About OMICS Group

OMICS Group International is an amalgamation of Open Access publications and worldwide international science conferences and events. Established in the year 2007 with the sole aim of making the information on Sciences and technology 'Open Access', OMICS Group publishes 400 online open access scholarly journals in all aspects of Science, Engineering, Management and Technology journals. OMICS Group has been instrumental in taking the knowledge on Science & technology to the doorsteps of ordinary men and women. Research Scholars, Students, Libraries, Educational Institutions, Research centers and the industry are main stakeholders that benefitted greatly from this knowledge dissemination. OMICS Group also organizes 300 International conferences annually across the globe, where knowledge transfer takes place through debates, round table discussions, poster presentations, workshops, symposia and exhibitions.

About OMICS Group Conferences

OMICS Group International is a pioneer and leading science event organizer, which publishes around 400 open access journals and conducts over 300 Medical, Clinical, Engineering, Life Sciences, Pharma scientific conferences all over the globe annually with the support of more than 1000 scientific associations and 30,000 editorial board members and 3.5 million followers to its credit.

OMICS Group has organized 500 conferences, workshops and national symposiums across the major cities including San Francisco, Las Vegas, San Antonio, Omaha, Orlando, Raleigh, Santa Clara, Chicago, Philadelphia, Baltimore, United Kingdom, Valencia, Dubai, Beijing, Hyderabad, Bengaluru and Mumbai.

Chemiluminescent Determination of Hydrogen Peroxide using Fe^{III}-TAML activator, a Potent Peroxidase Mimicking Enzyme

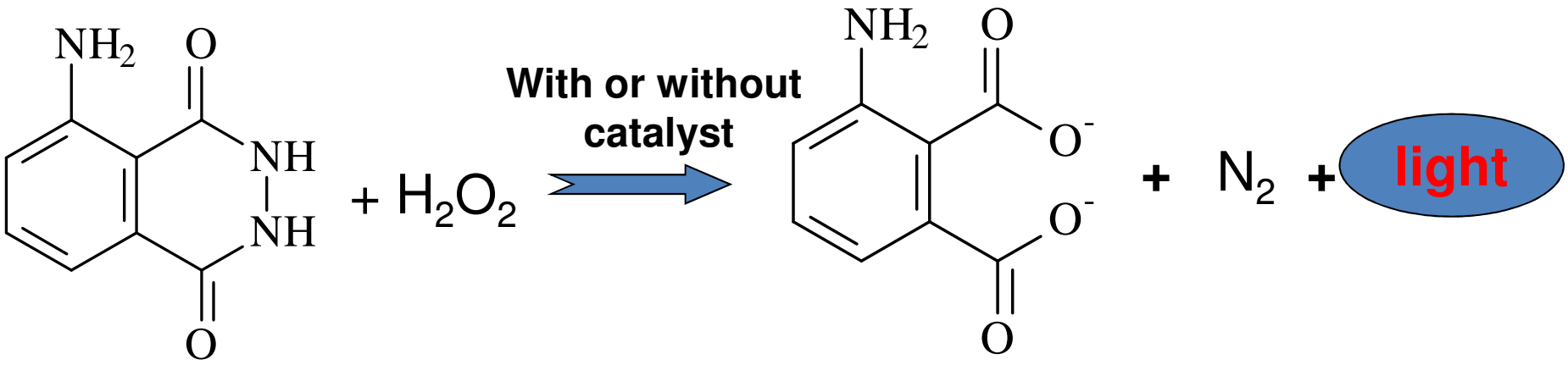


Ivan Sakharov

Lomonosov Moscow State University,

Russia

Scheme of formation of chemiluminescence upon oxidation of luminol



LUMINOL

3-aminophthalate

Horseradish peroxidase, HRP

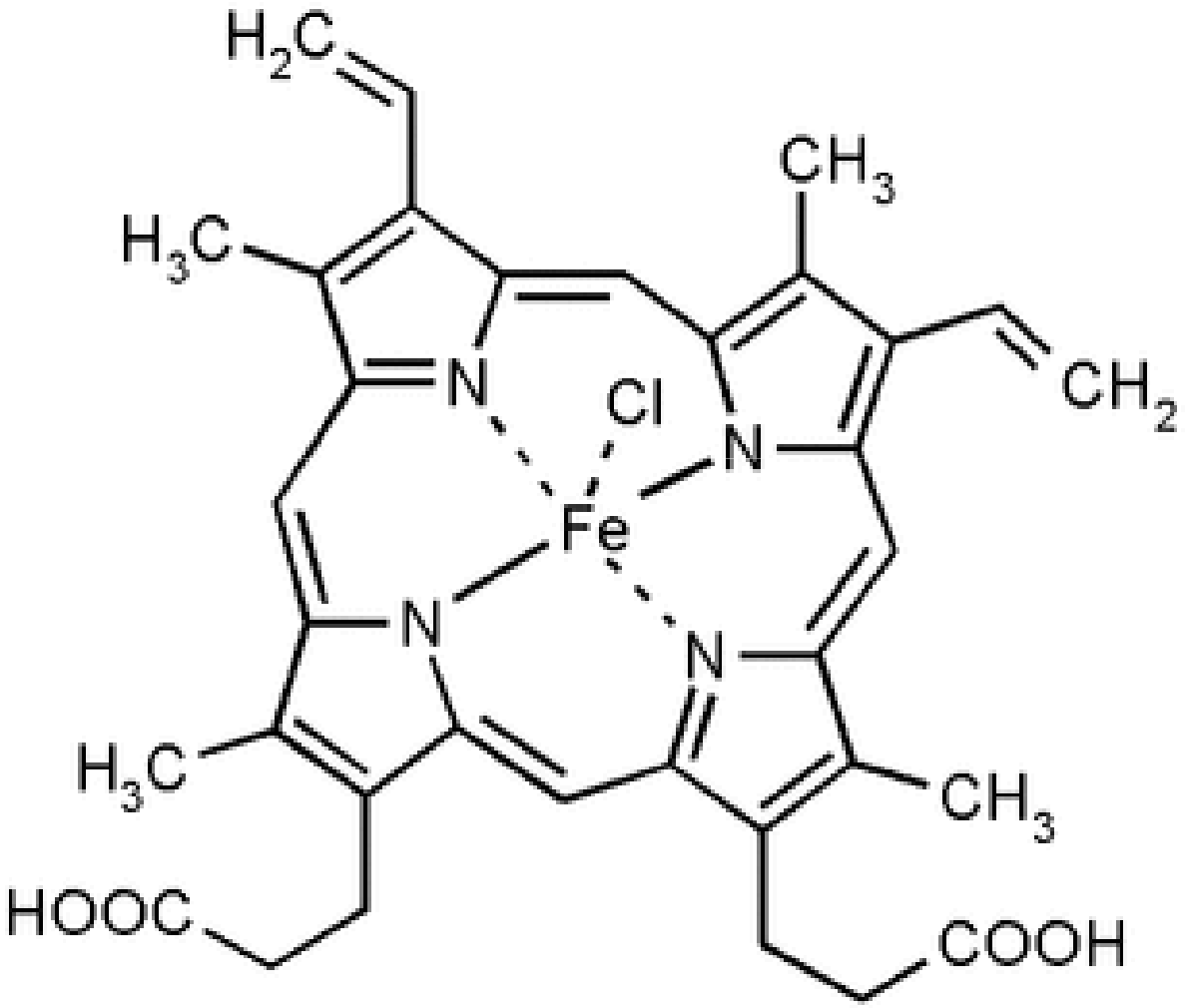


Advantages
-High activity
-Low background (pH 8.3-8.6)

Disadvantages
- High cost
- Low stability

Horseradish roots

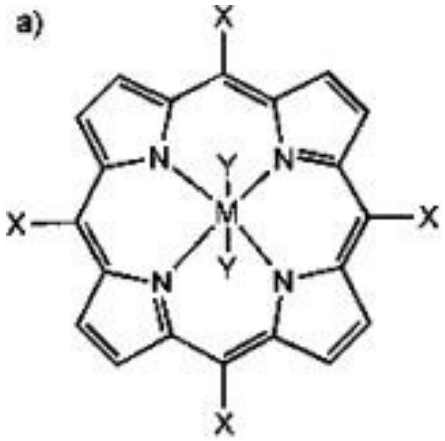
Mimetics of peroxidase



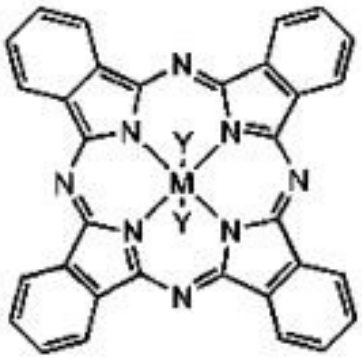
hemin

Derivatives of porphirin as HRP mimetics

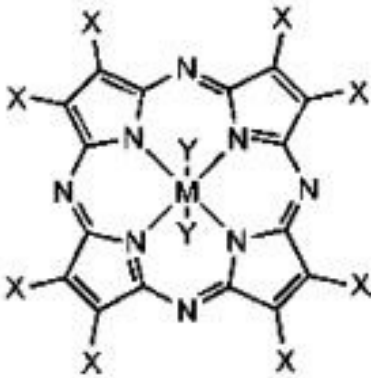
a)



Metalloporphyrin

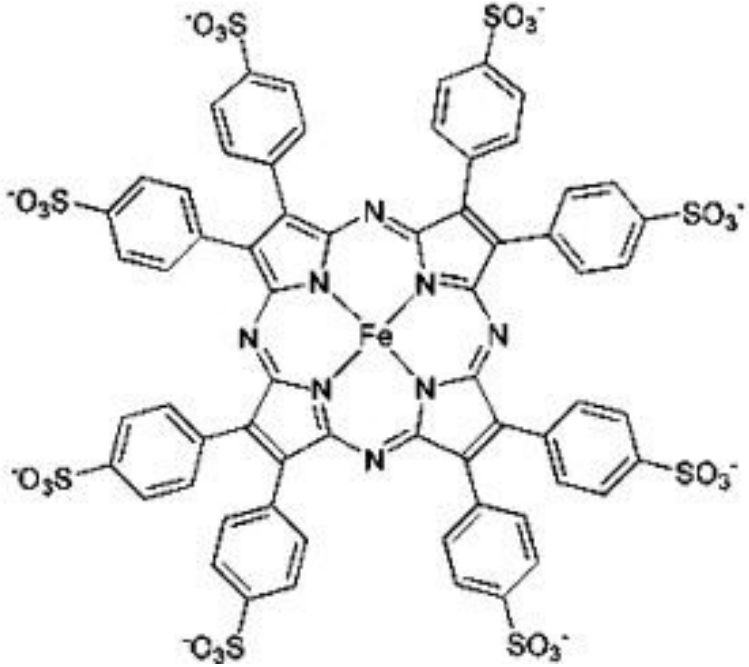


Metallophtalocyanine



Metalloporphyrazine

b)



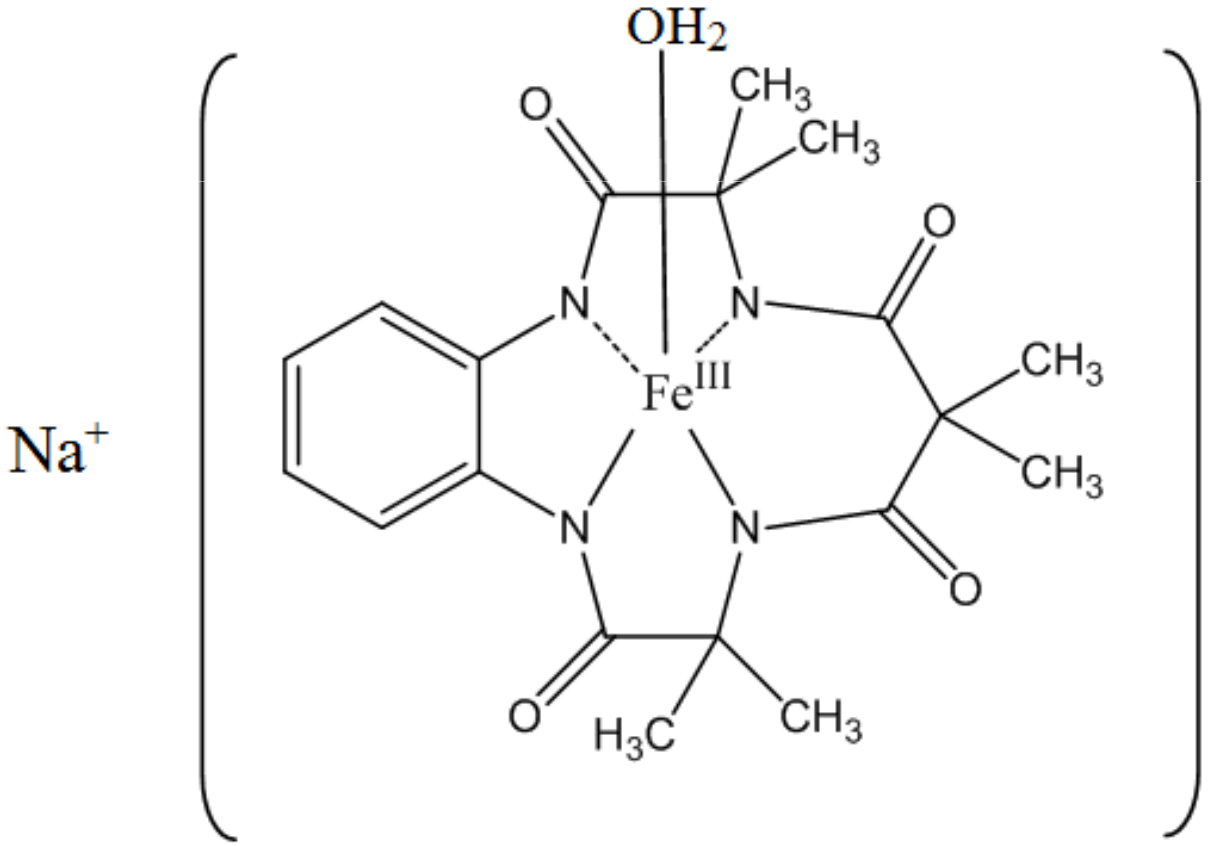
nanoparticles

(Fe_3O_4, CuO, TiO_2, Ag, WS_2)

New mimetic of peroxidase

Fe^{III}–TAML activator of peroxide (TAML)

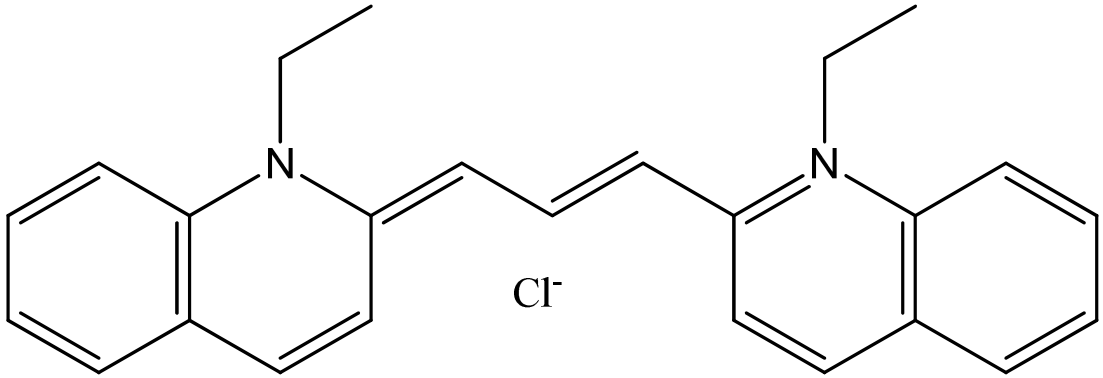
TAML – tetraamido macrocyclic ligand



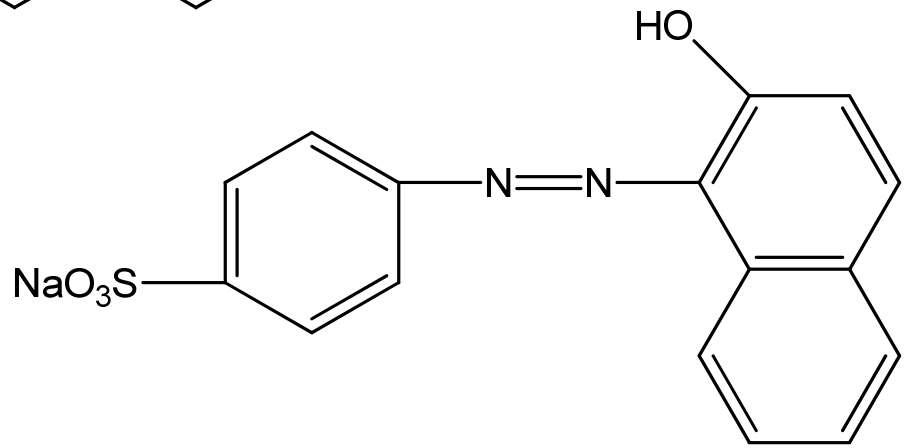
Prof. Terrence Collins
Carnegie Mellon University, USA

Fe^{III}–TAML activator is produced by GreenOx Catalysts, USA

Environmental compounds used successfully by Collins et al. as substrates of Fe^{III}–TAML activator



Pinocyanol chloride



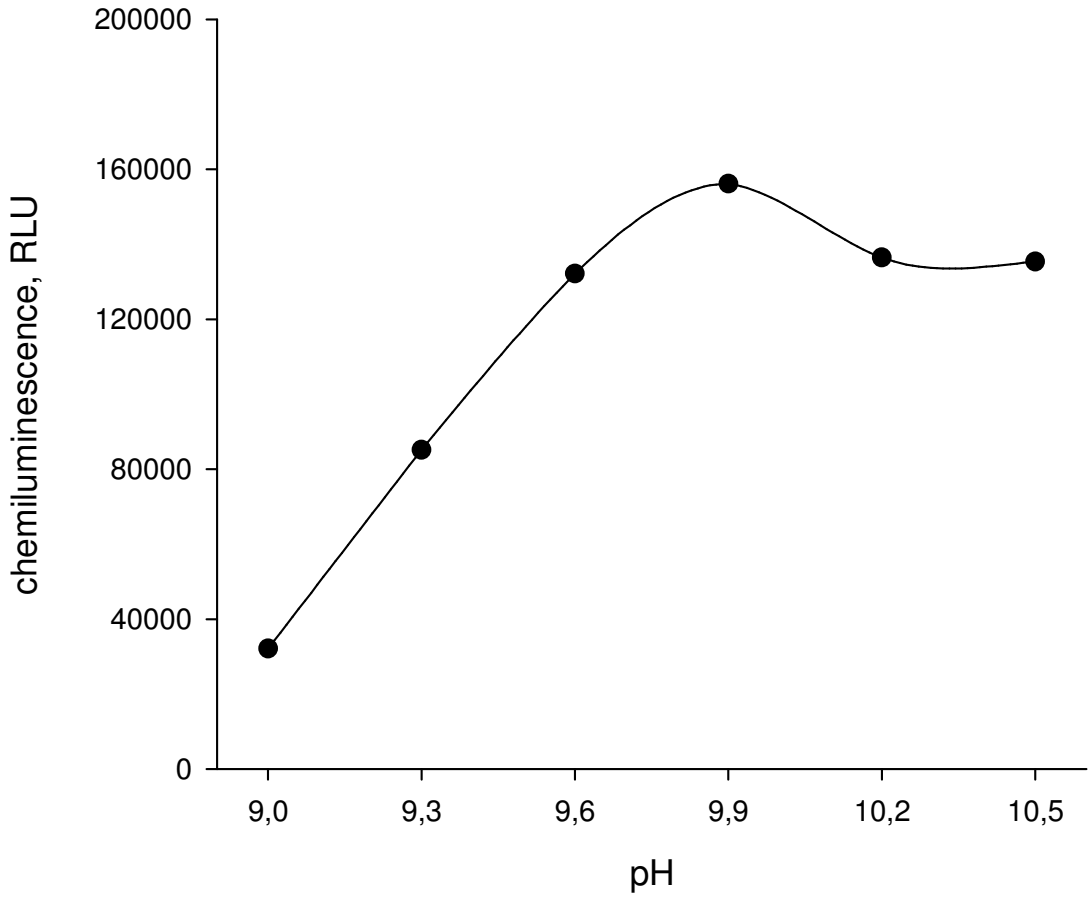
Orange II

First task of our work was to find an answer, on the question, whether Fe^{III}–TAML activator catalyzes the oxidation of limunol with hydrogen peroxide?

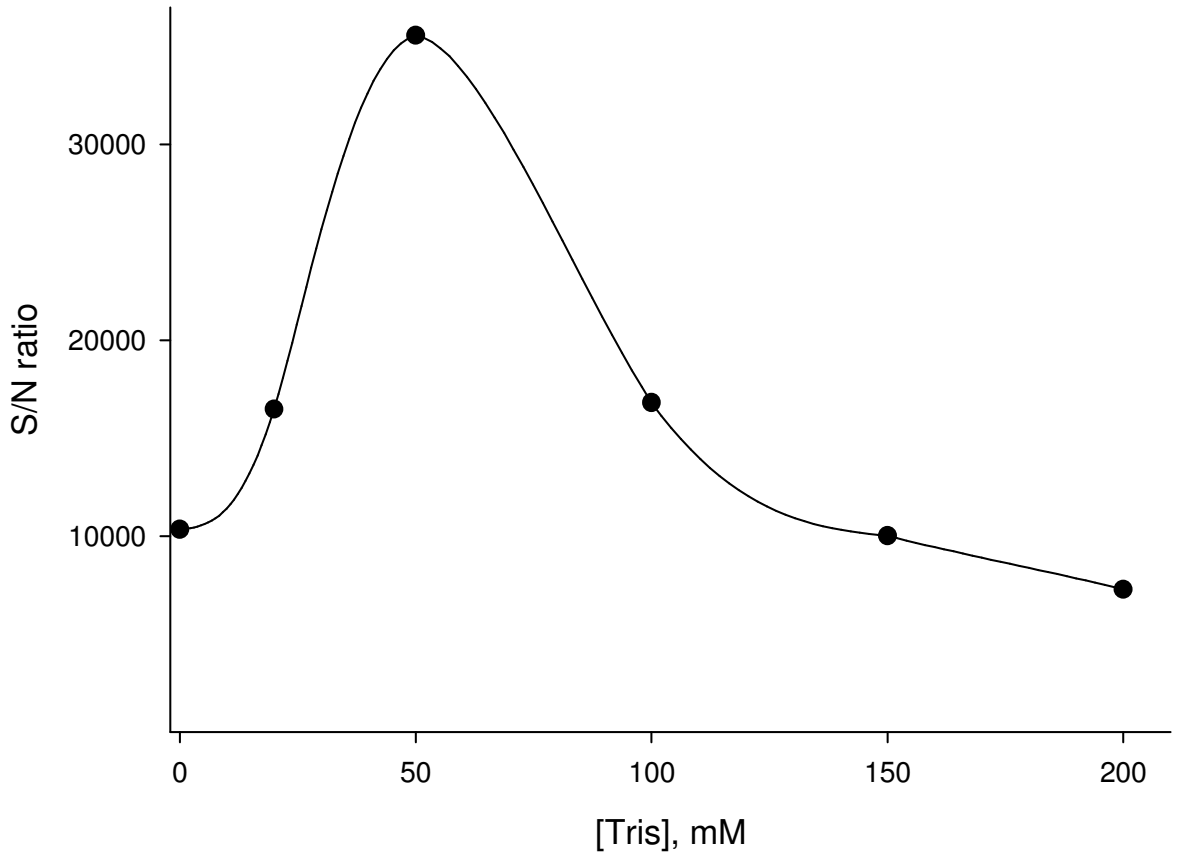
Luminol + hydrogen peroxide $\xrightarrow{\text{TAML}}$



Optimization of experimantal conditions of Fe(III)–TAML activator catalyzed-oxidation of luminol



Optimization of experimantal conditions of Fe(III)–TAML activator catalyzed-oxidation of luminol



Optimized conditions for performance of Fe(III)–TAML activator catalyzed-oxidation of luminol

20 мM carbonate buffer, pH = 9.9

with 50 мM Tris

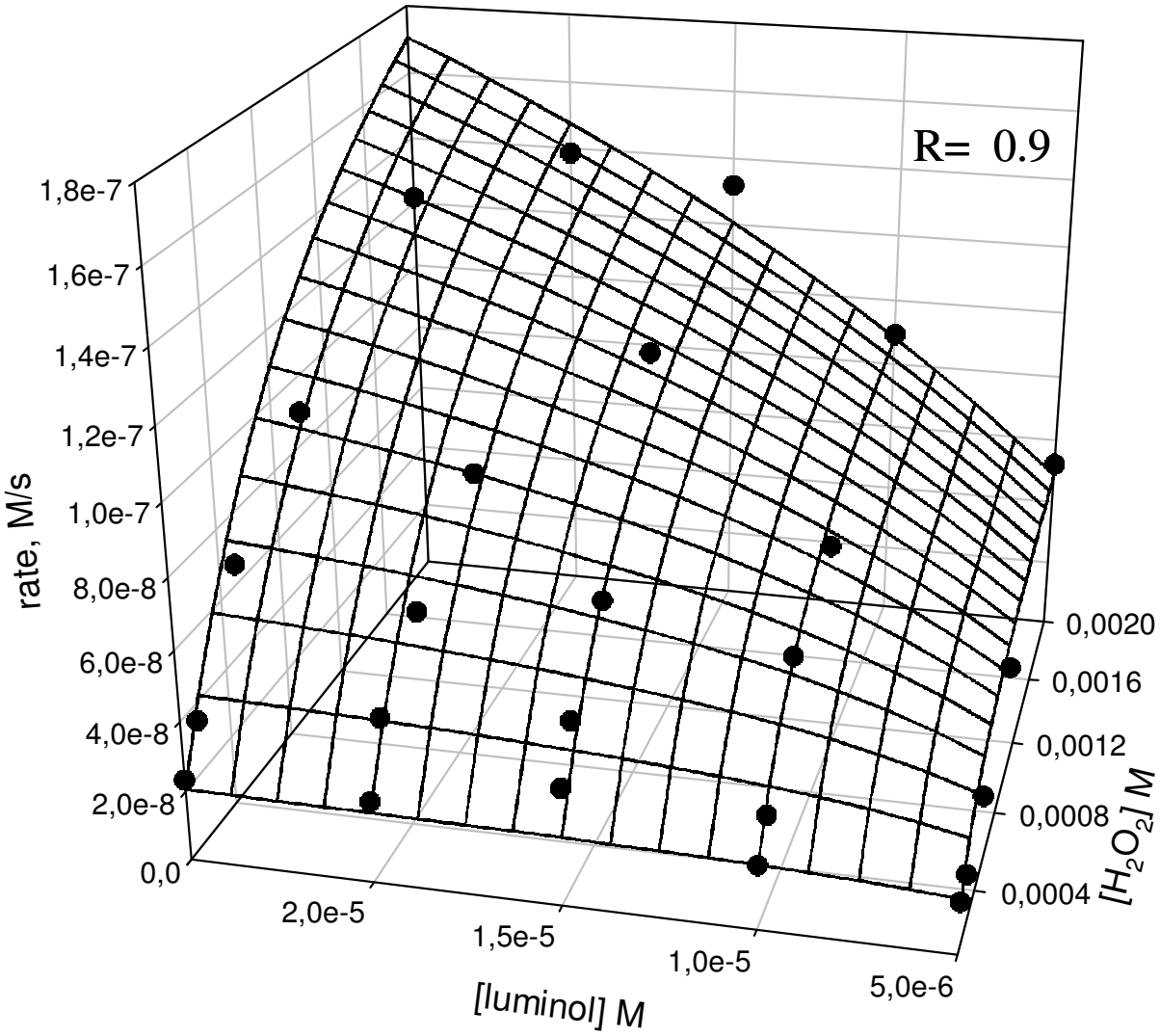
Efficiency of catalysis of Fe^{III}–TAML activator in the reaction of luminol oxidation

$$Fe^{III}\text{-TAML} + H_2O_2 \xrightarrow{k_I} \text{oxidized TAML}$$

$$\text{oxidized TAML} + \text{luminol} \xrightarrow{k_{II}} Fe^{III}\text{-TAML} + \text{product(s)} + \text{light}$$

Under steady state conditions
we have the following equation:

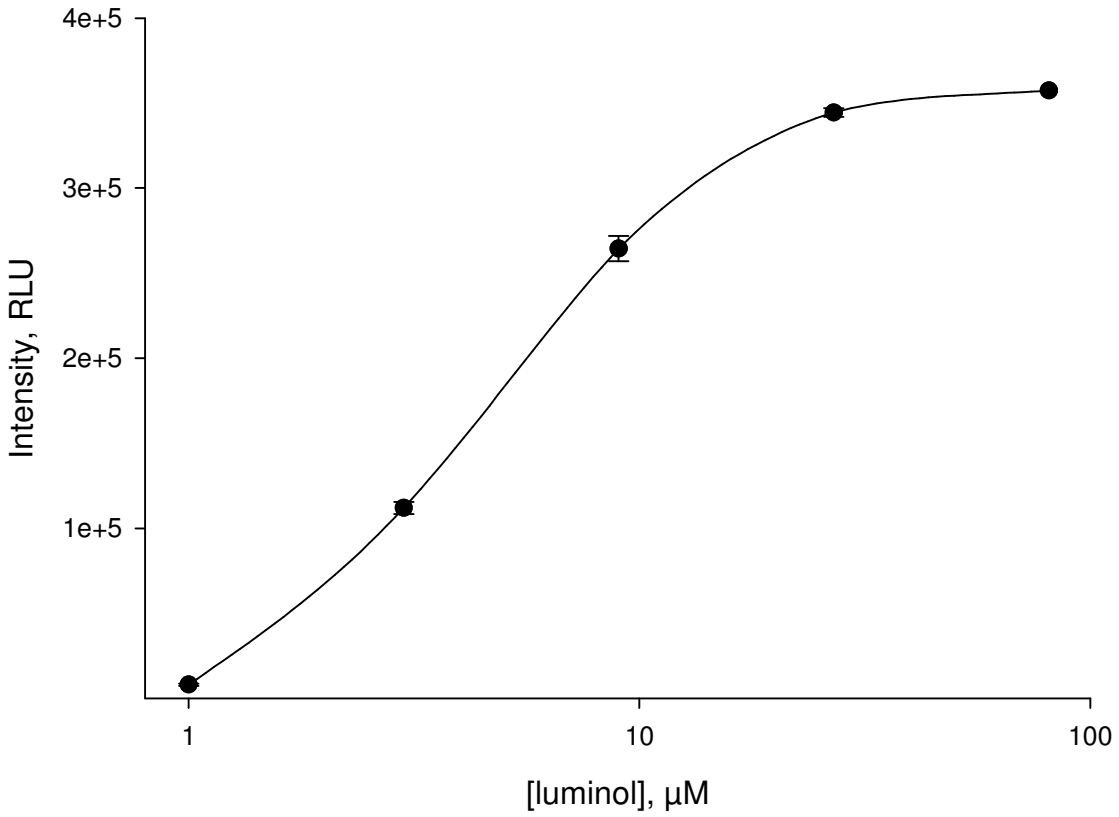
$$-\frac{d[\mathbf{luminol}]}{dt} = \frac{k_I k_{II}[\mathbf{1a}][\mathbf{peroxide}][\mathbf{luminol}]}{k_I[\mathbf{peroxide}] + k_{II}[\mathbf{luminol}]}$$



$k_I = 2250\ M^{-1}c^{-1}$

$k_{II} = 1 \times 10^5\ M^{-1}c^{-1}$

Development of chemiluminescent assay for determination of hydrogen peroxide using Fe(III)–TAML activator

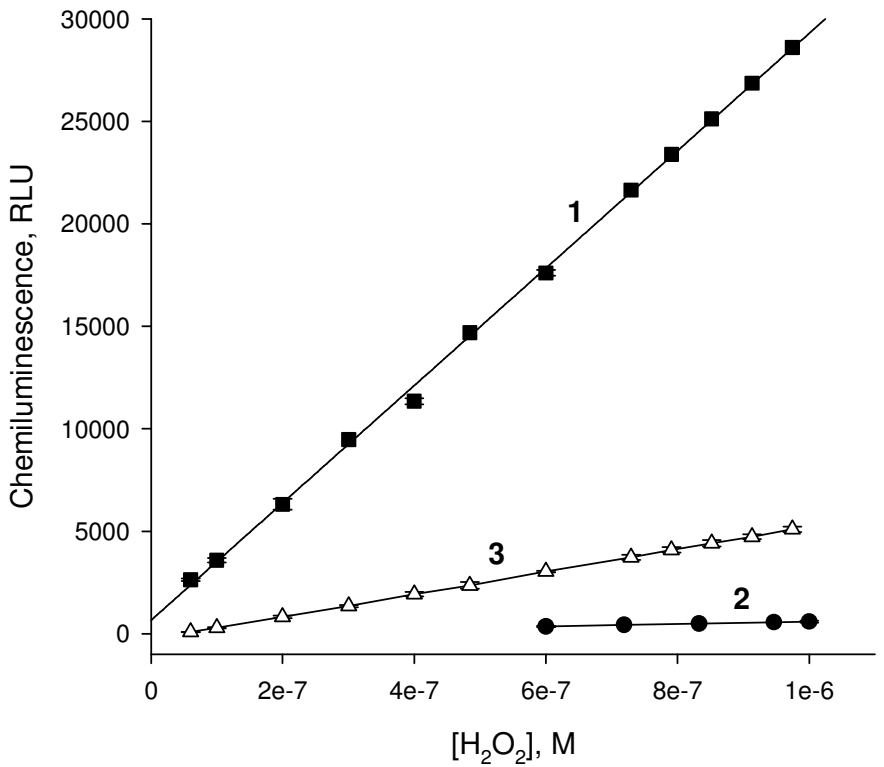


20 мМ carbonate buffer, pH = 9.9

[Tris] = 50 мМ

[Luminol] = 27 μM

Calibration curves for determination of hydrogen peroxide using Fe(III)-TAML (1), hemin (2) and HRP (3)



	Fe^{III}-TAML	Hemin	HRP
Sensitivity, RLU/M	10^{11}	2 x 10^{9}	2 x 10^{10}
Detection limit, μM	0,05	0,6	0,1
Working range, μM	0,06 – 1	0,6 – 1	0,1 – 1

CONCLUSIONS

1. **Fe^{III}-TAML is the potent peroxidase mimic in chemiluminescent oxidation of luminol with hydrogen peroxide**

2. **Using Fe^{III}-TAML the sensitive chemiluminescent method for the determination of hydrogen peroxide has been developed**

These results open good perspectives to apply Fe^{III}–TAML activator in analytical methods instead HRP

The results of this presentation have been published in Talanta 125 (2014) 361–365

I thank my coworkers

from Lomonosov Moscow State University, Russia

Dr. Marina Vdovenko

Alexandra Demyanova

Kiril Kopylov

THANK YOU

for

your attention