Medical and Recreational Uses of Morphine

Molecules, whether organic or inorganic, have always played an important role within our society and culture. Naturally made products have proven to be able to provide several uses many of which have the properties to treat an ailment of the body or alter the way in which our body works such as allergy relief medications, sleeping aids, and pain killers. Morphine is one of the molecules that have impacted the world as its main use is to provide a method of pain relief within the body. It has been known to be widely used in the medicinal field as an analgesic but can also be utilized to create heroin, a highly addictive and less bulky derivative used for recreational drug use. Those that have been found to use heroin repeatedly are at high risk for addictive behaviors and even death by overdose. This essay will discuss the importance of morphine to society by emphasizing its medical use and abuse potential.

In 1804, the German pharmacist, Friedrich Sertturner, originally extracted and isolated morphine as it was a naturally occurring product. Morphine is a latex-type compound that can be extracted from opium from the plant, *Papaver somniferum*. This particular compound was one of the first to be isolated from a plant source, which led to research into many additional types of plants that are used in medicines today. In order to remove the opium, one must open up the opium seed thus allowing the liquid form of latex to come out and dehydrate. The opium seed and the exposed latex can be seen below in Figure 1.

![Figure 1. Opium seed and exposed latex](image)

Morphine is mainly used for medical purposes primarily for acute and chronic pain relief. It is one of the most used standards found in the medicinal field specifically utilized for patients with cancer. Some of the main forms of delivery into the body are orally or intravenously while injections into the muscle or directly under the skin are normally for those who may be abusing the drug. Abusers of the drug have a high possibility of overdose, because tolerance to the effects occurs rapidly and the user may administer more than necessary when attempting to achieve their
respective ‘high’. An overdose of morphine has the ability to cause asphyxia, which is a lack of oxygen being supplied to the body. Breathing depression can occur when gas exchange within the body ceases to work and there is a buildup of carbon dioxide in the body. In order to treat an overdose of morphine, the opioid antagonist, Naloxone can be used to reverse the effects that morphine has on the body. Using Naloxone immediately inhibits morphine which causes the body to begin the withdrawal stage.

From morphine, several derivatives and analogs have been created that also have similar effects on the human body. Some of the more well-known derivatives are codeine, hydrocodone, and oxycodone. By looking at the structure of morphine in Figure 2, there are several alterations to this molecule that allows for the derivatives to be just as effective. Some of these alterations include a methylation of one of the hydroxyl functional groups to produce codeine while an additional carbonyl group creates the molecule hydrocodone. Morphine can also be used to create heroin by the addition of two acetyl groups.

![Figure 2. Chemical structure of Morphine](image)

Unfortunately, there are several side effects that can occur when using morphine such as dizziness, diarrhea, constipation, in addition to an upset stomach. One of the more important side effects is the possibility of addiction to morphine or its semi-synthetic derivative, heroin. Tolerance for the use of morphine along with its euphoric and analgesic effects contribute to addictive behaviors. In addition to tolerance, morphine can also cause physical and psychological dependence.

One aspect to the physical dependence side is that the lack of morphine can cause withdrawal when the body begins to metabolize the drug and remove it from the system. Withdrawal begins approximately 6-14 hours after the final dose of morphine has been administered. Initially, a craving for morphine will occur followed by irritability and anxiety while the user then goes into a state of dysphoria. Cramping, hot and cold flashes, loss of appetite and muscle twitches can begin to occur when the user is craving the drug but cannot find a suitable source. The body will have an increase in these effects over time with possible diarrhea and vomiting that can cause severe weight loss in the user. On the psychological side, users continually address their use of the drug which causes them to crave it. Many users will also have issues controlling their thoughts that wander into the use of the drug causing them to eventually cave in and use the drug.
Opioid receptors can be found in many areas of the body such as the spinal cord, brain, and as well as the digestive tract. There are four major subtypes of the G protein-coupled opioid receptors, which are kappa, delta, mu, and the Nociceptin receptor. All of these receptors have different functions within the body that range from euphoria, anxiety, analgesia, and sedation while they can also be found in all areas of the body.

For any receptor within the body, there are agonists and antagonists. An agonist is a type of molecule can bind to a given receptor thus causing the receptor to activate and engage in a biological response. In contrast, an antagonist can bind to the receptor, but inhibit the biological functions. As previously mentioned, Naloxone is commonly used to treat a morphine overdose or addiction. By using Naloxone, the opioid receptor can be blocked, which will prevent the biological responses that would normally occur when an opiate binds to the receptor.

One current study utilizing the effects of morphine is a newer method called morphine infusion. This type of treatment is one that can help those with untreatable, chronic pain for patients with a variety of ailments. Morphine has always been a staple in the medical field as it lays down the baseline for pain treatment; however, in 2009, a new study using morphine was begun to determine the effects of intrathecal treatment. [2] Initially, the research behind this treatment developed when opioid receptors were found within the intrathecal space in the body that allowed for morphine to be deposited within this particular area. Research has shown that the addition of morphine assists the body in pain management without affected the major sensory and motor functions that are normally impaired when morphine is introduced to the body.

Overall, morphine has been a widely utilized molecule that is considered the best standard regarding analgesic compounds that reduce the effects of pain in the body. It is one of the first-ever extracted molecules from a plant and can be used to derive several compounds with similar levels of usefulness. Like many analgesics, it is a highly addictive substance that can lead to overdose and death if administration goes untreated. Fortunately, research continues on the molecule that allows for even more uses and specificity to be determined for morphine.

References