

Media Release:

Cannabis **Causes** Cancer, Major Congenital Abnormalities and Inheritable Defects including Cancers in Babies and Children.

<http://www.sciencedirect.com/science/article/pii/S0027510716300574>

By showing that genetic mechanisms exist to account for previously observed elevated rates of cancers in people exposed to cannabis and major congenital abnormalities in their offspring, UWA researchers were able to show that the previously described statistical associations in many studies were in fact **causal** in nature. As long ago as 1965 scientists defined the criteria which would need to be met to imply that a particular statistical association would be causal in nature. With regard to cannabis the most difficult of these has been the identification of a molecular and genetic mechanism which would account for the surprising and diverse findings.

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Cannabis has been linked epidemiologically with ten cancers in adulthood including the mouth and throat, larynx, lung, leukaemia, brain, prostate, cervix, testes and bladder. Cancer development in cannabis-exposed people has often been reported to occur at younger ages, and to be very aggressive and rapidly lethal. Indeed similar observations are also true of addictions to other drugs including alcohol, tobacco, opioids and benzodiazepines. It apparently implied a diffuse action at the cellular level rather than any organ-specific toxicity.

Similarly a wide variety of congenital abnormalities has been described in many studies studying foetal abnormalities in babies born to cannabis-exposed mothers. These included cleft lip and palate, spina bifida and encephalocoele, absent and shrunken ears and eyes, microcephaly, major heart defects of many kinds, abnormalities of the fingers, major defects of the abdominal wall so that babies are born with their bowels hanging out, and shortened arms, known as phocomelia. The great diversity of tissues affected by these changes again implied toxic effects occurring at the cellular level rather than tissue-specific actions.

Perhaps worst of all very high rates of cancers have been reported in the first few years of life in children exposed *in utero* to cannabis through their mother's use. These include major childhood leukaemia, and nerve cell and muscle cell cancers. Such children experience inheritable teratogenicity and cancerogenicity.

Chromothripsis, or chromosomal shattering, was recently shown to occur when chromosomes fall off the cellular framework of cell division, known as the "mitotic

spindle", become isolated in micronuclei, become shattered by the normal process of gene duplication and transcription, and then get re-joined in a haphazard or higgledy-piggledy way.

Epigenetics refers to the information encoded in the genome but not in the genetic code *per se*. This happens through the addition of one-carbon methyl groups to various DNA bases; by changes to the histone proteins around which the DNA helix is wound; and through various short and long non-protein coding information-only RNA strands which read information back to the DNA-proper and control the flow of information from the main gene sequence. Cannabis changes all three. Since cannabis and other drugs of addiction cause both chromothriptic and epigenetic changes, this implies that there are therefore not one but two genotoxic mechanisms to explain the previously confusing findings relating to cancer and congenital abnormalities, some of which are inheritable.

UWA researchers were therefore able to show that, together with previously published work, all the criteria for cannabis *causing* these major defects had been fulfilled.

This dramatic finding is of major importance with cannabis use increasing in many nations around the world, and Australia apparently set to follow a similar erroneous trajectory. This finding has major public health importance, and is also important to authorities internationally charged with regulating drug use and protecting vulnerable populations. It also carries major implications for cancer researchers, addiction medicine professionals, psychiatrists, psychologists, counsellors, educators, employers, child care workers and parents.

See :

Reece A.S., Hulse G.K. *"Chromothripsis and Epigenomics Complete Causality Criteria for Cannabis- and Addiction- Connected Carcinogenicity, Congenital Toxicity and Heritable Genotoxicity."*

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