Sundry Topics

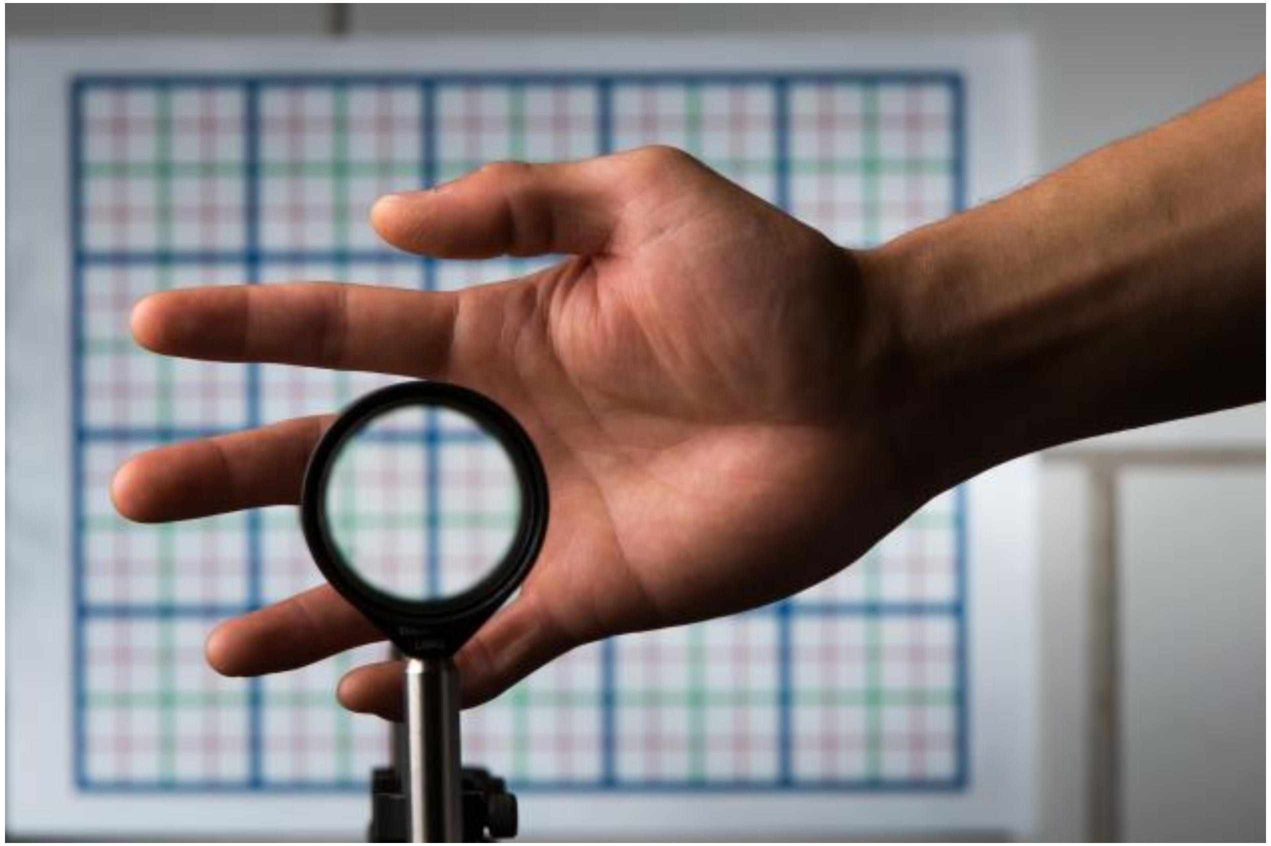
ESAME

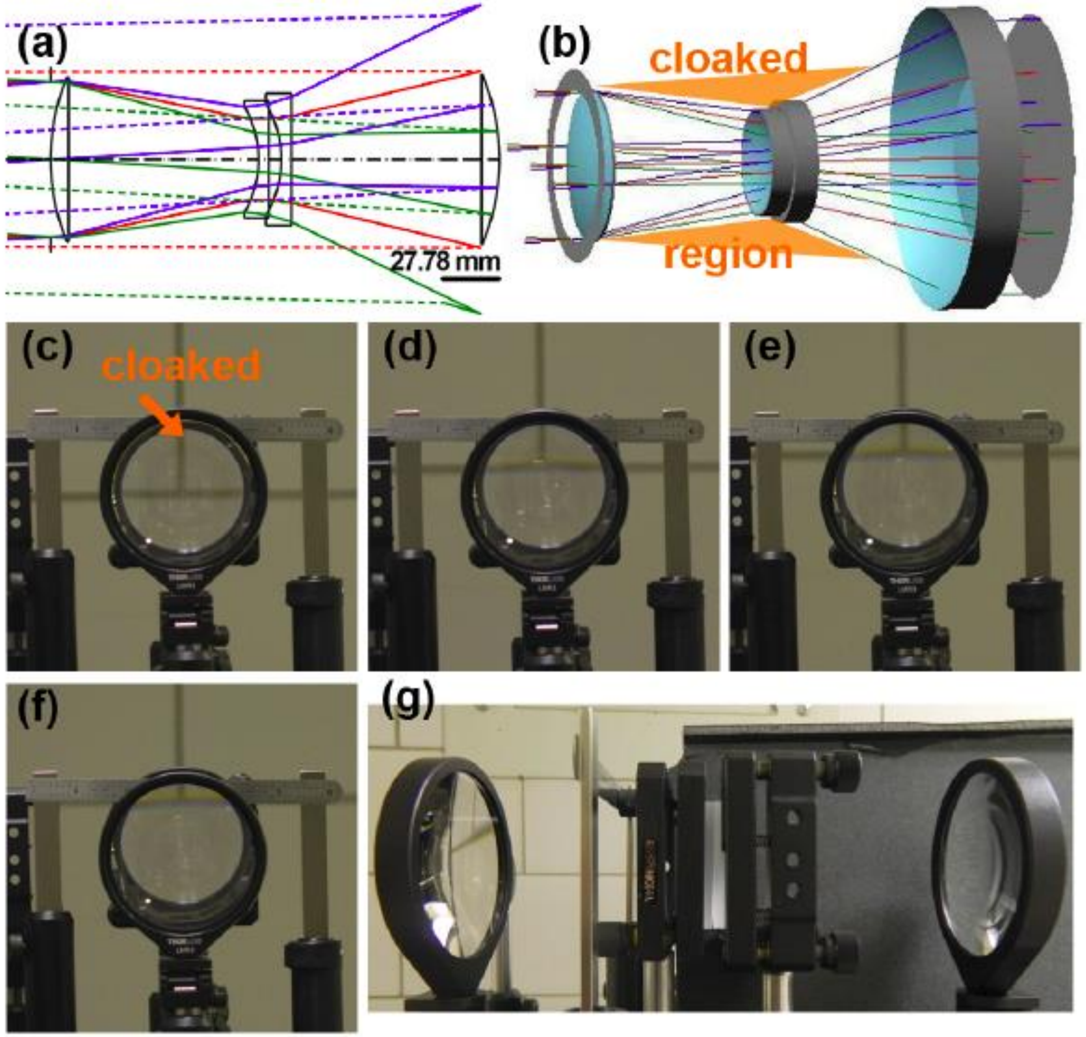
- TMR- SCRITTO A26 8 giugno= Materiali intelligenti
- TMR Orale Venerdi 16 giugno B24=TMR

- TMR- SCRITTO A26 29 giugno= Materiali intelligenti
- TMR Orale 7 luglio venerdi =TMR

- TMR- SCRITTO A26 20 luglio= Materiali intelligenti
- TMR Orale Venerdi 28 luglio B24=TMR

Cloaking





(a)
27.78 mm
(b)
cloaked
region
(c)
cloaked
(d)
(e)
(f)
(g)

Article | OPEN

Surface Wave Cloak from Graded Refractive Index Nanocomposites

L. La Spada, T. M. McManus, A. Dyke, S. Haq, L. Zhang, Q. Cheng & Y. Hao

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Electrical and electronic engineering
Metamaterials
Synthesis and processing

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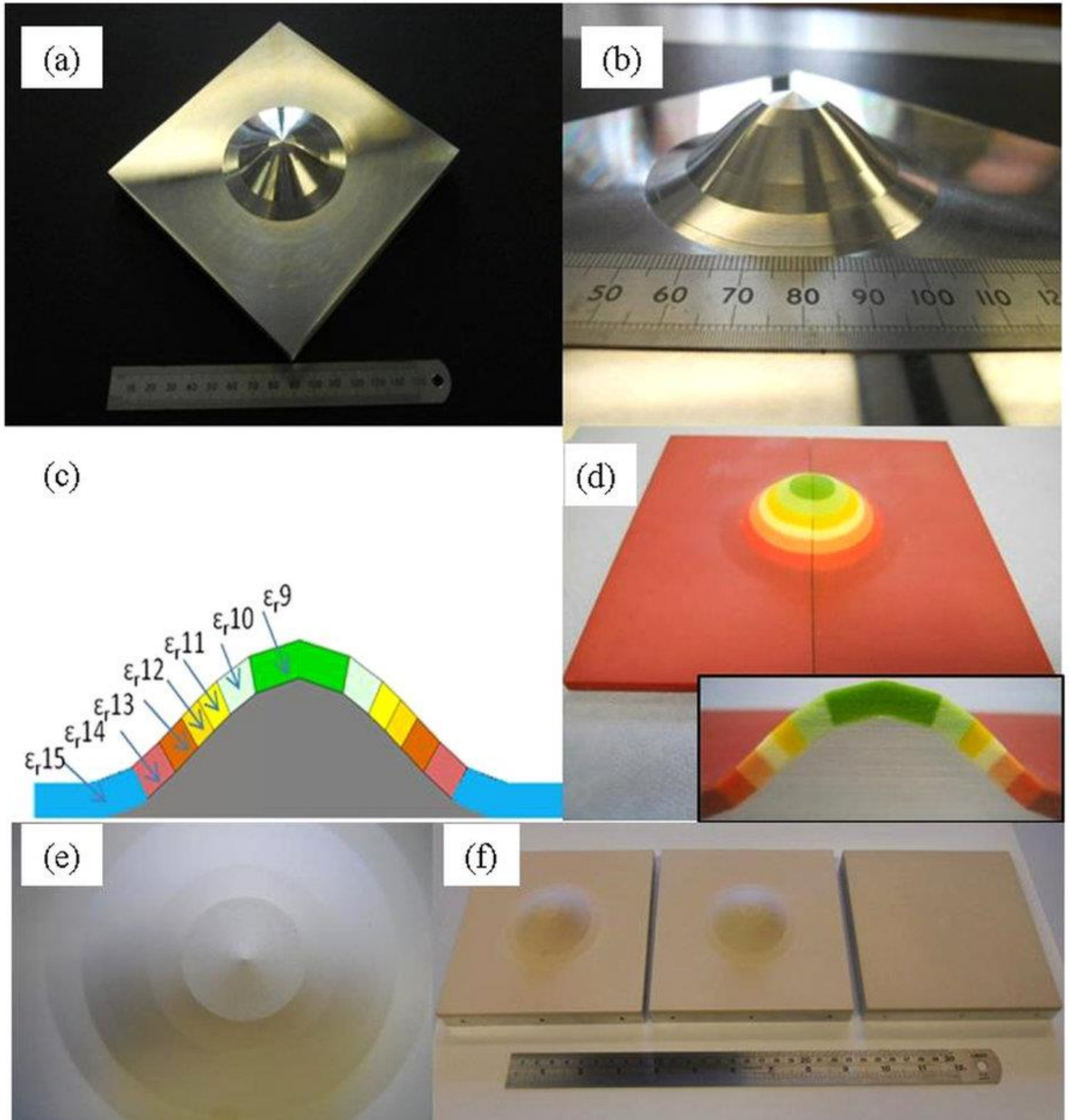
Abstract

Recently, a great deal of interest has been re-emerged on the possibility
to manipulate surface waves, in particular, towards the THz and optical

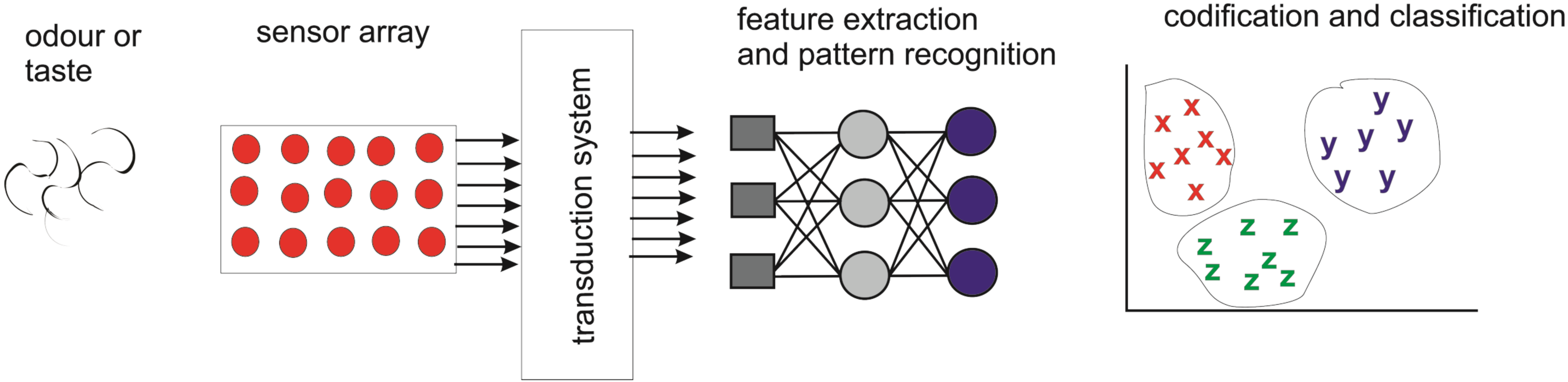


(a)
(b)
(c)
εr9
εr10
εr11
εr12
εr13
εr14
εr15
(d)
(e)
(f)

E-nose, artificial nose, and tongue

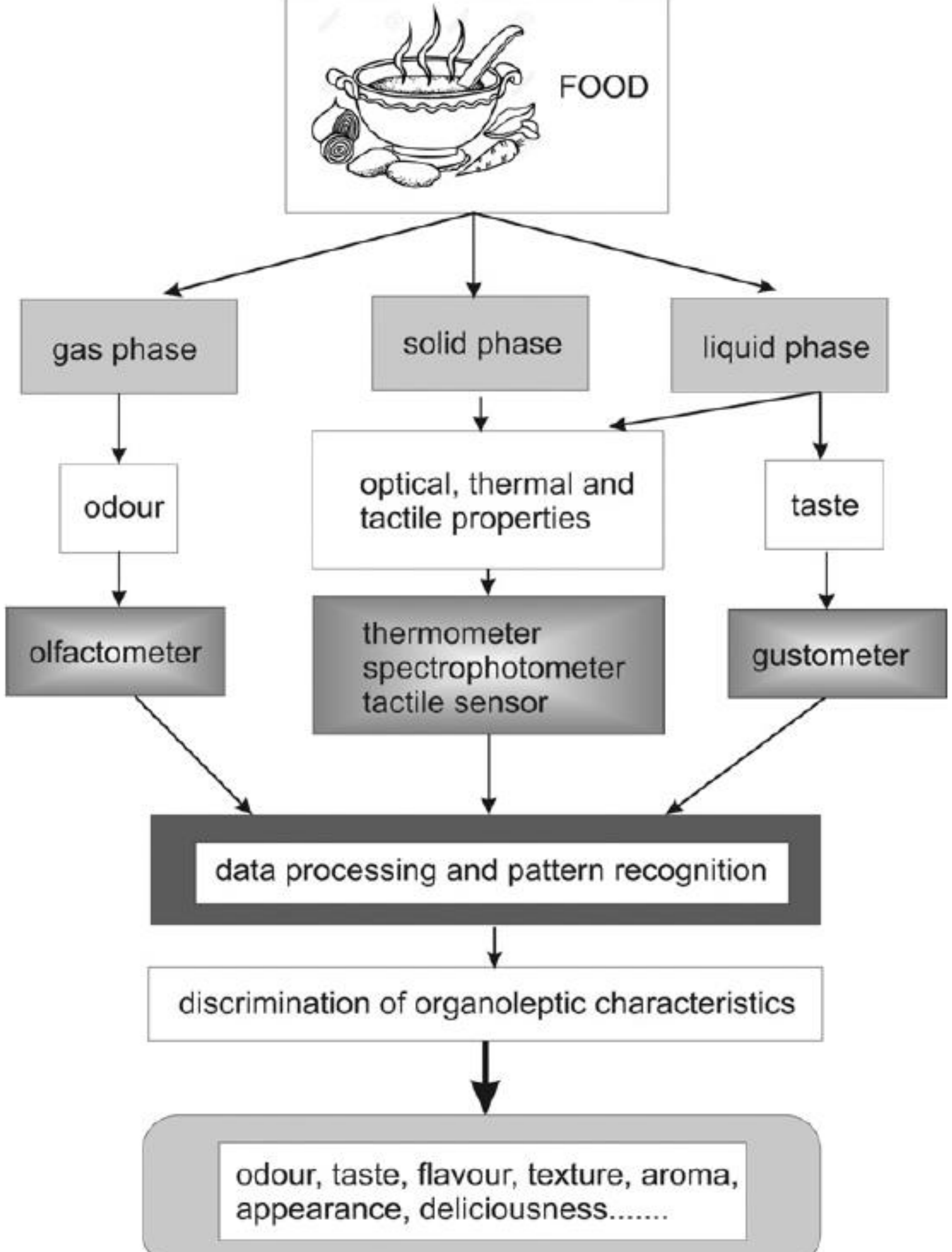
- An essential difference between smell and taste is that while the sense of taste can be qualified and classified into the five sensations which pertain to five different chemical classes (sweet, bitter, acid, salty, and ‘umani’), a similar qualification has not been established for smell.
- In fact, it appears that taste and smell in mammals are codified differently, the sense of taste being mainly due to the firing of specific receptors for the five qualities and odor being due to the pattern of firing of several olfactory receptors in unison upon binding with an odorant molecule.

E-tongue, e-nose



Material	Transduction principle	application
Inorganic semiconductors: metal oxides	Conductometric, optical, potentiometric, FET	Nose
Conducting polymers	Conductometric, gravimetric, optical, impedentiometric	Nose and tongue
Organic semiconductors: porphyrins,phthalocyanines	Conductometric, gravimetric, impedentiometric	Nose and tongue
Polymers with organic salts	Impedance	Nose and tongue
Polymers with lipids	Potentiometric	tongue
Polymers with carbon black	Impedentiometric, conductiometric	Nose and tongue
Organic chromphores	optical	tongue
Chalcogenide glasses	potentiometric	Nose and tongue
Carbon nanotubes	Conductometric, Impedentiometric, potentiometric	Nose and tongue
Graphene	Conductometric, Impedentiometric, potentiometric	Nose and tongue
Metal and metal oxide nanoparticles	FET	nose
Nasal and tongue epithelia	FET	Nose and tongue
Taste receptors	FET	tongue
Olfactory receptors	FET	Nose

ORGANOLEPTICS



Ingegneria Genetica-

Introduzione del materiale genetico in una cellula in modo tale che replica il DNA o la proteine per cui codifica (insulina umana, interferon, humanised mice).

Come? Cut and paste di DNA in maniera specifica usando enzimi

- enzimi di restrizione
- ligasi

Usando questa tecnica è possibile dividere un genoma complesso in piccoli frammenti e inserirli in un vettore che puo essere replicato nelle cellule dei microbi.

Per fare Molecole e Materiali intelligenti

Enzimi di restrizione o endonucleasi di restrizione

sono enzimi prodotti dai batteri per digerire il DNA dei virus. Tagliano il DNA in punti specifici. Conosciamo almeno 1000 diversi enzimi di restrizione.

Eg EcoRI

HpaII 5’ CCGG3’ → 5’ C CGG3’
3’GGCC5’ → 3’GG CC5’

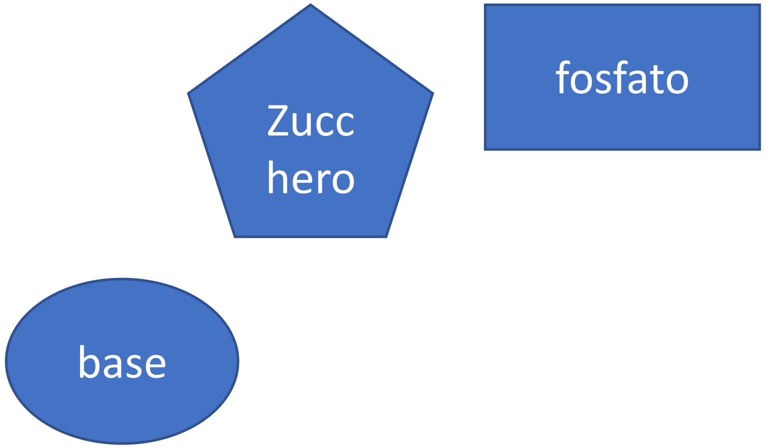
Sticky end

HpaI 5’ GTTAAC3’ → 5’GTT AAC3’
3’CAATTG’ → 3’CAA TTG’

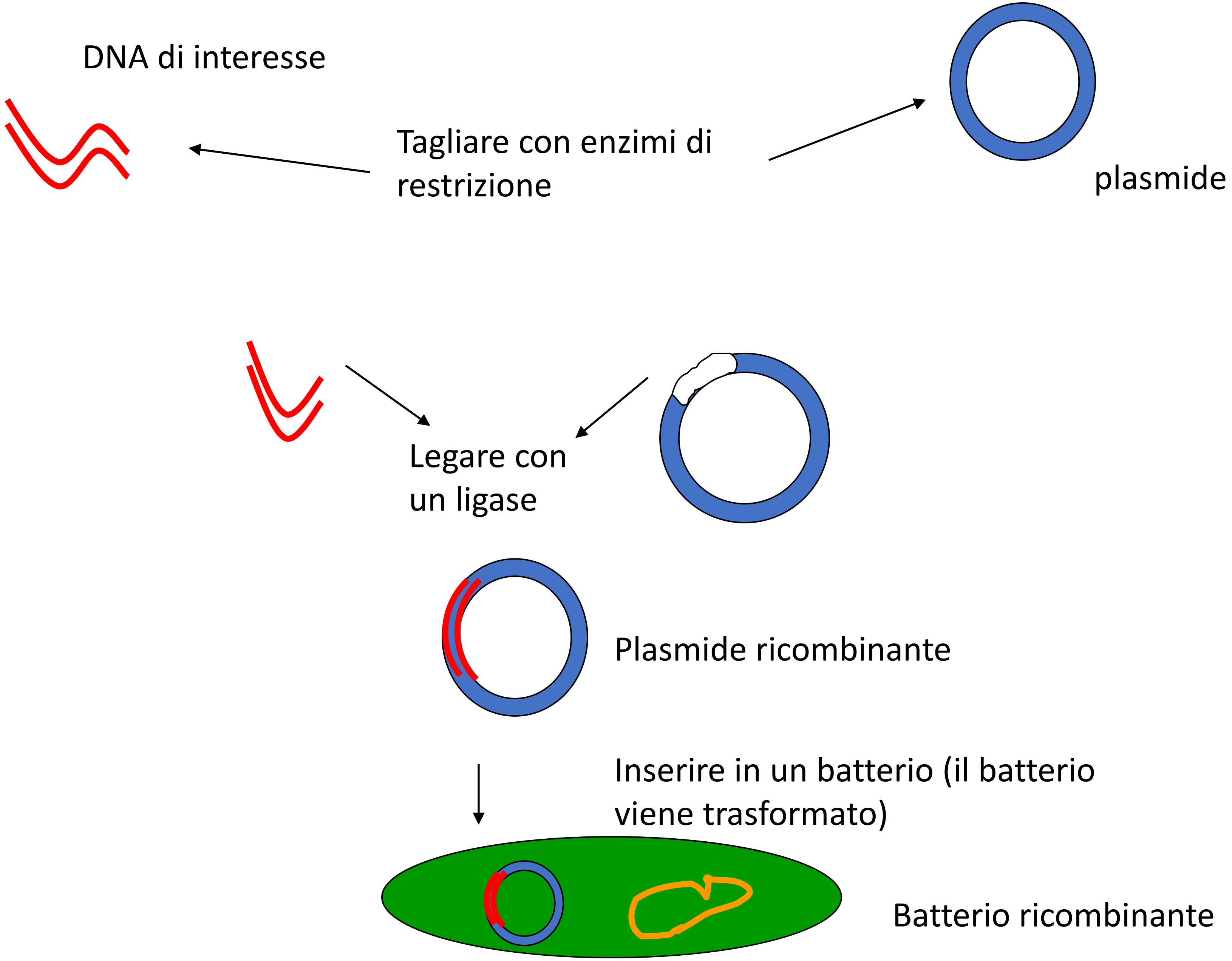
Blunt end

Ligasi

La DNA ligasi provviene da una batteriofago. Il DNA puo essere ligata con legami H, ma ci vuole un enzima per formare un legame covalente tra 3’OH e 5’fosfato. La reazione è potenziata da ATP

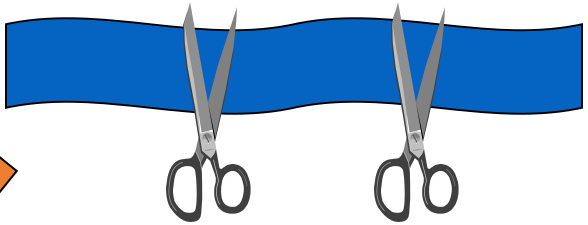


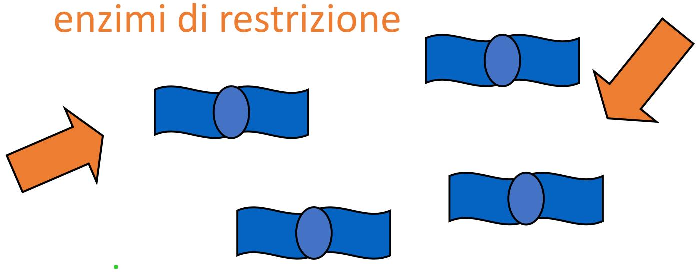
DNA RICOMBINANTE



DNA Ricombinante /Mutagenesi a sito specifico

Sequenza di DNA con il gene di interesse prelevato da un batterio madre tramite enzimi di restrizione

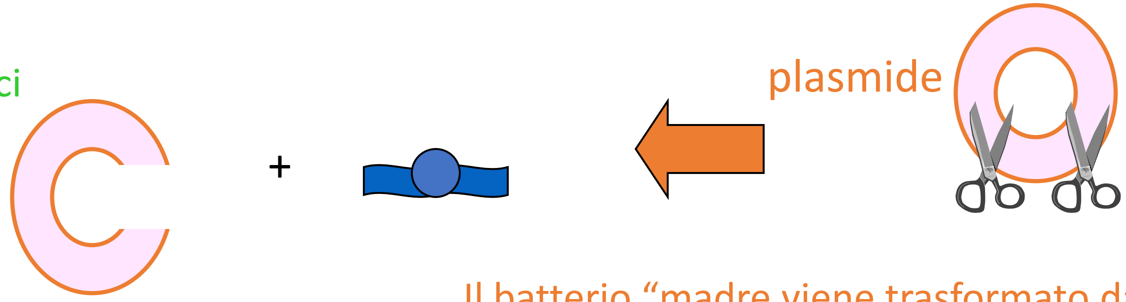




Dopo purificazione viene inserito nel plasmide (vettore)
tagliato con stessi enzimi di restrizione

Per mutagenesi
il gene viene modificato
alterando la sequenza
di DNA in punti specifici
tramite PCR ad es.

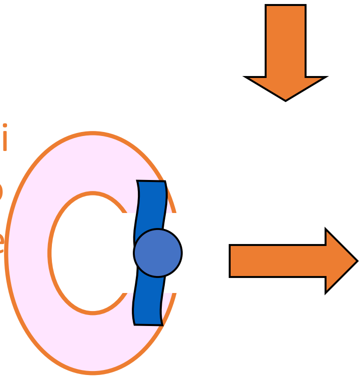
plasmide



Vengono ricombinati con i ligasi

Il batterio "madre viene trasformato dal plasmide
ed i cloni ricombinati sono selezionati e fatti crescere.
Per far ciò bisogna sequenziare il DNA per assicurarsi che sia giusto

Esistono diversi metodi per la scelta del giusto plasmide ricombinante



LA PROTEINA MUTATA VIENE ESPRESSA

SI SPERA!!

Plasmide ricombinante

PROBLEMI

- Proteine grandi non possono essere espresse semplicemente nei batteri

- Il DNA di origine eucariotica ha una sequenza molto complicata, che non può essere decodificata dai batteri

- Non abbiamo una teoria universale che permetta di predire in base ad una data sequenza di amino acidi l’eventuale struttura terziaria e la funzione della proteina risultante

Progettazione Razionale e Mutagenesi Casuale

•Non sappiamo bene come modificare una proteina per renderla più stabile, più affine, o per catalizzare un substrato diverso

Sappiamo che la struttura terziaria delle proteine è determinata dall'equilibrio di diverse forze, quali:

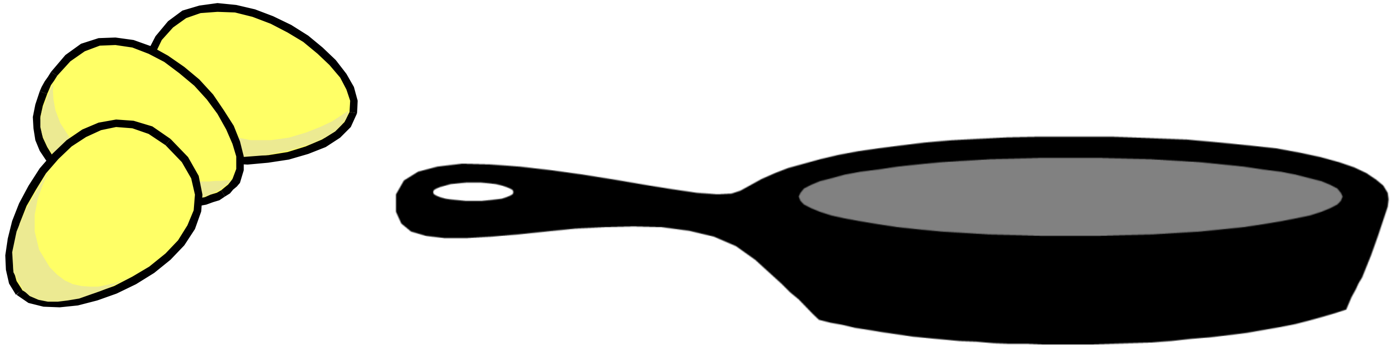
- legami idrogeno
- interazioni elettrostatiche
- interazioni con i solventi
- Van der Waals

e che proteine sono strutture metastabili ed in continua evoluzione

(es. batteri)

Towards the nonstick egg: designing fluorous proteins

Anyone who has made scrambled eggs will have had cause to praise the properties of Teflon. Teflon's highly chemically inert and nonstick nature derives from the per-fluorinated polymer poly-tetra-fluoro-ethylene. Perfluorocarbons have unique and valuable physical properties not found in nature. By incorporating fluorine into proteins, it might be possible to produce biological molecules with novel and useful properties.



CRISPR-CAS9

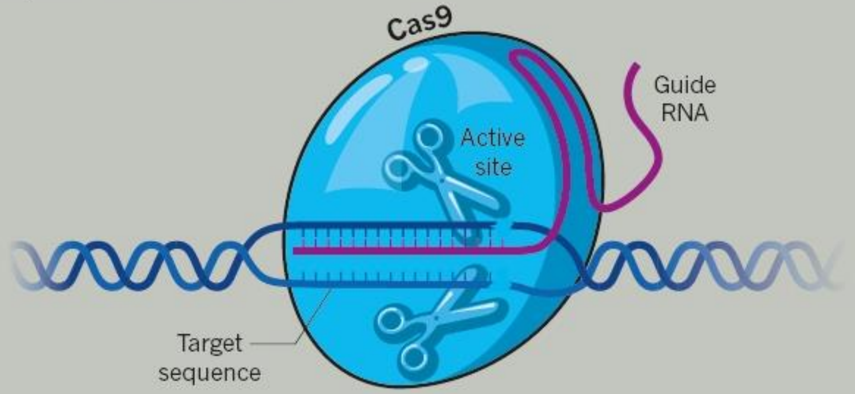
- https://www.youtube.com/watch?v=2pp17E4E-O8
- https://www.youtube.com/watch?v=oMaiIyGfhQw

HACKING CRISPR

By modifying the molecular machinery that powers CRISPR–Cas9 gene editing, scientists can probe the functions of genes and gene regulators with unprecedented specificity.

Snip snip here

There are two main components of CRISPR–Cas9: the Cas9 enzyme, which cuts DNA, and a snippet of RNA that guides these molecular scissors to the sequence that scientists want to cut.

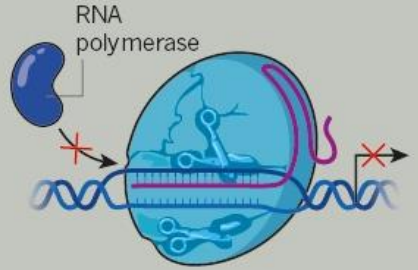


Broken scissors

The Cas9 enzyme can be broken so that it no longer cuts DNA. But with the right guide RNA, it can still attach to specific parts of the genome.

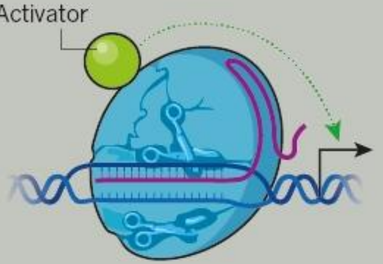
CRISPR inhibition

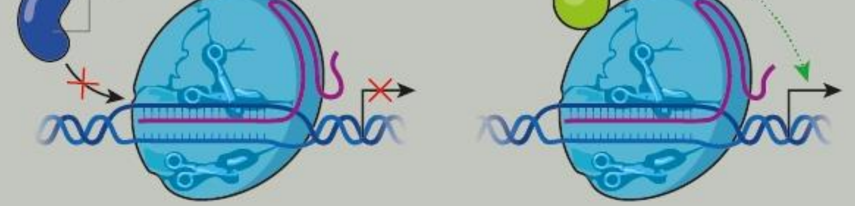
A broken, or 'dead', Cas9 enzyme will block the binding of other proteins, such as RNA polymerase, needed to express a gene.



CRISPR activation

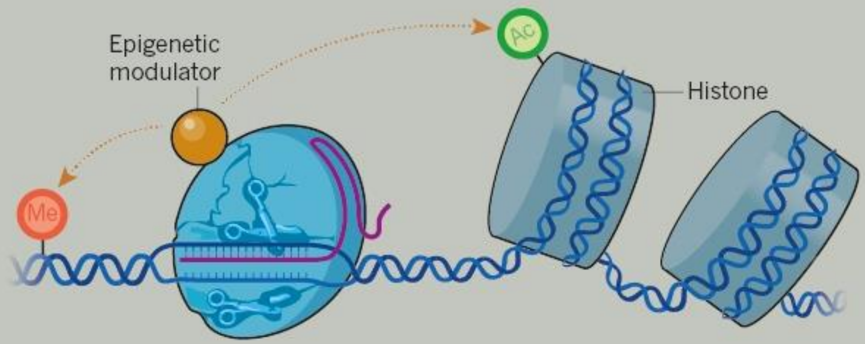
An activating protein can be attached to a dead Cas9 protein to stimulate expression of a specific gene.





CRISPR epigenetics

A broken Cas9 enzyme can be coupled to epigenetic modifiers, such as those that add methyl groups (Me) to DNA or acetyl groups (Ac) to histone proteins. This will allow researchers to study how precisely placed modifications affect gene expression and DNA dynamics.



Inducible CRISPR

Cas9 — either dead or alive — can be coupled to switches so that it can be controlled by certain chemicals or, as shown below, by light.