



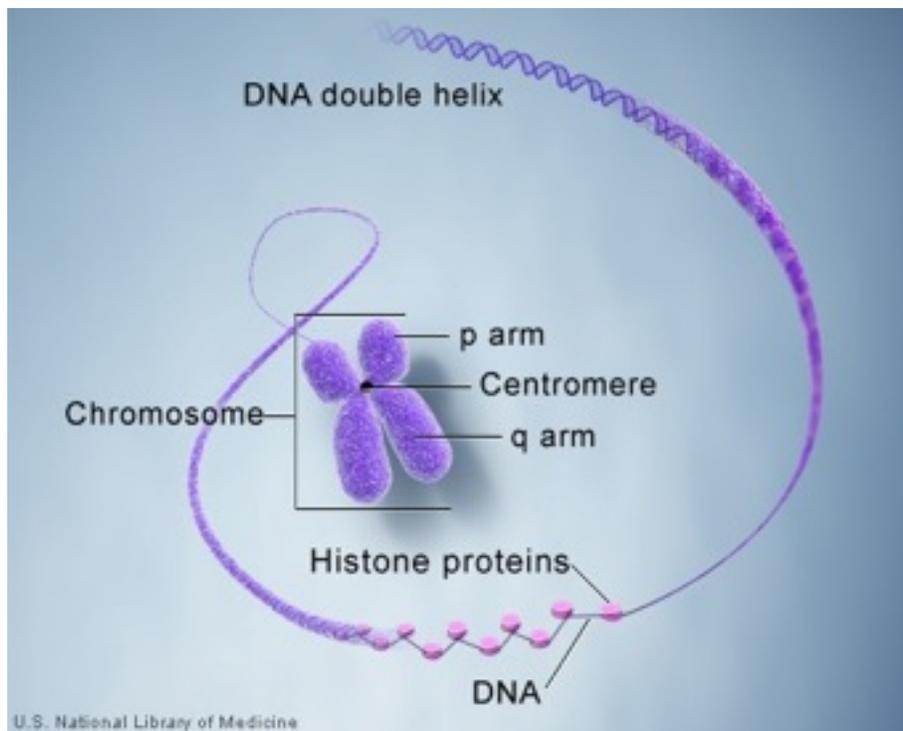
BEYOND NUCLEAR BACKGROUNDER

The X and Why of radiation damage

Lessons from TMI

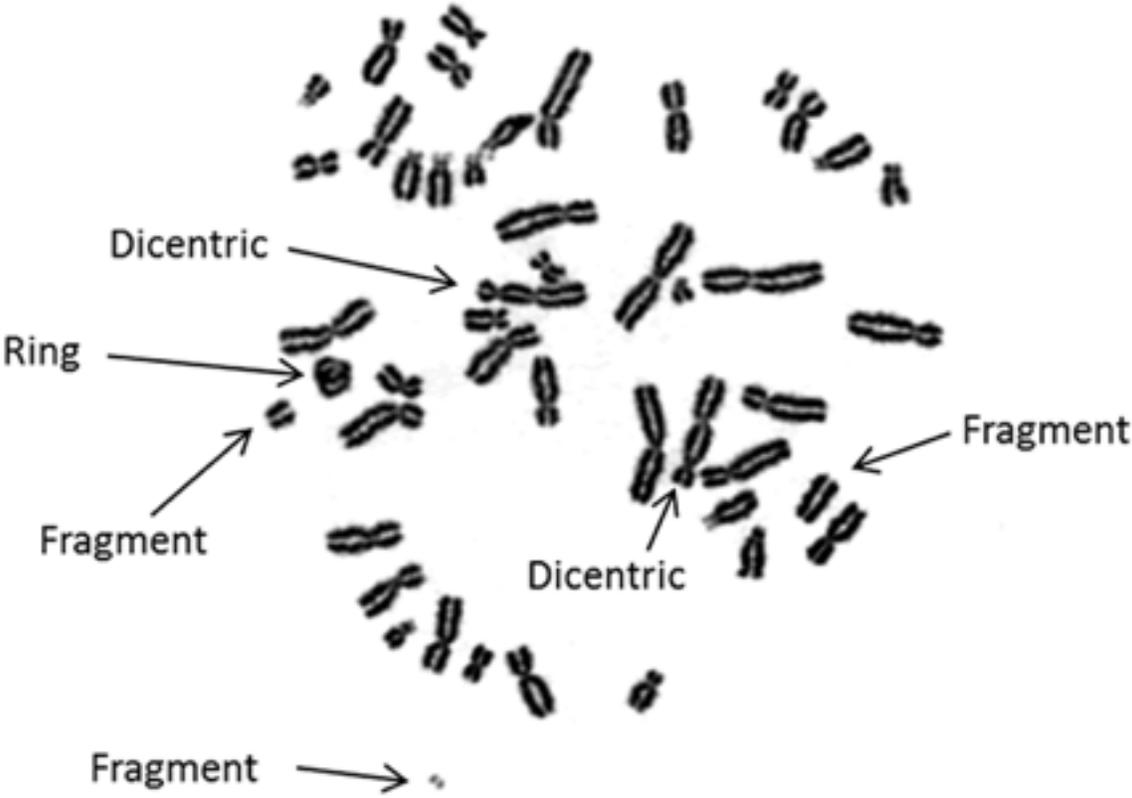
March 7, 2014

Chromosomes are formed from coiled DNA. Below is a graphic of a healthy chromosome. It looks much like an “x” with one central construction point or centromere:

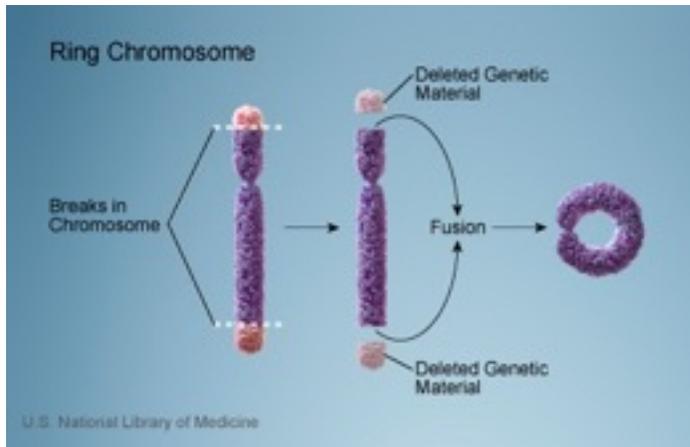


Having more than one centromere per chromosome (dicentric), or a centromere that is not functioning properly, will jeopardize proper cell division, possibly leading to disease-causing mutations.

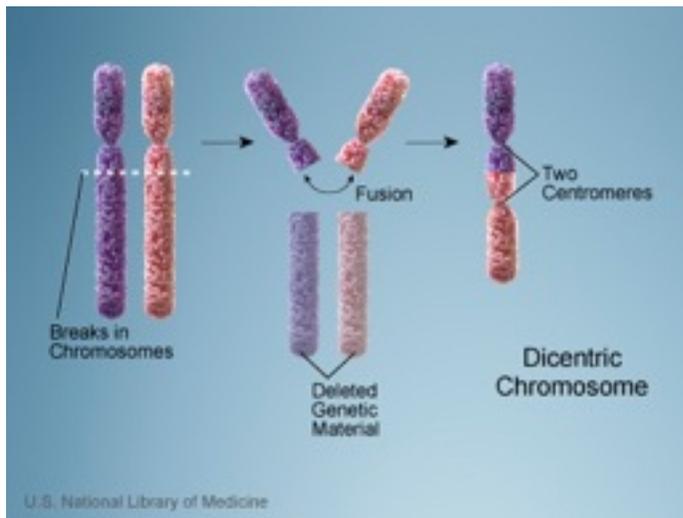
The arrows in this picture indicate chromosome malformations evident after radiation exposure. Note that some have two construction points (labeled dicentric), or in the case of the ring, one (improperly functioning) or no construction points.



Here are graphic representations of how radiation can cause these two types of chromosome mutations, by causing a break in chromosomes that then reforms incorrectly with other broken pieces.



Radiation can also cause centric or ring formations. These formations also occur naturally but are more rare than dicentric.



Dicentric chromosomes are a very good indicator of how much radiation a person has been exposed to, in some cases even for the dose ranges of interest in environmental epidemiology (low-dose, longer-term) exposures. This is because the formation of DC is highly specific to ionizing radiation, only occurring at a small [background frequency](#) of approximately 1 per 2,000 cells.

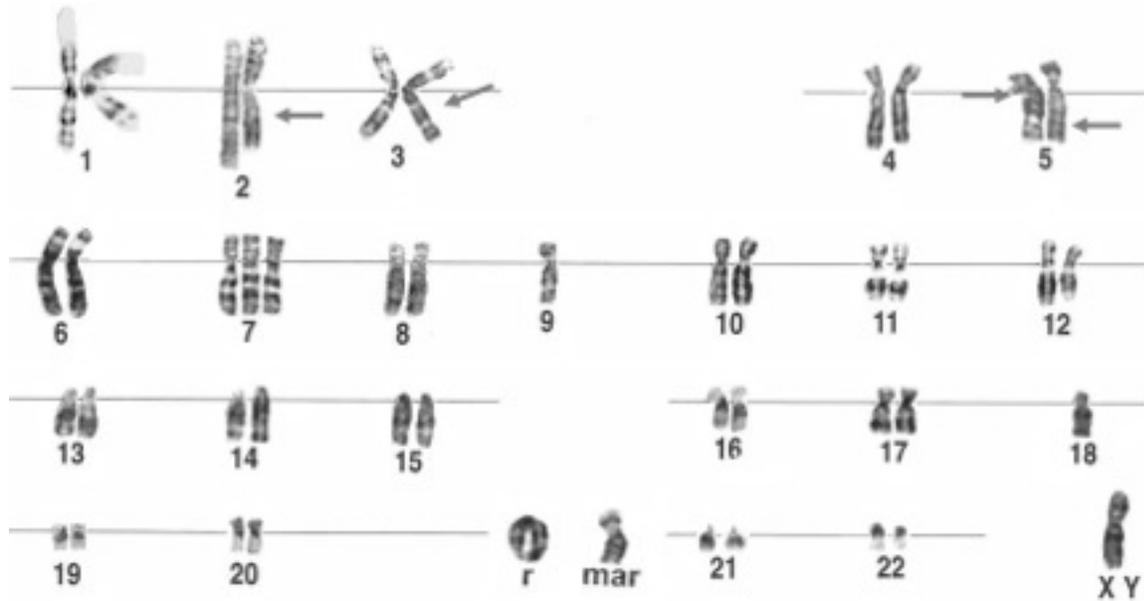
www.ncbi.nlm.nih.gov/pubmed/7453710

Both of these [malformations](#) indicate a loss of DNA that could result in disease later. Radiation workers (Mozdarani, 2002) often have higher incidence of these chromosome aberrations as do people who have or are at greater risk for cancer; and [cancer cells](#) often contain these abnormalities as do cells from people who suffer other maladies.

ghr.nlm.nih.gov/handbook/mutationsanddisorders/structuralchanges

www.ncbi.nlm.nih.gov/pubmed/23793898

Here is a picture of a human bladder cancer cell chromosome map (called a karyotype) featuring a ring chromosome, labeled with "r":



Labeled "c" below, is a partial karyotype of a human bone cancer cell, showing two dicentric:
([full image and reference](#))

www.springerimages.com/Images/MedicineAndPublicHealth/1-10.1007_s00428-005-0079-z-2



[Red arrows point to a dicentric malformation in a 33 year old suffering from premature ovarian failure.](#)

www.hindawi.com/crim/genetics/2013/573841/

