*The Impact of Prenatal Exposure to Marihuana and Cigarettes on Cognitive Development from Birth to Young Adulthood

- OR
  - Are there Joint and/or Cognizant Effects on the Prefrontal Lobes?

Plus legal status of Marihuana
*Plant

Female is more potent especially the flowering or bud portion.

Both leaves and buds can be smoked.

Male plants do not produce buds - which is what most people are after these days. So they are weaker generally in THC but they will still get you stoned.
The plant

- Cannabis preparations are usually obtained from the female *Cannabis sativa* plant.
- The plant contains at least 750 chemicals and some 104 different cannabinoids.
- The principal cannabinoids in the cannabis plant include delta-9-tetrahydrocannabinol (THC), cannabidiol (CBD), and cannabinol (CBN).
- THC is the primary psychoactive compound, with CBD, a non-psychoactive compound, ranking as the second cannabinoid.
- Generally, THC is found at higher concentrations than CBD.
The plant’s chemistry*

- The cannabinoid that is primarily responsible for the psychoactive effects sought by cannabis users is THC.
- THC is found in a resin that covers the flowering tops and upper leaves of the female plant.
- Most of the other cannabinoids are either inactive or only weakly active, although some, such as CBD, may modify the psychoactive effects of THC.
- The most common cannabis preparations are marijuana, hashish and hash oil.
- Marijuana is an herbal form of cannabis prepared from the dried flowering tops and leaves of the plant.
- Its potency depends on the growing conditions, the genetic characteristics of the plant, the ratio of THC to other cannabinoids, and the part of the plant that is used.
- Cannabis plants may be grown to maximize their THC production by the “sinsemilla” method by which only female plants are grown together.
What happens when you smoke up

• When a person smokes up a number of chemicals enter the brain including tetrahydrocannabinoi (THC) thought to be the major psychoactive ingredient in marijuana.

• THC latches on to a protein in the brain called cannabinoid receptor type 1, or CB1.

• These receptors are sprinkled liberally throughout the brain but in rather specific regions.
Sites of Cannabis Receptors*

- CB1 receptor in parts of the brain to do with movement (basal ganglia; cerebellum)
- Learning, memory (hippocampus)
- Higher cognitive functions (cerebral cortex especially frontal lobes)
- Reward Center (Nucleus accumbens)
- Emotional responses (amygdala)
- CB2 receptors outside the brain to do with immune system (spleen)
Observations in OPPS Neonates and Infants born to Cigarette smokers*

<table>
<thead>
<tr>
<th>Cigarette Neonatal Effects</th>
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<tbody>
<tr>
<td>✤ <strong>State Regulation</strong></td>
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<tr>
<td>✦ Increased tremors (at 4 days)</td>
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<tr>
<td>✤ <strong>CNS 'excitation'</strong></td>
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<tr>
<td>✦ hypertonicity (at 9 &amp; 30 days)</td>
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<tr>
<td>✦ heightened reflexes (at 9 &amp; 30 days)</td>
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<tr>
<td>✤ <strong>Behaviour</strong></td>
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<tr>
<td>✦ Auditory Effects</td>
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<tr>
<td>✤ decreased responsiveness</td>
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<tr>
<td>✤ decreased rate of habituation</td>
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<tr>
<td>✤ <strong>Growth</strong></td>
</tr>
<tr>
<td>✦ reduced weight &amp; head circumference</td>
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<tr>
<td>✦ catch up by 3 years</td>
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<tr>
<td>✤ <strong>Nursing</strong></td>
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<tr>
<td>✦ less likely to breast feed</td>
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<td>✦ wean sooner</td>
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Summary of Cigarette Findings
0-4 years of age*

• **Newborn** - auditory responsiveness & habituation; tremors & motoric reflexes

• **1 year** - MDI (96 vrs 110) & verbal cluster.

• **2 years** - MDI (106 vrs 119) & Reynell Expressive & Comprehensive. Significance lost when confounds controlled.

• **3 years** - GCI & language after confounds controlled.

• **4 years** - GCI & language after confounds controlled
Prenatal Marihuana
Summary Up To Preschool*

• Course of pregnancy, fetal and postnatal growth and behavior are relatively unaffected during neonatal and toddler stages

• Starting at approximately 3 years of age converging findings (from the OPPS and two other cohorts) suggest that

• 1/overall IQ is not affected but

• 2/abstract/visual reasoning subscales on IQ tests are negatively impacted

• 3/ as are facets of attention.

• Together, this suggests an impact on aspects of Executive Function - this will be elaborated in a moment.
Overall Summary*

• There appears to be a double-disassociation between the impact of the two drugs.

• Prenatal cigarettes have shown a continuity over the life-span with an impact on a number of domains contributing to overall IQ, verbal/auditory functioning and impulsivity.

• Prenatal marihuana impacts upon particular aspects of executive functioning - complex visuoperceptual problem solving and sustained attention.
Interpretation of Cigarette Findings-13-16yr olds*

- IQ deficits consistent with earlier findings
- Vulnerability of verbal memory also consistent with findings at younger ages
- Why achievement tests not significantly related while IQ is after statistical adjustment?
  - Possibly reflecting formal learning versus application of learning in new and different situations. Parental Education was major confounder
Marihuana Findings in 13-16 yr olds*

- Like in this & other cohorts at younger ages, IQ not related to prenatal marihuana exposure.

- Complex visual behaviour impacted (Peabody spelling versus WRAT spelling); longer latency [but not increased errors] on abstract design.

- In a complex mirror motor tracing task where both carefulness and speed emphasized, prenatally heavily exposed offspring did not differ from controls in precision but were significantly slower.

- Longer latencies (but not increased errors) also noted in visual search tasks in other cohorts.
Adolescence & Use*

• Thus using marihuana— the fancy term is Exogenous cannabis— during adolescence affects the function of the endocannabinoids in their role of neurogenesis at a critical stage of brain development.

• The teenage brain is still growing and refining its neural connections — as we said - a process that’s regulated in part by the brain’s natural endocannabinoid system.
What is Federally legal as of October 17, 2018*

• Subject to provincial or territorial restrictions, adults who are 18 years of age or older are legally able to:
  • possess up to 30 grams (one ounce) of legal cannabis, dried or equivalent in non-dried form in public
Objectives of the Marihuana legislation in Canada*

• The Government of Canada believes that the new regime for legal access to marijuana must achieve the following objectives:
  • Protect young Canadians by keeping marijuana out of the hands of children and youth.
  • Keep profits out of the hands of criminals, particularly organized crime.
  • Reduce the burdens on police and the justice system associated with simple possession of marijuana offences.
  • Prevent Canadians from entering the criminal justice system and receiving criminal records for simple marijuana possession offences.
Objectives of the Marihuana legislation*

• When considering how best to minimize harms associated with marijuana use, it is helpful to consider the two different approaches taken in controlling tobacco and alcohol use.

• In the case of tobacco, the overall objective is to reduce or even eliminate use for all Canadians.

• In contrast, the overall objective with respect to alcohol is to promote responsible use amongst adults, and to prohibit use amongst youth.

• These objectives are achieved largely through actions such as setting a minimum age for purchase, educational tools aimed at promoting responsible use, and taxation measures.