

Letter to the Editor

Rutherford, the Curies, and Radon

(Received 3 January 2000; accepted for publication 3 January 2000)
[S0094-2405(00)02603-1]

To the Editor,

As a postscript to the two recent articles in *Medical Physics* on the Curies' discovery of radium, and its application to medicine,^{1,2} it is interesting to note that the Curies were also responsible for the discovery of radon-222, the naturally occurring radioactive gas which is of much current interest in terms of background radiation exposure to the general population.^{3,4}

Their discovery followed closely on the insights of Rutherford and Owens in 1899 who, studying the "emanations" from thorium, made the key observation that "the radiation from thorium oxide was not constant, but varied in a most capricious manner" whereas "all the compounds of uranium give out a radiation which is remarkably constant."⁵ For example, if a door was opened, the amount of thorium emanation decreased, and if fresh air was blown across the detector, the thorium emanations decreased. Based on these observations Rutherford concluded that "the emanation ...acts like an ordinary gas," and "the intensity of the radiation has fallen to one half its value after an interval of about one minute."⁶ In modern terminology, Rutherford and Owens had discovered radon in the form of the short-lived isotope radon-220 (half life 51 s).

Later in 1899, Pierre and Marie Curie, studying the emanations from radium, concluded that "elle reste radioactive pendant plusieurs jours" [it stayed radioactive for several days].⁷ The Curies had detected the isotope radon-222 (half life 3.8 days), which is primarily responsible for domestic radon-progeny exposure, though they remained equivocal as to whether this emanation was, in fact, a gas: In 1901 Pierre Curie and Debierne discussed "la formation continue de gaz radio-actifs" [the continual formation of radioactive gas] from radium,⁸ but in Marie Curie's 1903 doctoral thesis she suggested that "we think, M. Curie and I, that the supposition that radium emits a gas is not yet justified."⁹ In fact that

the emanations emitted by radium are a radioactive gas was clearly demonstrated by Rutherford and Brooks in 1901,¹⁰ though they were careful to give credit to the prior observations of the Curies.

It is interesting to note that most standard sources¹¹ on the chemical elements list Ernst Dorn as the discoverer of radon, in 1900. In fact Dorn had basically repeated the Curies' experiment with more active radium compounds.¹²

¹E. L. Saenger and G. D. Adamek, "Marie Curie and nuclear medicine: Closure of a circle," *Med. Phys.* **26**, 1761–1765 (1999).

²R. F. Mould, "Marie and Pierre Curie and radium: History, mystery, and discovery," *Med. Phys.* **26**, 1766–1772 (1999).

³Committee on Health Risks of Exposure to Radon, *Health Risks of Exposure to Radon: BEIR VI* (National Academy, Washington, DC, 1999).

⁴D. J. Brenner, "Radon: Current challenges in cellular radiobiology," *Int. J. Radiat. Biol.* **61**, 3–13 (1992).

⁵E. Rutherford and R. B. Owens, "Thorium and uranium radiation," *Trans. R. Soc. Can.* **2**, 9–12 (1899).

⁶E. Rutherford, "A radioactive substance emitted from thorium compounds," *Philos. Mag.* **549**, 1–14 (1900).

⁷P. Curie and M.-P. Curie, "Sur la radioactivité provoquée par les rayons de Becquerel," *Compt. Rend.* **129**, 714–716 (1899).

⁸P. Curie and A. Debierne, "Sur la radio-activité induite et les gaz activés par le radium," *Compt. Rend.* **132**, 768–770 (1901).

⁹M. Curie, "Recherches sur les substances radioactives," *Chem. News* **88**, 85–178 (1903).

¹⁰E. Rutherford and H. T. Brooks, "The new gas from radium," *Trans. R. Soc. Can.* **7**, 21–25 (1901).

¹¹*Handbook of Chemistry and Physics*, 79th ed., edited by D. R. Lide, Jr. (CRC, Cleveland, OH, 1998).

¹²E. Dorn, "Versuche über sekundärstrahlen und radiumstrahlen," *Abh. Naturf. Ges. Halle* **22**, 37–43 (1900).

David J. Brenner
Center for Radiological Research,
Columbia University,
630 West 168th Street,
New York, New York 10032
Electronic mail: djb3@columbia.edu