marked and numerically coded in such a way that correct calls would tally with a three-digit target number. Five independent series were carried out and in each case a three-digit number was successfully identified without a single mistake,[11](#) indicating that in the majority of trials each card had been called correctly.

Pratt then returned to Prague for a replication of his and Ryzl's first collaborative experiment. On this occasion Stepanek again attained a highly significant score ( $p = 10^{-8}$ ).[12](#)

## **Focusing Effect**

Because records were being kept of Stepanek's performance on each individual card, a new phenomenon had come to light, which the experimenters called a 'focusing effect', a tendency for Stepanek to show a high level of ESP hitting on certain envelopes, a striking level of below-chance scoring on other envelopes and consistent chance-level scoring on the remainder.

The next experiment, carried out by Ryzl and Pratt and published in 1963, explored this effect, introducing new controls. Twenty cards were placed in envelopes in a way that neither experimenter could know their position. The envelopes were then randomized and themselves concealed within opaque covers which were kept sealed. Five thousand trials were carried out.[13](#) It was found that the effect persisted even when the envelopes were placed in different covers or the position of the card within the envelope was altered. Focusing effects also happened with newly-introduced envelopes and cards.[14](#)

In April 1963, three visiting Dutch scientists were invited by Ryzl to test Stepanek, performing 2,048 trials on which his score was highly significant ( $p = 10^{-15}$ ).[15](#)

Pratt returned to Prague for further experiments, in which the protocol was reinforced with the use of thicker envelopes to guard against temperature clues. Circumstances required that the experiments be carried out in surroundings unfamiliar to Stepanek. Initially, Stepanek performed only at chance level, but began succeeding two days before the arrival of a colleague of Pratt, JG Blom.[16](#) Highly significant results were obtained by the two experimenters repeating these tests.[17](#)

In summer 1964 [John Beloff](#), a British philosopher and parapsychologist, visited Prague to do an experiment with Ryzl, preparing targets prior to his departure from Edinburgh. Stepanek attained only chance results with these, and negative results with his regular targets, his only statistically-significant demonstration of [psi-missing](#).[18](#) It seemed Stepanek had lost his stability in performance; however, in the next two experiments it returned,[19](#) only to disappear again, resulting in a hiatus of more than a year.

When Pratt visited Prague again for the next experiment, significant results on the cards were attained. However, the results with respect to envelopes were marred by the fact that the same cover/envelope combinations were used, making it possible for the focusing effect to be accomplished by normal sensory means.[20](#)

Experiments carried out in November 1966 failed to show evidence of ESP. This time Stepanek's response to visible covers was also recorded, and this now revealed a bias towards particular covers, raising the question of whether this was a sensory imitation of his earlier successful ESP performance or a new phase of ESP.[21](#)

## Experiments in the US and Czechoslovakia

A new opportunity for testing opened up when Stepanek received Czech government permission to visit the United States in 1967. Initial testing by Pratt alone was disappointing.<sup>22</sup> However, the next series of experiments, carried out by Pratt and [William Roll](#), showed that Stepanek was now focusing on the covers, even when these were concealed within opaque manila envelopes (jackets).<sup>23</sup> Roll and Pratt carried out yet another experiment to compare Stepanek's accuracy on the typical white and green cards.<sup>24</sup> versus pieces of aluminum foil with one side coloured gold. He achieved significant success with the cards but not with the aluminum, which the experimenters speculated could be due to psychological factors.<sup>25</sup>

Pratt performed the next experiment in Prague with three other researchers, completely randomizing all four elements of the targets (cards, envelopes, covers and jackets) before each run. This produced highly significant results with regard to covers only.<sup>26</sup> The effect was sustained in a second published experiment in Prague involved alternating targets.<sup>27</sup>

In 1968, Stepanek again visited the University of Virginia in America, carrying out experiments with Pratt and Jürgen Keil. Four target objects on which strong focusing effects had occurred, two tending to produce white calls and two green, were used, with additional precautions against sensory cues, such as equalizing the weights of all targets. Results suggested that Stepanek had associated certain covers with green or white on a sensory basis, which he then continued with ESP when the covers were concealed.<sup>28</sup>

A second experiment dealt with a new focusing effect on the jackets, which were eventually concealed inside Jiffy book-mailing envelopes. As before, Stepanek focused on the second outermost layer of container.<sup>29</sup> A third experiment brought in [Ian Stevenson](#), whose main role was to take the point of view of the subject and ascertain that no hidden target was actually visible. Overall results were highly significant ( $p < 10^{-15}$ ).<sup>30</sup>

## Nature Article

Seven researchers who had worked with Stepanek published a brief report of their findings in the prestigious journal *Nature* in 1968,<sup>31</sup> causing a storm of reaction and correspondence in the journal that lasted for more than a year.<sup>32</sup> (See below, Criticism.)

## Final Experiments

In the following four years, the transfer of sensory focusing effects from the outermost container to extrasensory when it was covered seemed mostly to stop happening, which Pratt attributed either to psychological factors or Stepanek's ESP taking a route not detected by experimenters.<sup>33</sup> Nevertheless, there were some clearly significant results, such as when Pratt and parapsychologist Champe Ransom decided to take Stepanek back to the original protocol, concealing

white/green cards in small Jiffy envelopes. This produced significant results.[34](#) These tests were replicated four months later by Pratt and Keil.[35](#)

In 1990, following a seventeen-year hiatus, four researchers returned to test Stepanek but he performed at chance levels, having apparently lost his ESP ability.[36](#)

## Criticism

Sceptical critics reacted strongly to the publicity given to experiments with Stepanek. Their critiques were in turn addressed by parapsychologists.

### CEM Hansel

CEM Hansel, a psychology professor at the University of Swansea, included a brief critique of early work with Stepanek in his 1966 book *ESP: A Scientific Evaluation*, in which he derided Stepanek's 'act (for it can hardly be called more than that)'. He wrote: 'Since Stepanek handles the envelopes, it is likely that he utilizes cues due to bending or warping of the cards'.[37](#)

Pratt reproduced the critique in his 1973 monograph, claiming that Hansel 'made at least nine seriously misleading or erroneous statements'. He corrects Hansel's description of the procedure and points out that his statements ignore 'significant series in which PS neither saw nor touched the objects' and also 'conditions used to control explicitly against bent or warped cards'. He adds:

The testing was not the casual affair that Hansel implies, but was carefully planned and carried out by experimenters who had full control over the materials and the conditions for excluding sensory cues.[38](#)

Following the 1968 publication of the article by Pratt et al in *Nature*, Hansel published a brief rebuttal in the same journal, in which he argued that insufficient precautions were taken to prevent Stepanek from gaining knowledge of the cards' position by visual, tactile or olfactory means. Here, he further implied that Stepanek used one or more of these methods by noting that Stepanek was unsuccessful when the targets were enclosed in rigid boxes. Where Stepanek could not have obtained a view of the contents, Hansel argued, he could have acquired it from the experimenters, suggesting that Stepanek's scoring rates fell as the security was tightened.[39](#)

In his 1973 monograph, Pratt commented that the 'supposed weaknesses in the experimental procedure' described by critics were explicitly ruled out in the full reports, which he suggested the critics had not read.[40](#)

### Martin Gardner

Paranormal sceptic [Martin Gardner](#) published a book about the case, *How Not To Test A Psychic: 10 Years of Remarkable Experiments with Renowned Clairvoyant Pavel Stepanek* (1989). He collected every published report along with some unpublished ones and proposed a normal explanation for every successful test.

Gardner characterized the planning and execution of the experiments as 'careless' and criticized the investigators' failure to seek the advice of a magician as a precaution against cheating. He speculated that the focusing effect could have come about if lax controls enabled Stepanek to peek inside the envelopes at the cards or inner envelopes by sleight of hand; to identify the colour of the cards he might have gained information from the feedback at the end of a run, observed the randomization of the packets or simply peeked at the cards when the investigators' attention was engaged elsewhere. He argues that when proper controls were put in place, for instance when the envelopes were concealed inside wooden boxes, Stepanek's ability disappeared, suggesting that his methods had thus been foiled.

Stepanek, he suggests, was motivated by a desire for money and fame: he was paid a generous hourly wage which supplemented his otherwise meagre income and showed enthusiasm at the publicity given to him in the *Guinness Book of Records*.

Gardner's book was reviewed by parapsychologists including John Beloff and Jürgen Keil, both of whom had experimented with Stepanek.

### **John Beloff**

Parapsychologist [John Beloff](#) praised the level of dedication shown by Gardner, unusual among critics, in taking the trouble to read the research reports. But he doubted Stepanek's ability to insert a finger into the covers, especially when these were large and would have required him to insert his whole hand – an occurrence the experimenters could hardly fail to observe.<sup>41</sup>

Beloff also noted that Stepanek's nervous disposition militated against the kind of long-term deception that Gardner had proposed, observing that 'nothing that is known about Stepanek's personality suggests that psychopathic streak that would be indicated if he were carrying on a dangerous game of deceit during all those years'.<sup>42</sup> He concludes that Gardner's target is not so much Stepanek, whom Gardner praises for fooling parapsychologists, as parapsychologists themselves.

### **Jürgen Keil**

In a detailed rebuttal, Keil criticized the book's tone of 'denigration', stating that its 'whole purpose is to misrepresent a period of careful research'.<sup>43</sup> Citing a report of one of his own experiments,<sup>44</sup> he pointed out that it refutes Gardner's claims. He noted also that Stepanek had a webbed-hand condition which even after surgery made manipulative actions difficult for him.

Keil conceded that the proximity of Stepanek to the target materials made the exclusion of possible sensory clues more difficult than in other test situations, obliging the experimenters to thoroughly describe the conditions. However, he argued that Gardner's characterization of Stepanek as a 'clever performer' is only achieved by falsely representing data in the experimental reports. He suggested that Gardner focused on weaker studies, pointing out that he gave only cursory attention to two experimental reports that Pratt considered to be the best evidence of ESP 'because alternative hypotheses could be rejected with considerable confidence'.<sup>45</sup> He disputed Gardner's claim that the jacket targets concealed in the

Jiffy bags came within half an inch of the opening, which would have enabled Stepanek to surreptitiously open the gap to view it: the gap was actually four inches. He found it 'hard to understand' how Gardner could have believed his own explanation, commenting that for Stepanek 'to poke his finger into the open side, which was always pointing away from him, would have required such an uncommon position of his hand and arm that it would have been immediately obvious to the most casual observer'.[46](#)

## **George Hansen**

In a chapter in his 2001 book *The Trickster and the Paranormal*, George Hansen wrote positively of Gardner as 'the most prolific and influential critic of the paranormal'.[47](#) With regard to Stepanek, he considered that Gardner 'convincingly demonstrated that the investigators did not use sufficiently strict controls and did not understand methods a magician might use to cheat'.[48](#)

On the other hand, Hansen criticized Gardner's grasp of statistics, remarking that throughout the book he showed 'an ignorance and carelessness entirely unexpected from someone who has written so clearly on probability and someone so honored by mathematicians'. Gardner was 'amazingly uninformed about how scientific research is actually conducted, reported, and evaluated', Hansen wrote. He charged Gardner with selectively reporting negative results and falsely passing off significant results as having been close to chance.

For instance, on page 67 of *How Not to Test a Psychic*, Gardner cited a study in which Stepanek achieved 2,636 hits out of 5,000 trials, giving a deviation from chance of 136, but claimed this was very close to chance level. In fact, as the original report stated, the score gives a  $z = 3.85$  with a  $p = .00012$  (2-tailed). This is a very significant result and anyone familiar with these kinds of calculations, even seeing just the raw score, should immediately recognize the outcome to be significant.[49](#)

Hansen concluded that Gardner was out of his depth discussing technical and theoretical issues of parapsychology.

## **Milan Ryzl**

In a letter published in the *Journal of Parapsychology*, Ryzl made similar criticisms as Beloff and Keil, asserting that 'in no experiment was PS [Stepanek] allowed to handle the target materials in the way suggested by Gardner (that by opening the flaps of outer covers with his fingers he could peek and see their contents).'

Ryzl also revealed that Stepanek had received a letter from Gardner urging him to write an article or give an interview disclosing the methods by which he cheated. Gardner promised to help publicize the report, also to produce a documentary film that would make Stepanek at once internationally famous and likely to receive substantial honoraria.[50](#) That Stepanek resisted these inducements testifies to his honesty and integrity, Ryzl maintained.



According to the journal editors, Gardner confirmed the authenticity of the letter but disputed the purpose for which it was sent and threatened to sue if it was reproduced in the journal.[51](#)

KM Wehrstein and Robert McLuhan

## Literature

Beloff, J. (1990). Review of *How Not To Test A Psychic: 10 Years of Remarkable Experiments with Renowned Clairvoyant Pavel Stepanek* by M. Gardner. *Journal of the Society for Psychical Research* 56, 171-75.

Blom, J.G., & Pratt, J.G. (1968). A second confirmatory ESP experiment with Pavel Stepanek as a 'borrowed' subject. *Journal of the American Society for Psychical Research* 62, 8-45.

Gardner, M. (1989). *How Not To Test A Psychic: 10 Years of Remarkable Experiments with Renowned Clairvoyant Pavel Stepanek*. Amherst, New York, USA: Prometheus Books.

Hansel, C.E.M. (1966). *ESP: A Scientific Evaluation*. New York: Scribner's.

Hansel, C.E.M. (1969). ESP: Deficiencies of experimental method. *Nature* 221, 1171-72.

Hansen, G.P. (2001). [Martin Gardner, in \*The Trickster and the Paranormal\*](#). Xlibris US, 291-311.

Kappers, J., Akkerman, A.E., Van der Sijde, P.C., & Bierman, J. (1990). Resuming work with Pavel Stepanek. *Journal of the Society for Psychical Research* 56, 138-47.

Keil, J. (1990). How a skeptic misrepresents the research with Stepanek: A review of Martin Gardner's *How Not To Test A Psychic*. *Journal of Parapsychology* 54, 151-67.

Keil, H.H.J., & Pratt, J.G. (1969). Further ESP tests with Pavel Stepanek in Charlottesville dealing with the focusing effect. *Journal of the American Society for Psychical Research* 63, 253-72.

Pratt, J.G. (1964). Preliminary experiments with a 'borrowed' subject. *Journal of the Society for Psychical Research* 42, 1333-46.

Pratt, J.G. (1967). Further significant ESP results from Pavel Stepanek and findings bearing upon the focusing effect. *Journal of the American Society for Psychical Research* 61, 95-119.

Pratt, J.G. (1968a). Seeking the trail of the focusing effect: I. An exploratory investigation of Pavel Stepanek in Prague. *Journal of the American Society for Psychical Research* 62, 158-70.

Pratt, J.G. (1968b). Seeking the trail of the focusing effect: II. The first stage of ESP research with Pavel Stepanek in Charlottesville. *Journal of the American Society for Psychical Research* 62, 171-89.



Pratt, J.G. (1973). A decade of research with a selected ESP subject: An overview and reappraisal of the work with Pavel Stepanek. *Proceedings of the American Society for Psychical Research* 30, 1-78.

Pratt, J.G., & Blom, J.G. (1964). A confirmatory experiment with a 'borrowed' outstanding ESP subject. *Journal of the Society for Psychical Research* 42, 381-89.

Pratt, J.G., & Jacobson, N. (1969). Prediction of ESP performance on selected focusing effect targets. *Journal of the American Society for Psychical Research* 63, 38-56.

Pratt, J.G., Jacobson, N., Blom, J.G., & Meinsma, G.L. (1969). A transitional period of research on the focusing effect: From confirmation towards explanation. *Journal of the American Society for Psychical Research* 63, 21-37.

Pratt, J.G. & Keil, H.H.J. (1969). The focusing effect as patterned behaviour based on habitual object-word associations: A working hypothesis with supporting evidence. *Journal of the American Society for Psychical Research* 63, 314-37.

Pratt, J.G., & Keil, H.H.J. (1972). Further consideration of the Stepanek focusing effect in the light of recent research findings. *Journal of the American Society for Psychical Research* 64, 345-56.

Pratt, J.G., Keil, H.H.J., & Stevenson, I. (1970). Three-experimenter ESP tests of Pavel Stepanek during his 1968 visit to Charlottesville. *Journal of the American Society for Psychical Research* 64, 18-39.

Pratt, J.G., & Ransom, C. (1972). Extrasensory perception or extraordinary sensory perception? A recent series of experiments with Pavel Stepanek. *Journal of the American Society for Psychical Research* 66, 63-85.

Pratt, J.G., & Roll, W.G. (1968). Confirmation of the focusing effect in further ESP research with Pavel Stepanek in Charlottesville. *Journal of the American Society for Psychical Research* 62, 226-45.

Pratt, J.G., Stevenson, I., Roll, W.G., Blom, J.G., Meinsma, G.L., Keil, H.H.J., & Jacobson, N. (1968). [Identification of concealed randomized objects through acquired response habits of stimulus and word association](#). *Nature* 220, 89-91.

Roll, W.G., & Pratt, J.G. (1968). An ESP test with aluminum targets. *Journal of the American Society for Psychical Research* 62, 381-86.

Ryzl, M. (1966). A model of parapsychological communication. *Journal of Parapsychology* 30, 18-30.

Ryzl, M. (1990). Correspondence. *Journal of Parapsychology* 54, 282-84.

Ryzl, M., & Pratt, J.G. (1962). Confirmation of ESP performance in a hypnotically prepared subject. *Journal of Parapsychology* 26, 237-43.

Ryzl, M., Barendregt, J.T., Barkema, P.R., & Kappers, J. (1965). An ESP experiment in Prague. *Journal of Parapsychology* 27, 161-74.

Ryzl, M., & Beloff, J. (1965). Loss of stability of ESP performance in a high-scoring subject. *Journal of Parapsychology* 29, 1-11.

Ryzl, M., Freeman, J., & Kanthamani, B.K. (1965). A confirmatory ESP test with Stepanek. *Journal of Parapsychology* 29, 89-95.

Ryzl, M., & Otani, S. (1967). An experiment in duplicate calling with Stepanek. *Journal of Parapsychology* 31, 19-28.

Ryzl, M., & Pratt, J.G. (1963a). A further confirmation of stabilized ESP performance in a selected subject. *Journal of Parapsychology* 27, 73-83.

Ryzl, M., & Pratt, J.G. (1963b). A repeated-calling ESP test with sealed cards. *Journal of Parapsychology* 27, 161-74.

Ryzl, M., & Pratt, J.G. (1963c). The focusing of ESP upon particular targets. *Journal of Parapsychology* 27, 227-41.

Ryzl, M., & Ryzlova, J. (1962). A case of high-scoring ESP performance in the hypnotic state. *Journal of Parapsychology* 26, 153-71.

Stanford, R.G., & Pratt, J.G. (1970). Extrasensory elicitation of sensorially acquired response patterns? *Journal of the American Society for Psychical Research* 64, 296-302.

## Endnotes

### Footnotes

- [1.](#) Pratt (1973), 49.
- [2.](#) Ryzl & Ryzlova (1962), 154.
- [3.](#) Pratt (1973), 49-50.
- [4.](#) Pratt (1973), 53.
- [5.](#) Pratt (1973).
- [6.](#) Gardner (1989).
- [7.](#) Ryzl & Ryzlova (1962).
- [8.](#) Ryzl & Ryzlova (1962), 163.
- [9.](#) Ryzl & Pratt (1963c), 227.
- [10.](#) Ryzl & Pratt (1962)
- [11.](#) Ryzl (1966). This is the date of publication; the experiment was conducted in August 1962.
- [12.](#) Ryzl & Pratt (1963a).
- [13.](#) Ryzl & Pratt (1963b).
- [14.](#) Ryzl & Pratt (1963c).
- [15.](#) Ryzl et al. (1965).
- [16.](#) Pratt (1964).
- [17.](#) Pratt & Blom (1964); Blom & Pratt (1968).
- [18.](#) Ryzl & Beloff (1965).
- [19.](#) Ryzl et al. (1965); Ryzl & Otani (1967).
- [20.](#) Pratt (1967). See Pratt (1973), 12-13.

- [21.](#) Pratt (1968a).
- [22.](#) Pratt (1968b).
- [23.](#) Pratt & Roll (1968).
- [24.](#) In this later series of trials, the coloured side of each card was green rather than black.
- [25.](#) Roll & Pratt (1968).
- [26.](#) Pratt et al. (1969).
- [27.](#) Pratt & Jacobson (1969).
- [28.](#) Keil & Pratt (1969).
- [29.](#) Pratt & Keil (1969).
- [30.](#) Pratt, Keil, & Stevenson (1970).
- [31.](#) Pratt et al. (1968).
- [32.](#) Pratt (1973), 61.
- [33.](#) Pratt (1973), 21.
- [34.](#) Pratt & Ransom (1972).
- [35.](#) Pratt & Keil (1972).
- [36.](#) Kappers et al. (1990).
- [37.](#) Hansel (1966).
- [38.](#) Pratt (1973), 60-61.
- [39.](#) Hansel (1969).
- [40.](#) Pratt (1973), 61.
- [41.](#) Beloff (1990).
- [42.](#) Beloff (1990), 173.
- [43.](#) Keil (1990), 151.
- [44.](#) Pratt, Keil, & Stevenson (1970).
- [45.](#) Keil (1990), 153. The studies he referred to are Blom & Pratt (1968) and Pratt, Keil, & Stevenson (1970).
- [46.](#) Keil (1990), 160.
- [47.](#) Hansen (2001), 294.
- [48.](#) Hansen (2001), 296.
- [49.](#) Hansen (2001), 297.
- [50.](#) Ryzl (1990), 284.
- [51.](#) Ryzl (1990), 284, n2.