

BIOLOGICAL TESTS IN WOMEN'S SPORTS

Soleen Soran | September 9, 2024



PARIS 2024



Executive Summary

Biological Tests in Women's Sports: Women's sports use biological tests, also known as sex (gender) tests, to prevent men from participating in women's competitions and to ensure fairness for all. However, these tests, exclusively imposed on women, fail to accurately identify unfair genetic advantages and discriminate against a specific group of women with specific genetic backgrounds. This paper focuses on the history of biological and sex tests, eligibility criteria set by different sports federations, the role of social media in the spread of misinformation, and recommendations on how to create better eligibility criteria for a more fair and safe space for every woman to compete. The case of Imane Khelif, a boxer who was the subject of criticism and scrutiny about her gender over unsubstantiated claims, is used as an example of the issues female athletes face in competitive sports.

Introduction

In the world of professional sports, male and female athletes are separated into different categories for the same sport to make the competitions fair for all participants. Since the Paris 1900 Olympic¹, the introduction of sex verification tests for female athletes has been made mandatory to ensure that no male athlete can participate in a women's competition. The legitimacy and effectiveness of these tests, intended to ensure fair competition, have been the subject of extensive discussions among athletes and sports professionals.

The recent case of Imane Khelif sparked discourse on the validity of these tests. Khelif, who gained widespread attention after beating her Italian opponent, Angela Carini, in just 46 seconds during the 2024 Paris Olympics, faced intense scrutiny for her disqualification from a previous boxing competition over an unspecified sex test that claimed she had a genetic

advantage. Despite competing in women's boxing her entire life, Khelif was targeted by the media and questioned about her gender.²

This incident has opened discussions surrounding the necessary requirements for female athletes to participate in women's sports, the ambiguous guidelines set by sports committees for eligibility requirements, the ethical implications of these sex affirming tests, and the dangers of misinformation. This paper sheds light on the history of women in sports and the validity of the biological tests they go through.



Imane Khelif a Professional Algerian Boxer. Credit: Getty Images

History of Women in Sports

In high risk, competitive sport competitions men and women are separated to ensure safety and fairness of the games. There was reluctance in allowing women to compete in elite competitions as there were beliefs that women's bodies could not take on the extremities of such activities. As soon as women were allowed to have their own games, questions about the

true gender of women participating in the games came to question, which is why gender confirmation tests were introduced.

The first time a woman had to go through a gender confirmation test was in 1928 when Kinue Hitomi, a track and field athlete, was reportedly taken aside after her win to be “examined” to confirm her womanhood. In the 1980s Martina Navratilova, a tennis player, was constantly ridiculed for looking masculine and public opinion was that she was not suitable to play in women’s sports. More recently, Serena Williams, widely regarded as one of the best tennis players of all time, was met with accusations that she was a man during her professional career.³



Serena Williams, a Professional American Tennis Player. Credit: Getty Images

Even though it was proven that these athletes were indeed women and eligible to compete in women's sports, they still faced criticism and accusations for the entirety of their careers. This shows, if a woman doesn't conform to the definition of a feminine woman, she gets accused of not being a woman.

Timeline of the Tests⁴

1966

At the Commonwealth Games in Jamaica, a body examination test was enforced on all the female athletes that was described as "being groped" by one of the participating athletes.

At a competition in Winnipeg, a track athlete reported being disqualified for failing the test as she was told she was "not big enough up there". These tests were highly disliked by the athletes and were petitioned to be removed or changed for their intrusiveness and inefficacy for many years to come.

The IAAF adapted to a chromosome and testosterone examination. participate in the games.

1940

The International Amateur Athletic Federation (IAAF) officially began a "femininity check", which required athletes to produce a certificate confirming their female gender status to be able to participate in the games.

1988

The IAAF substituted the chromosome and testosterone examinations for a health check by a doctor.

1992

IAAF removed all forms of gender examination, arguing such tests were unnecessary when doping tests were also performed.

1999

The IOC also removed their gender tests in favor of doping tests.

2021

The IOC released their revised framework on athlete qualifications. They acknowledged that qualifying factors for women's sports can differ depending on the sport and are now encouraging international sports federation to come up with their own unique rules and regulations while considering the three values of fairness, inclusion, and non-discrimination.

1996

The International Olympic Committee (IOC) initially chose to continue using chromosome tests but had to align their policies with those of the IAAF after the chromosome tests were deemed unreliable during the 1996 Atlanta Games, when eight competitors failed the tests but were later allowed to compete following further examinations.

2000

The 2000 Sydney games were the first elite competitions in three decades where female gender tests were not enforced.

The Biological Determinant of the Female Sex

Genetic sex is determined at conception when a sperm (carrying either a X or Y chromosome) and an egg (carrying an X chromosome) merge together. The resulting embryo ideally has 46 chromosomes the last pair of chromosomes are typically XX for female or XY for male. While this is the usual process, variations can occur, such as having more or fewer chromosomes leading to what is known as Difference in Sexual Development (DSD). During the first four weeks, the embryo's sex is not yet determined. By week five and onwards, undifferentiated gonads develop, setting the stage for the embryo's sex to be determined and further developed over time.⁵

DSD Explained

If there are any deviation from the typical chromosome structure for male and female, we then have a condition called Difference of Sexual Development (DSD). If there are extra chromosomes in the last pair of chromosomes or an abnormal Y chromosome it is considered DSD. This will affect the hormones and the reproductive organs leading to atypical body structure and growth.

DSD can happen over 40 varieties of chromosome abnormalities and it affects 1.7% of the population which is about 1 in 60 people. Some people with DSD show strong signs of gender confusion and can have female reproductive organs but male hormone levels and body structure, while some can go their entire lives without knowing they have such condition because the signs are too minor to be noticed.

It has been noticed that DSD is more common among elite athletes, especially female athletes with an extra Y chromosome configuration. Many signs of DSD include increased muscle mass, endurance, or other physical traits that are advantageous in sports. This may create an early affinity for sports in athletes due to the physiological characteristics that

favor athletic performance. Their bodies may respond more effectively to training, reinforcing their interest and success in athletic endeavors. This connection between genetics and environment shows the complex relationship between biological factors and athletic potential.⁶

Sex cannot be determined solely on the XX and XY configurations of the genes, a lot of women who carry a Y chromosome live their whole lives looking and feeling like a woman. They can also have active female reproductive systems and give birth with the right hormonal treatments.

Many believe women born with a DSD condition should not be able to compete in female competitions because women or not, they have a genetic advantage that no amount of training and hard work would make it possible for women with XX chromosome to reach.

There has always been discussions and disqualifications over female athletes with DSD. Lately, a lot of sport federations have tightened their regulations even further by prohibiting any female athlete with a sex variation to compete in their games. Additionally, some federations have required every female athlete to produce documentation proof of a XX chromosome configuration prior to participation in the competitions.⁷

In 2018, track and field sports federations released a statement declaring that female athletes with DSD conditions are prohibited from participating in their competitions. This sparked debate especially among the participating athletes as all the three medalists in the 2016 Rio games in the 800m women track and fields were diagnosed with DSD. The federation released a statement saying that athletes with DSD can participate only if they lower their testosterone levels before the competition, citing that higher levels of testosterone gives them an unfair advantage.

Twice Olympics winner in the 800m games runner Caster Semenya (who also has DSD) has commented on this decision as being ridiculous because athletes have always had genetic advantages for different reasons and that they didn't have any "unfair" advantages. She

refused to undergo testosterone treatments stating that it was unnecessary and discriminatory and has filed a lawsuit against the federation.⁸

Importance Put on Testosterone in Women's Sports

Testosterone is a hormone produced by the testes in men and ovaries in women, as well as in the adrenal glands and the peripheral tissues by both. Testosterone helps with liver functions, kidneys, bone density and more. All humans need to have this hormone in their body to function. However, men are known to generally have more testosterone after going through puberty as it is also responsible for body hair, deep voice, increased muscle fiber, increased height, and more.⁹

However, the amount of testosterone does not predict how the body uses it. Every healthy person has the necessary amount of testosterone that their body needs to function properly. The testosterone receptors in the body come in different numbers and efficiency, some bodies must produce high level of testosterone because of the lack of sufficient receptors to receive the hormone and some bodies produce very little testosterone because of the adequate amount of receptors, at the end both of these bodies have the right amount of the hormone working in their bodies but with different quantities.

The complete effects of the testosterone hormone on the body need more research, as of now because of its relation to muscle mass, testosterone levels are compared to doping levels and are expected to be tested and medically dealt with as such. However, this is a shortsighted opinion as science has concluded that doping levels and testosterone levels are not the same, and as such, they can't be measured the same way.

Can women have high levels of Testosterone? Yes. Women can have high testosterone levels and men can have low testosterone levels. However, it's mostly women who have a difficult time with sports federation when it comes to testosterone levels.¹⁰

While women must go through many tests that almost always includes testosterone level tests, men are never questioned about their gender for exhibiting low testosterone levels. This shows that testosterone tests are not a decisive measure of gender. The IOC agrees with the statement that “Testosterone is an important factor shaping performance in elite athletes in certain sports, events and disciplines” but they also believe it’s not a definitive factor in an athlete's performance.¹¹

In addition, it has been noted that the calculation of female testosterone levels for research has been done mostly on nonathletic women and that the levels of testosterone between female athletes and male athletes often overlap.

As per the rules and regulations of many of the sports federations, any female athlete (with DSD conditions or not) exhibiting high levels of testosterone that is considered too high for a woman, must artificially lower their testosterone levels.

Artificially lowering one's testosterone levels can be done by taking hormone therapy (often using testosterone suppressor medication) or surgical measures (such as gonad removal). As mentioned before, research has shown that the body produces the necessary amount of testosterone to function properly, so by artificially lowering testosterone levels the athlete is at risk of serious and irreversible damage to her/his health. Many believe forcing women with DSD or high amount of testosterone levels to undergo such procedures is unethical and cruel.¹²

Discrepancies in Sports Federations

Imane Khelif is just another female athlete going through the same scrutiny many of the other female athletes mentioned in this paper have gone through. What makes her case stand out is the unusual media coverage she received during the Paris Olympics while many of the criticism she received was for allegedly being a man or for having a DSD disorder and men’s

testosterone levels, there was no actual evidence to prove any of these claims. The only statement released by the International Boxing Association (IBA) on her disqualification from the 2023 female boxing world championship was the following "The athletes did not undergo a testosterone examination but were subject to a separate and recognizable test, whereby the specifics remain confidential. This test conclusively indicated that both athletes did not meet the required necessary eligibility criteria and were found to have competitive advantages over other female competitors."¹³

Sometimes, the specifics of certain eligibility tests are kept confidential to protect the privacy and mental wellbeing of the athletes involved, but considering the way the IBA handled the public outrage Khelif has received, it's apparent that the privacy or wellbeing of the athlete was not a priority for them, and that there might have been other unknown factors behind the publicity she received.

After the controversy at the Olympics, and the disqualification of Khelif by the IBA garnered more attention, the IBA released more information about the tests. One IBA official claimed the unspecified test Khelif failed was a Chromosome test, claiming she had XY chromosomes without providing evidence. In a meeting, the IBA president Umar Kremlev, called them testosterone test. However, the labs where the tests were done and are accredited by world anti-doping agency (WADA) has released a statement saying it does not oversee any gender tests and that it only deals with doping tests.

After the decision to disqualify Khelif and one other female athlete (Lin Yu-Ting from Chinese Taipei), Lin did not appeal the decision, and Khelif dropped her claim after initially appealing it. The IBA used this information as confirmation that Khelif was not qualified to play in the games, and she was aware of it, which is why she accepted their decision to disqualify her.

The IBA still stands firm with their decision of disqualifying Khelif as having a genetic advantage over other female athletes for their reasoning. On the other hand, the IOC disagree with this decision as they are standing firmly on their decision on letting Khelif participate in

the 2024 Paris women boxing Olympics, even though they also sighted high levels of testosterone in Khelif's system. IOC president Thomas Bach said in a meeting "We have two boxers (Imane Khelif and Lin Yu-Ting) who are born as a woman, who have been raised a woman, who have passport as a woman, and who have competed for many years as women. And this is the clear definition of a woman. There was never any doubt about them being a woman".



IOC president Thomas Bach. Credit: Getty Images

There are no consistencies across the sports committees and federations regarding the qualifications of certain athletes and the way to manage their competitions, especially in terms of what genetic advantages are allowed and what are considered unfair.

In the event of the inability of two international bodies to determine a fair method to determine eligibility, the public is left with the responsibility of determining the qualification. This is the main source of the heated discourse around Khelif's qualifications.

IOC Policies on Sex Variation and Their Updated Inclusion Criteria

In 2021, the IOC released their updated framework on fairness, inclusion and nondiscrimination based on gender identity and sex variations. After receiving backlash for allowing openly transexual athletes such as Laurel Hubbard, to compete in the 2020 Tokyo Olympics¹⁴, the IOC went over their rules and regulations and released an updated version to be followed for the 2024 Paris Olympics.

These new policies focused on fairness and inclusion for all athletes including transexual and athletes with gender variations without discrimination. An important statement they made in said document was that they are letting the sports federations of each sport handle the qualification factors in their own games as they believe that each sport has different qualifying factors and that a one fit-for-all universal test would not be fair to determine qualification criteria for all the different games. They encourage the sports federation to create their qualification criteria based on fairness, inclusion and non-discrimination.

One of the principles mention that when developing eligibility criteria, there should not be a sex test as these tests have proven to not be efficient or true in determining unfair advantages in athletes. The framework uses Australian Rules football as a good example of how to create an inclusion criterion that is fair to transgender and athletes with gender variation. The Australian Football League (AFL) eligibility criteria include the assessment of each athlete's height, weight, speed, jump, bench, and more.

The IOC recognizes that safety is the most important for athletes in certain competitions which is why they mention that for the inclusion criteria for such sports, the federations

should focus on inclusion criteria that measure injury risk and not sex variation or hormone tests. For example, in boxing, the athletes are separated into different weight classes so that similar size athletes can compete without the risk of serious injury or discrimination against different sized athletes.

The framework emphasizes on the importance of protecting their athletes and for there to not be unnecessary medical examinations, and that the federations should always follow a rule of inclusion in the case of absence of evidence of genetic or any kind of advantages. They conclude the framework by emphasizing the importance of the mental and physical health of the athletes above all else.¹⁵

The Controversial History of the IBA

Khelif had been competing in IBA's tournaments for a long time before they suddenly disqualified her at the 2023 world championship. Khelif won against the previously unbeatable Russian boxer Azalia Amineva, and three days later, The IBA conducted a gender test following numerous complaints from officials about potential foul play, on the grounds that some male players were passing off as women. As a result, they disqualified Khelif. Khelif commented on her disqualification as a conspiracy and her opponent Amineva reclaimed her undefeated status. Many found the timing of this to be strange since the IBA is known to have strong Russian connections and at the time the president of the IBA was Russian. In 2016, the IBA were found to be match-fixing and doing other wrongful conduct during the Rio de Janeiro boxing Olympics. An investigation uncovered that the IBA had used corrupt Judges and referees to manipulate the results of the matches. The president of IBA at the time, Wu Ching-Kuo, was found guilty of overseeing such a scheme and was banned from the boxing committee for life in 2018. After that, in 2019, Gafur Rakhimov, became the new president of the IBA. His reign was short lived as he stepped down the same year for there had

been concerning allegations about him being a Patron of an organized Russian criminal group called the “Brother’s Circle” or “Thieves in Law” who were involved in drug trafficking.

Umar Kremlev has been the president of IBA after Rakhimov until now. One of his controversial actions includes allowing Russian boxers to compete under the Russian flag after the IOC banned Russian players from competing amid the Russia and Ukraine war. He decided to stay president after his term ended, not allowing the organization to vote on the decision. He also moved all IBA’s operations to Russia.¹⁶ The IOC permanently banned the IBA from organizing Olympic boxing in 2019 due to their many disputes and it concluded that boxing will not be on the Olympics sports programs for 2028. IOC also decided that if any country wanted to participate in the Olympics, they must choose a boxing federation other than IBA to represent them.¹⁷ Since the news of Khelif’s match, the IBA have received both support and scrutiny from the public.

The two camps strongly oppose each other, some say IBA is too controversial to be trusted with their test results while others applaud them for taking a hard stance on their qualification criteria for women’s sports. Kremlev has taken on his social media to double down on his organization’s decision to disqualify Khelif, he even offered Carini (Khelif’s opponent who lost against her) the gold Olympics prize money of \$100,000 as he commented on how unfair her match was. He has also utilized social media to criticize the Olympics, calling their president Bach “evil” and called on him to resign immediately.¹⁸



Umar Kremlev President of the IBA . Credit: Inside the Games .

Sports & Politics

The Olympics originated from ancient Greece as a group of different games to celebrate the best of humanities capabilities and to promote peace where all the participating nations agreed on having a truce during the once in every four years event.

The Olympics we celebrate today were revived from the old events by Pierre de Coubertin in 1896 to continue the tradition of promoting peace and international solidarity. Pierre has emphasized the importance of the pursuit of excellence, sportsmanship, respect, unity, and inclusion as the principles of the Olympics spirits. He also stated that the competitions must not be political, yet we often see world problems reflected in the event.

One of the many political controversies the Olympics have witnessed, was during the 1936 Berlin Olympics where Adolf Hitler used the event to promote his Nazi ideologies before the second world war¹⁹. For the 2024 Paris Olympics, there were many protests for allowing a handful of Russian athletes in the games because of Russia's ongoing invasion of Ukraine²⁰,

as well as many requests to ban Israel for their crimes against Palestine. Many of these requests were ignored by the organizers.²¹

However, Russia has been banned since the 2016 Rio Olympics for using performance enhancing drugs with a state sponsored doping program, Russian athletes can compete but not under the Russian flag. A similar incident is attributed to Germany, who in the 1970s and 1980s, performed systematic doping to their athletes under state supervision.

There have been many more allegations of bribery and corruption in the history of the Olympics. The number of controversies increase with each new event, the event that was once made to unite humanity and ignite peace among everyone is now becoming a platform for political controversies and issues of integrity, fairness and inclusion, challenging the very ideas, it was designed to promote.²²

Genetic Advantages

While it is known that men often have physical advantages over women in certain sports, testosterone cannot be credited as the sole cause of this advantage. If fairness is the goal of competitive sports, then many more factors must be considered. For example, environmental factors such as being from an upper-class family, or a wealthy country are an advantage for tennis and golf sports. Genetic factors such as being from a west African descent is advantageous to being good at running. Biological factors such as having large hands are important to be good at sports like basketball and swimming, being left-handed in tennis, being tall in basketball and volleyball, being short and petite in gymnastics. All of these are considered as genetic advantages. Drawing the line at the levels of testosterone becomes controversial when all the above genetic advantages are ignored.

In men's sports biological wonders are celebrated. Usain Bolt was not forced to take genetic and biological tests to prove he was in the normal range of a man when he won multiple racing competitions by huge margins. Yao Ming was not disqualified from playing basketball for being a danger to the other players because he was too tall at 228cm. Micheal Phelps was not called out by the media for having an unfair advantage over the other competitors for having hyperextended joints and extraordinary high lung capacity, he was admired for his biological advantages. Women athletes, however, are questioned about their womanhood the moment they stand out. They are not allowed to be different and unique without being scrutinized to the point of disqualification.



Yao Ming (On the Left) a Professional Chinese Basketball Player. Credit: AP

Spread of Misinformation

Misinformation is easy to spread for a highly publicized event. Negative misinformation spreads even quicker when that highly publicized event is greatly criticized.

The opening ceremony of the Paris Olympics received backlash from the public for its over the top performances including queer and drag queen models and celebrities in a scene resembling Leonardo De Vinci's popular painting of "The Last Supper". A lot of people complained about being shoved political agendas and "woke culture", religious people were upset over what they deemed mocking of their religion.

The Olympic organizers apologized, explaining that the scene depicted Dionysus, the Greek god of partying and madness, intended to highlight the absurdity of conflict and war. They stated that there was no religious connotation and that their goal was to celebrate diversity in Paris. However, many were not satisfied with this response and maintained a critical view for the rest of the Paris Olympics.²⁴

The Role of Mainstream Media

The mainstream media is trusted by many as a reputable and well researched source of information. However, that is not the case a lot of the time especially when the media has an agenda they want to push, such as the Paris Olympics being too controversial and "woke" for including trans athletes.

A lot of big mainstream media channels took some comments made by Carini and Khelif's disqualification by the IBA and her physical appearances as a confirmation that Khelif was a transgender woman and without validating any of the information they shared. They propagated these assumptions as facts to the public. Media networks such as: Sky News, Fox News, Daily News, Good Morning Britain and dozen more shared headlines referring to Khelif

as “Biological male” “XY chromosomes” “Person with male hormones” without having concrete evidence to support these claims. On the other hand, they described Carini as fearing for her life, crying over her shattered dreams, feeling wronged by the system, and having to tap out after only two punches.

The Effect of Social Media

This media attention created a snowball effect where big names took to their social media accounts to slander Khelif even further, expanding the circle of scrutiny to their millions of followers. Names including Elon Musk, Marjorie Taylor Greene, JD Vance, Liz Truss, JK Rowling and more were among them.

In response to these attacks, Khelif went out to say at a press conference “I am a woman like any other woman. I was born a woman. I have lived as a woman. I compete as a woman.” She has stated that she will be filing a lawsuit for “aggravated online harassment” against a lot of the big names who made social media posts about her claiming that she was not a woman.

While many athletes still believe that Khelif should not have qualified to take part in the games, many others have shown their support for her. Even Carini, her opponent who was also in the light of this controversy, released the following statement in a recent interview: “All this controversy makes me sad. It wasn’t something I intended to do. Actually, I want to apologize to her and everyone else. I was angry because my Olympics had gone up in smoke. I don’t have anything against Khelif. If I were to meet her again, I would embrace her”.²⁵

Social Perception of Gender Identity in the West versus the Middle East

Western media has been promoting its own ideas about gender identity by questioning Khelif's gender identity in a way that fits Western standards. However, this ignores the complicated and sensitive situation in countries like Algeria, where queer and transsexual people have no rights, and even women's rights are lacking. In Algeria, gender identity is tied to conservative values, and deviating from traditional gender roles can be dangerous.

Women in Algeria, like many countries in the Middle East and Africa, face significant challenges, including legal and social discrimination, limited access to education and employment, and a lack of representation in political and public life.

Addressing gender issues in women's sports requires a universal commitment to gender equality that respects cultural differences and promotes the empowerment of women everywhere.²⁶

Underlying Issues with Racism in Woman's International Sports

The way gender identity is viewed in the West is very different from how it's viewed in the Middle East and non-western countries, and these differences often lead to discrimination, especially against female athletes from non-Western countries. For example, women athletes from Africa and Asia face unique challenges because of the mix of their race, culture, and Western ideas of what it means to be a woman.²⁷

In many Western countries, gender identity is tied to specific physical traits and behaviors that fit traditional Western ideas of femininity, like how someone looks, sounds, or even whether they have body hair. When athletes from non-Western countries don't match these expectations, they can be unfairly judged and singled out. Bioethicist Katrina Karkazis pointed out that many of the rules used to define "femininity" are based on biased and

subjective Western standards. This kind of scrutiny isn't just about gender; it's also about race, with non-western women in sports often being targeted.

Almost all athletes who are questioned on their womanhood and continuously go through difficult gender exams have been women of color who don't possess the ideal western women look.



Caster Semenya and Lynsey Sharp in the 800m Race Olympics 2016 Rio. Credit: goodthingsguy

Conclusion and Recommendations

Female athletes have been going through gender-determination tests since the creation of sex segregated sports competitions. Many of these tests are not an accurate representation of genetic advantages, and the procedures taken to pass them can have irreversible consequences. Sports federations disagree over unified procedures and criteria for international sports eligibility. It has also been noted that women of color are the targets of these gender scrutiny campaigns because their features deviate from the ideal western women look.

These gender identification tests also have societal and cultural aspects, and they should be considered when dealing with athletes from non-western countries. While athletes from western countries get treatment to adjust their high hormonal, or specifically testosterone, levels, athletes from non-western countries usually don't enjoy those same privileges, and they also face backlash from the societies they come from if they were found to have tinkered with their hormone levels.

Creating a modern foundation of what is considered an unfair genetic advantage in each sport can create a fairer and more inclusive sports world for all athletes especially women with hormonal or genetic problems who have faced discrimination all throughout history. It will also protect all athletes by not letting anyone gain a big advantage by competing in the wrong category.

To promote fairness and inclusion in international sports there is a need to create more accurate and agreed upon inclusion criteria where they focus more on physical attributes rather than looks and hormone levels. Also, discussions on gender identity in sports across the world should be approached with more respect and understanding of the differences of perception in different countries.

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BIOLOGICAL TESTS IN WOMEN'S SPORTS



CONTACT

CHANNEL8 BUILDING,
KURDSAT QTR , SULAYMANIYAH, IRAQ
+964-773-608-8885
INNOV8@CHANNEL8.MEDIA