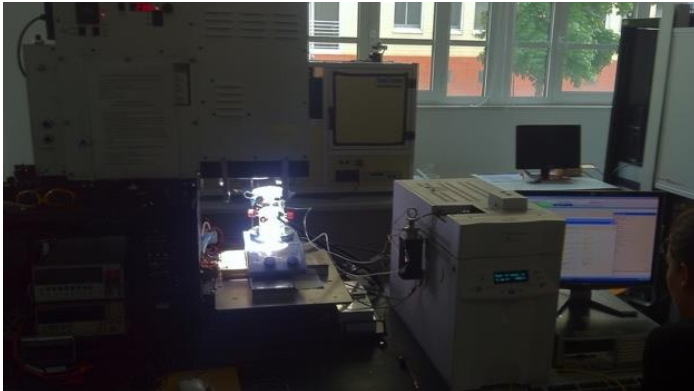


Dipartimento di Scienza dei Materiali, Centro MIB-SOLAR (U5)



WE NEED ENERGY FOR

ELECTRICITY

Photovoltaics

THERMAL ENERGY -
HEATING
Direct/Fuels

REACTANTS AND FUELS

for manufacturing and transportation

- *1st and 2nd Gen: natural photosynthesis (biomasses, biofuels)*
- *3rd Gen: Artificial Photosynthesis (reduction of H_2O and CO_2 to H_2 , CH_4 , CH_3OH , etc.)*

Combustibili e Reagenti da Energie Rinnovabili



Natural photosynthesis
(1st and 2nd Gen. biomasses)

Photovoltaic
(electricity)

Single step
process

Refinery
process

Double step
process

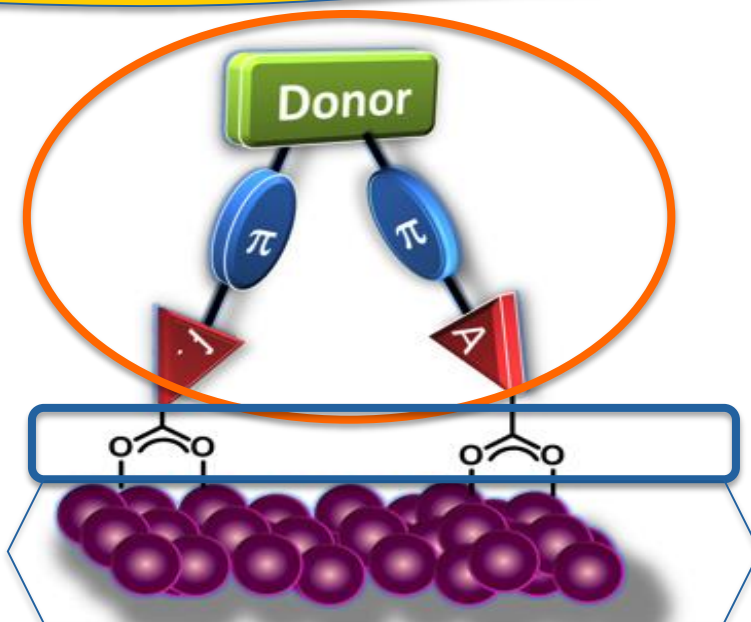
PV-driven
electrolysis

Artificial photosynthesis
(3rd Gen)

Solar fuels (H_2 , O_2 , CH_4 , CH_3OH , etc.)

L'approccio molecolare

electrolyte/transport layers/...



DYE/LIQUID-SOLID INTERFACE

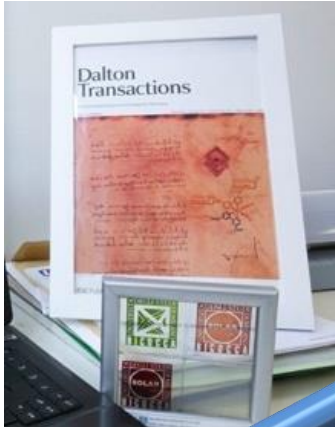
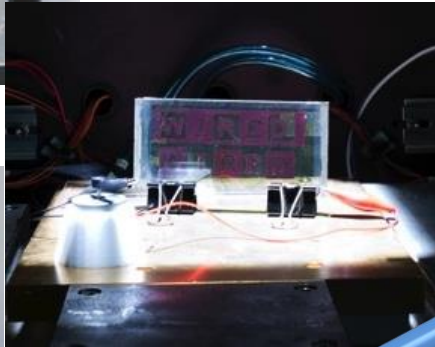
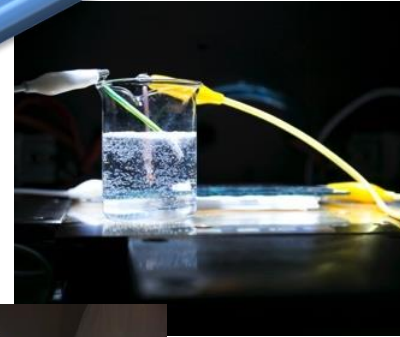
**MOLECULAR
 ENGINEERING**
 tuning of device
 properties

ORGANIC/OXIDE INTERFACE

**SEMICONDUCTOR
 OXIDE**
 charge collector

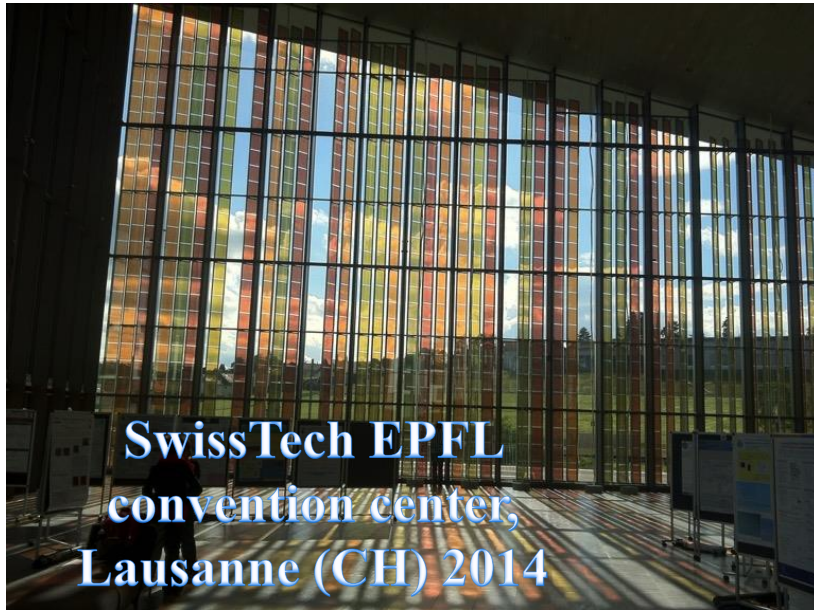
Argomenti

Fotovoltaico organico



Combustibili Solari

Industria: integrazione architettonica



90 mq, 24 kWh/day
(9000 kWh/y)



Verso l'economia dell'idrogeno



**ITALY: first hydrogen service station (Bolzano Sud, A22, Brennero highway)
(June 2015)**

Fotovoltaico

PROGETTAZIONE, SINTESI E CARATTERIZZAZIONE DI MOLECOLE E POLIMERI AROMATICI ED ETEROAROMATICI



progettazione

e

sintesi



caratterizzazione



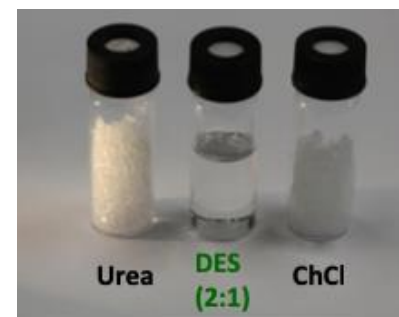
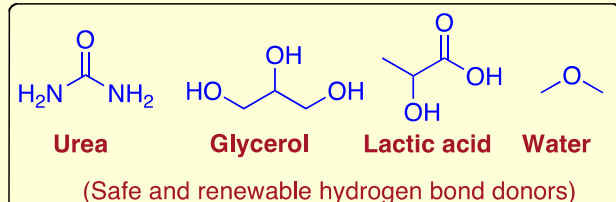
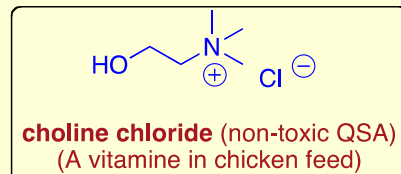
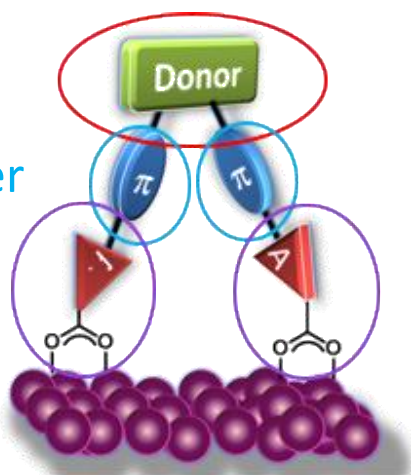
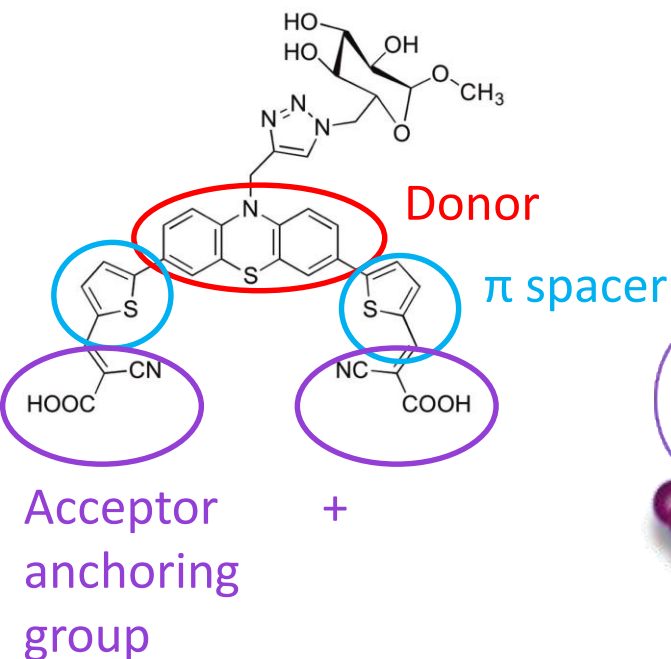
dispositivo



applicazione



SENSIBILIZZATORI A BASE AROMATICA ED ETEROAROMATICA



ELETROLITI A BASE ACQUOSA

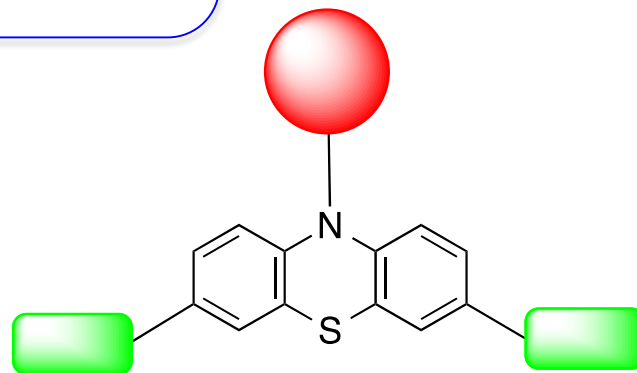
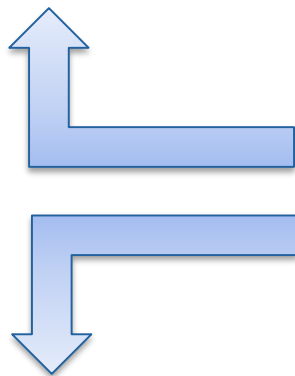
Design of metal free sensitizers

*** Enhancing optical properties and light harvesting efficiencies**

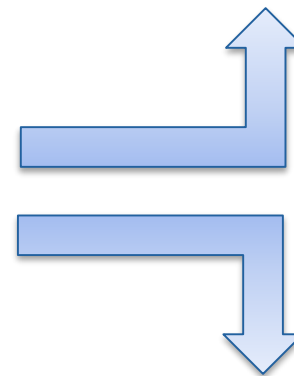
» Introduction of π spacers between D and A groups

*** Enhancing wettability**

» Hydrophilic groups



phenothiazine scaffold



*** Enhancing the stability of bonding with TiO_2 in water**

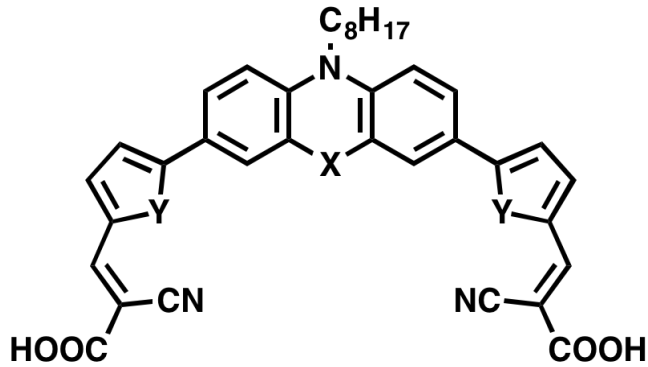
» Different anchoring groups

*** Bio-inspired conjugates**

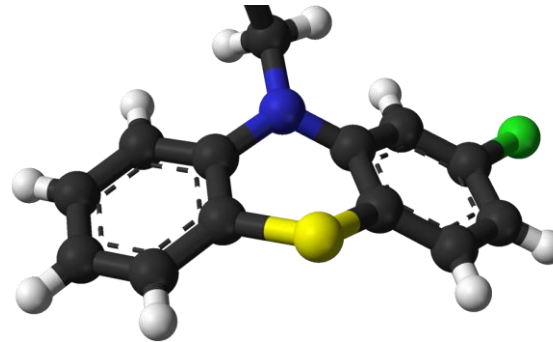
» Sugars, Hydrogenases

WORK AT MIB-SOLAR:

metal-free dye-sensitized photocatalysis to hydrogen

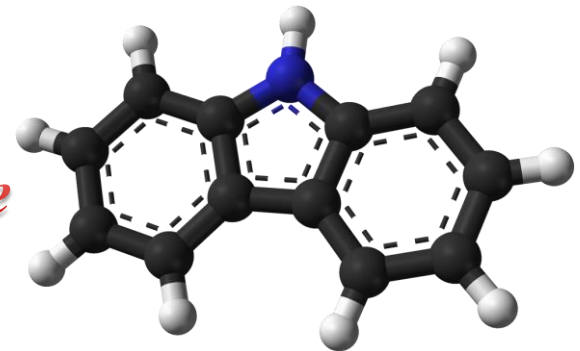


Phenothiazine/ Phenoxazine

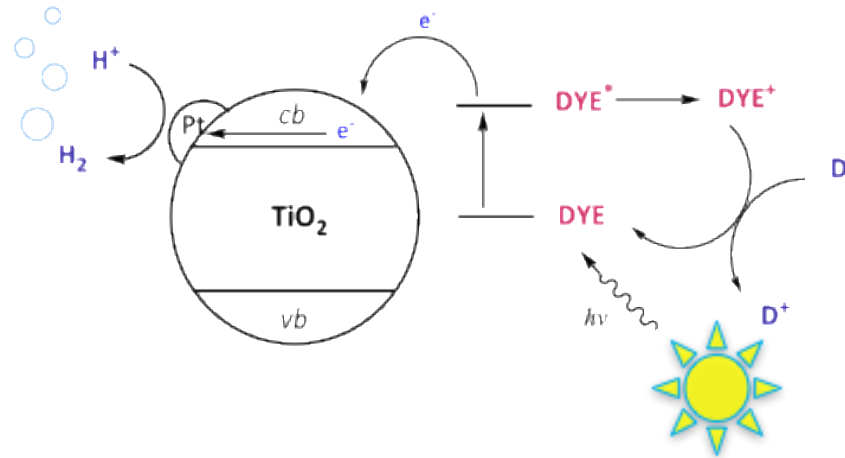


Bended core

Planar core



Carbazole

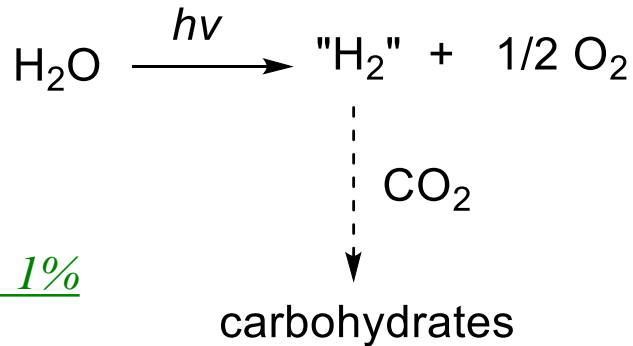


Introduction:

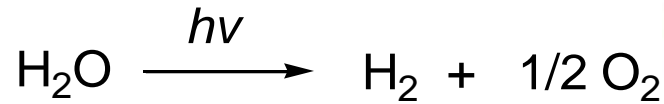
Natural vs Artificial Photosynthesis

Natural Photosynthesis

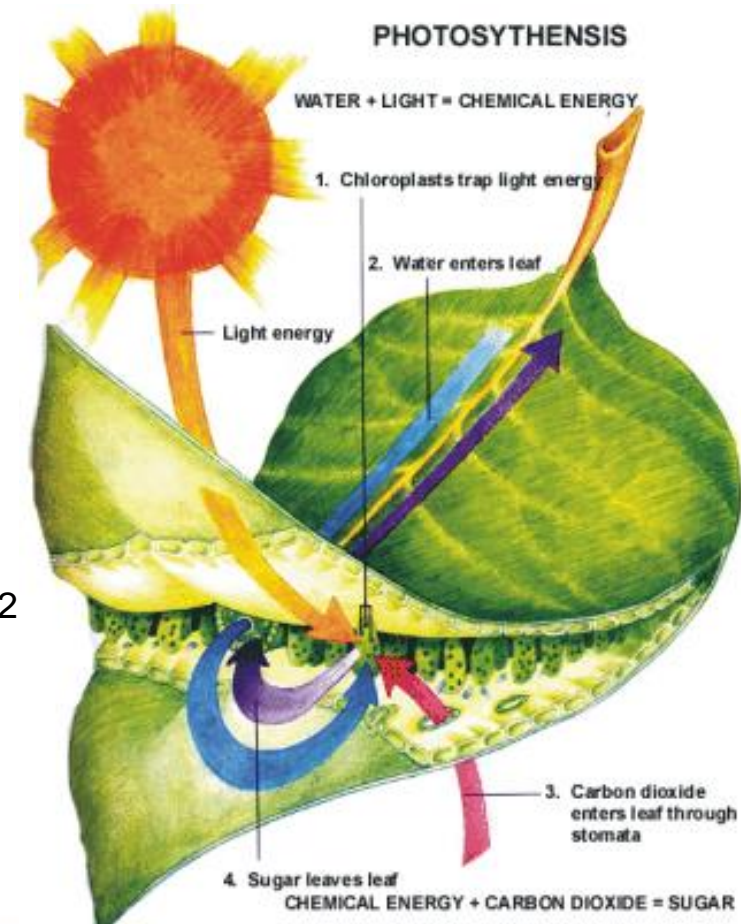
Solar efficiencies < 1%



Artificial Photosynthesis

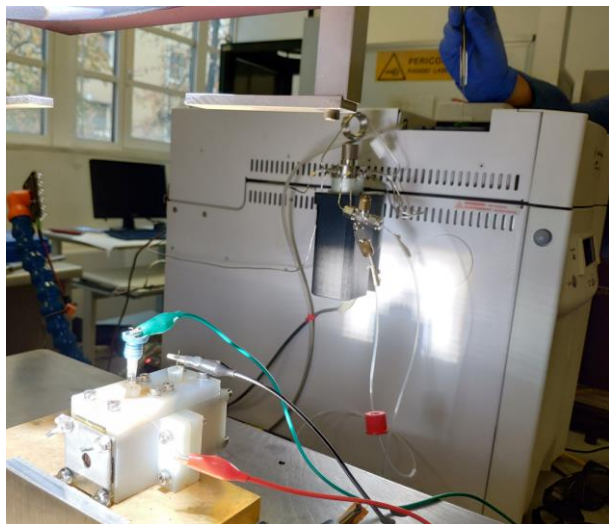
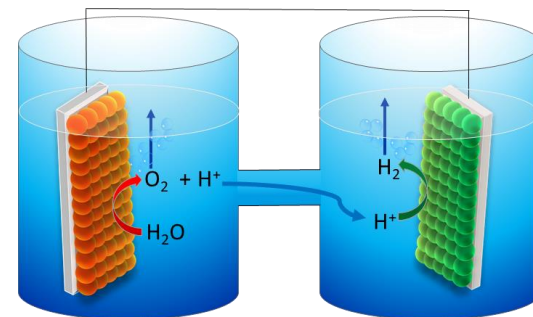
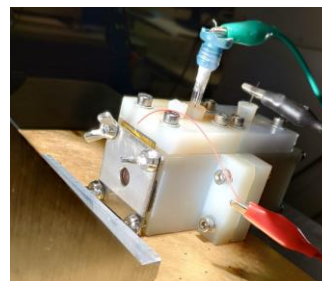
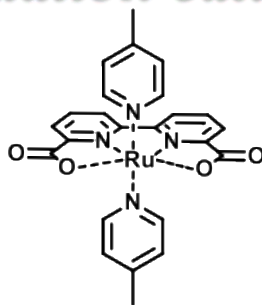
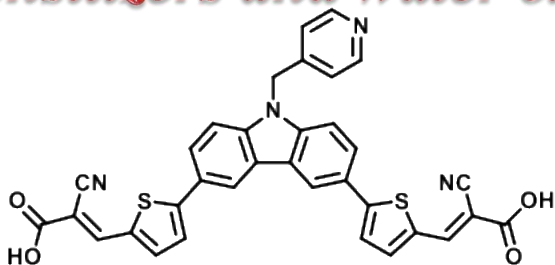


THE CHEMICAL CHALLENGE:
 Increase efficiency of multi-electron
 multi-proton transformations

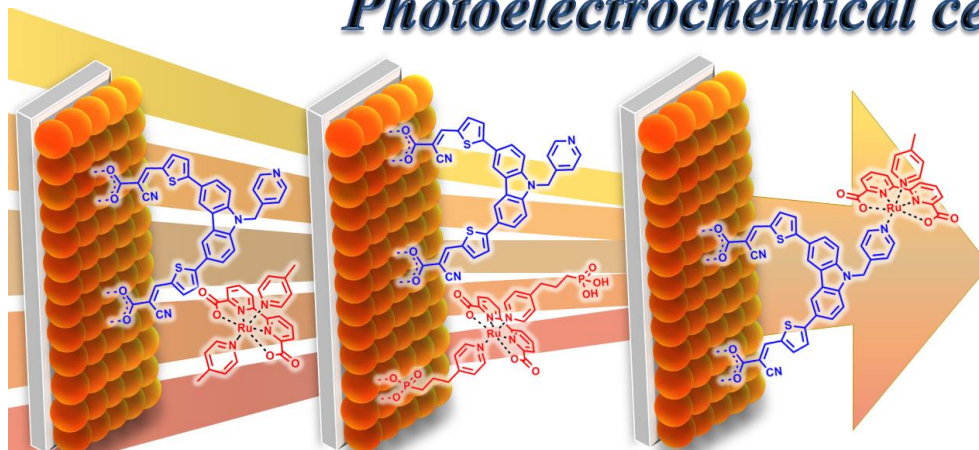


metal-free dye-sensitized photoelectrochemistry to hydrogen

Sensitizers and water oxidation catalyst



Photoelectrochemical cell



Roadmap to artificial leaf