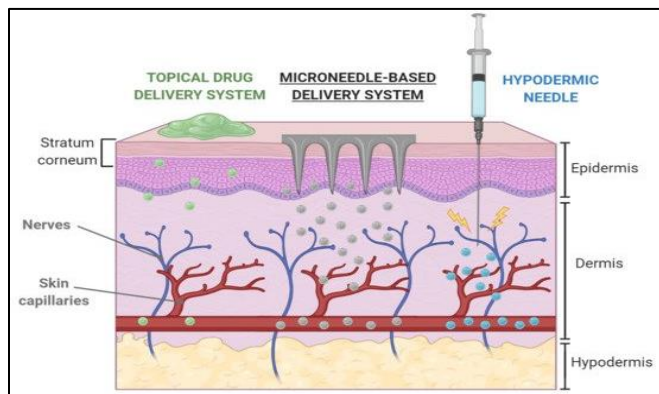


Potential Transdermal Microneedles for the Delivery of Coronavirus Vaccine

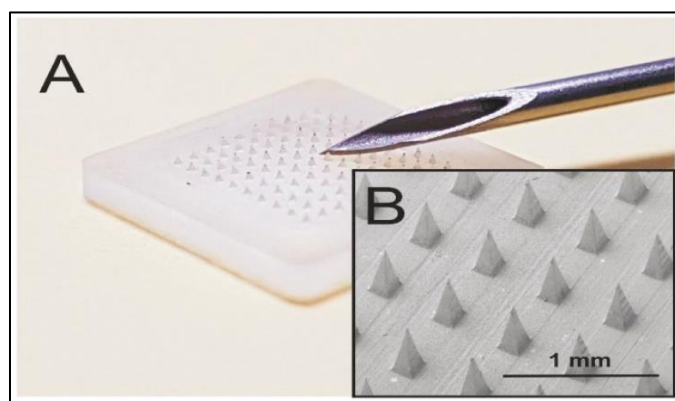


Globally in the past week, rates of new COVID-19 (caused by the novel coronavirus SARS-CoV-2) death and cases continued to increase, with almost 4 million new cases and 60 000 new deaths recorded. As of 15 November 2020, total 53.7 million confirmed cases and 1.3 million deaths have been reported to WHO [1]. Therefore, safe vaccines inducing rapid potent and long-lasting virus-specific immune responses against this infectious agent are urgently needed. Researchers working on a potential vaccine against the new coronavirus causing the COVID-19 pandemic are exploring the use of a fingertip-sized skin microneedles patch for the delivery [2].

Microneedles are composed of a collection of micron sized needles which can penetrate the skin in a painless manner [3] and have been investigated for the delivery of vaccines in recent years [4] [5]. Researchers led by Drs. Louis Faló, Jr. and Andrea Gambotto from the University of Pittsburgh recently described the development of microneedles array (MNA) delivered MERS-CoV (Middle East Respiratory System-CoV) vaccines and their pre-clinical immunogenicity.

A method of delivering the MERS vaccine into the mice was developed by the team using microneedle patch. Three different experimental MERS-CoV vaccines induced the production of antibodies against the virus when delivered by microneedle patch to mice. Compared to the responses generated by regular injection, these responses were stronger along with a powerful immune stimulant (an adjuvant). At the end of the experiments, the levels of antibodies kept increasing over time in mice vaccinated by microneedle patch. A similar microneedle vaccine targeting the spike protein of SARS-CoV-2 was developed by the team using the knowledge gained from development of the MERS vaccine. The vaccine initiated robust antibody production in the mice within two weeks [6].

Microneedles based transdermal delivery of coronaviruses-S1 subunit vaccines is a potential immunization strategy against coronavirus infection [2]. According to the researchers, at large-scale, the components of the experimental vaccine could be made quickly. Moreover, since the final product doesn't require refrigeration, it could be produced and placed in storage until required. However, much work still needs to be done to explore the safety and efficacy of this candidate vaccine [7].

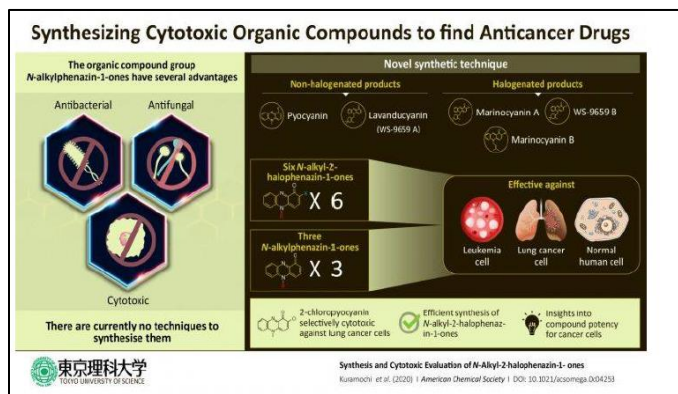


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Development of Cytotoxic Compounds Using Novel Synthetic Method



One out of six lives are being taken globally each day, by the fatal disease cancer which places it as the second leading cause of death and despite of the desperate attempts of worldwide researchers, a cure for cancer is yet to be found. Professor Kouji Kuramochi from Tokyo University of Science, along with his fellow scientists have shown glimmer of hope in by turning to phenazines, a certain set of organic compounds. N-alkylphenazin-1-ones called phenazinones, a batch of nitrogen-containing heterocycles have been proven destructive against bacterial cells, fungal cells and some phenazines like lavanducyanin, pycocyanin, lavanducyanin-derived WS-9659 A, WS-9659 B, and marinocyanins A and marinocyanins B, can cause cytotoxic effects as well and by this effect they can cause the death of cells; thus, it is anticipated that they may be able to destroy tumor cells if they are pointed against cancer cells. Be that as it may, obtaining them from their native sources (e.g. Bacteria) is hard. For that reason, synthesis of these phenazinones was necessary and was done by performing halogenation, a process of appending halogens and another process of

adding oxidant and a water molecule, named oxidative process was used. After experimenting, N-alkyl-2-halophenazin-1-ones were effectively derived and among the compositions, 2-chloropyocyanin showed severe cytotoxicity against cells of lung cancer. Synthesized phenazinones on animal studies and clinical trials need more verifications, although, some of the studies proposed that these are four times more particularly toxic to cancer cells compared to normal cells and thus, should have fewer side effects.

Now, the question remains, why do we need to use the synthetic method instead of traditional chlorination technique to produce N-alkylphenazin-1-ones? Answer to that question is traditional method for this case produced undesirable products whereas synthetic method does not and WS-9659 B was produced for the first time using the synthetic method.

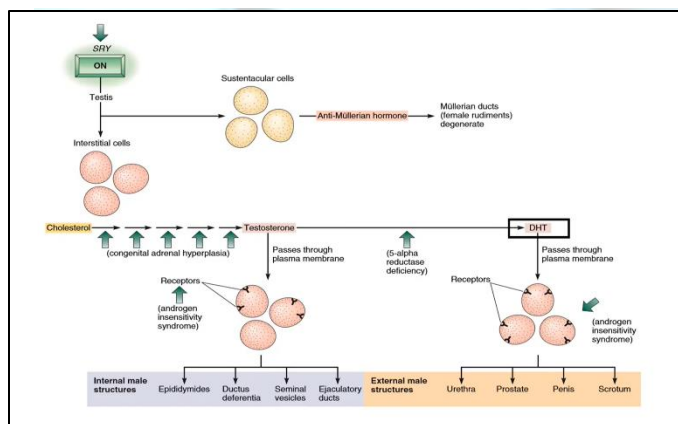
According to Professor Kouji Kuramochi, many other natural products can be synthesized which will be led by this finding and since it uses oxidative coupling reaction, the experiment uses oxygen resulting into an environment friendly method.

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Can You Be A Girl with A XY Chromosome or A Boy with A XX Chromosome?



We know from our general education that chromosome-based sex determination wherein the chromosome can determine the male and female. For instance, the XX represents that it will be female and the XY represents that it will be male. But is it true always? Yes! It's true but not all the time. Two persons one male and another female changed the idea of chromosome-based sex determination where the female had the XY chromosome and the male had the XX chromosome. This phenomenon gave rise to two different types of syndrome that are called XX male syndrome and XY female syndrome. After this, we started to understand that XX is not always female and XY is not always male. As a result, the question has arrived that if the XX and

XY are not enough to determine the sex in human then what determines the sex of the individual person? Scientist has found that the exact answer was inside the gene of the Y chromosome.

Gender development is not being cleared until the 5th week of the embryo development. During the 5th week all embryos develop two unspecialized gonads which will develop as either testes or ovaries. If the set of tube called the Mullerian ducts are started to form at the 6th week or 42 days then the individual is going to develop the female reproductive system.

On the other hand, if the gonads are started to form the Wolffian duct then it will lead to the male reproductive system. The choice to develop the male or female reproductive system mainly occurs in the 6th week of the development of the fetus. Some other sources claim that it starts after the 42 days which is the starting of the seventh week that depends on the constituents and the genetic composition of the chromosome. The sustentacular cells that secrete the hormone named anti-Mullerian hormones which further destroys the potential female structure like uterus, ducts and vaginal duct. At the same time, the interstitial cells help in the secretion of the testosterone by producing from the cholesterol that stimulates the development of the male internal structures such as epididymis, ducts differentia, seminal vesicle and ejaculatory ducts, Moreover, some of the

testosterone developed into di-hydro testosterone (DHT) which works in the building up of the process of external male sex organs like prostate, penis, scrotum etc. Also, it depends on the genetic expression of the gene of interest. If the SRY gene means the Sex-determining Region of Y chromosome activated then the hormones regulate the development of the male reproductive system pathway.

Also, the absence of the expression of SRY gene then the female reproduction pathway arrives. This situation helps us to understand that until the 6th week of the fetus development all of the human kind remain as woman and only after the development of the SRY gene we can be identified a person is male or female.

Thus, these modern innovations of the science help us to know about more interesting factor that leads to know several disease pathogenesis and many unknown factors that can help us to understand better the mechanism of the sex determination and for a better health and disease of the human fortune.

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