

## **The Ugly and the Beautiful: The use of the $^{14}\text{C}$ bomb peak to measure the age of human cells**

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During the Cold War of the 1950s and 1960s, the USA and the Soviet Union performed atmospheric nuclear weapons testing of ever increasing power and intensity. When it became clear that by this action the whole world would be contaminated with life-threatening radioactive fallout, the Nuclear Test Ban Treaty of 1963 was signed by the USA, Soviet Union and Great Britain, essentially stopping atmospheric nuclear weapons testing. By this time, the intense neutron flux from the hydrogen bomb tests had produced some excess  $^{14}\text{C}$  on top of the natural  $^{14}\text{C}$  in atmospheric  $\text{CO}_2$ , creating a unique isotope label of carbon at a known point in time. Since atmospheric  $\text{CO}_2$  exchanges continuously with the biosphere and the hydrosphere, the  $^{14}\text{C}$  excess was transferred to every material which participated in this exchange. As a result, all human beings who lived between 1950 and 2000 were labeled with  $^{14}\text{C}$  from this “bomb peak”.

This unique signal of all living matter on Earth can be used for a variety of applications ranging from forensic medicine to basic research in molecular biology. Among these applications, perhaps the most interesting one is the possibility to study the birth date of cells in the human body. It allowed for the first time to retrospectively (i.e. after the death of an individual) to reconstruct the time distribution of cells in the body from measurements of  $^{14}\text{C}/^{12}\text{C}$  ratios in DNA extracted from human cells [1].

The current presentation will describe the use of the  $^{14}\text{C}$  bomb peak to learn more about the human brain and other important cells in humans, and will also mention connections to forensic studies of various kinds [2,3].

- [1] K.L. Spalding et al., Retrospective birth dating of cells in humans, *Cell***122** (2005) 133-143.
- [2] D. Grimm, The mushrooms cloud’s silver lining, *Science***321** (2008) 1434-1437.
- [3] E.M. Wild and W. Kutschera, Altersbestimmung dank Atomtests, *Spektrum der Wissenschaft* (März 2016) 62-65 (in German).