Prof. Enzo Alessio
Curriculum Vitae, and of Scientific and Didactic Activity

Updated February 2017

EDUCATION AND PROFESSIONAL CAREER

1982	Master Degree (*cum laude*) in Chemistry (University of Trieste, Italy)
1983-1984	Research fellow at the Department of Chemistry, University of Trieste
1985	Research Associate at the *Istituto Guido Donegani* of Novara, research center of the chemical company Montedison SpA
1989	Ph. D. in Chemistry (University of Ferrara, Italy, jointly with Trieste and Venice)
1990-2000	Assistant Professor of Inorganic Chemistry (Faculty of Sciences, University of Trieste)
1991-1992	Postdoctoral researcher (recipient of a NATO-CNR Fellowship) at Emory University, Atlanta (USA), supervisor Prof. Luigi G. Marzilli
2000-present	Associate Professor of Inorganic Chemistry (Faculty of Sciences, University of Trieste).
2005-2009	Director of the Ph D Course in Molecular Sciences of the University of Trieste.
2006-2012	Director of the Ph D School in Chemical and Pharmaceutical Sciences and Technologies of the University of Trieste.
2008 (1 month)	Visiting Professor, Universitè Louis Pasteur, Strasburg (France)
2008-present	Responsible for the NMR facility of the Department
2011-2012	Vice-director of the Department of Chemical and Pharmaceutical Sciences.
2012-2016	Member of the Board of Professors of the Ph D School in Chemistry (in conjunction with the University of Venice since 2014).
2013	National scientific qualification (*Abilitazione Scientifica Nazionale*) to function as Full Professor in the area 03/B1 (*Fondamenti delle Scienze Chimiche e Sistemi Inorganici*) and 03/B2 (*Fondamenti Chimici delle Tecnologie*). The evaluations, copied by the official website (Sito Docente), are reported below.
2014-2016	Department delegate for scientific research
2016 (6 months)	Visiting professor at the University of Zurich (Switzerland)

03/B1 - I FASCIA

ALESSIO ENZO

Indietro

INDICATORI

SETTORE CONCORSUALE	SSD	# ARTICOLI NORMALIZZATI	# CITAZIONI NORMALIZZATE	# INDICE H-C
03/B1		58	191,7	25

Giudizio collegiale:

La Commissione, nel valutare la domanda del Dr. Alessio Enzo per l'abilitazione al ruolo di Professore Ordinario, ha preliminarmente analizzato i 20 lavori scelti dal Candidato, ed avendoli giudicati pertinenti al settore 03/B1 "Fondamenti Delle Scienze Chimiche e Sistemi Inorganici" ha proceduto nella valutazione della domanda, prendendo atto che, in accordo ai dati forniti dal MIUR, il Dr. Alessio Enzo risulta aver superato tre sui tre parametri definiti dal Decreto Ministeriale n. 76 del 7 giugno 2012. In questo caso, in accordo al Verbale del 21 marzo 2012, la Commissione giudica "soddisfacente ai fini dell'abilitazione l'ottenimento di ulteriori 4 punti derivanti dalla valutazione complessiva delle pubblicazioni e dei titoli diversi dalle pubblicazioni". La Commissione ha proceduto all'analisi quantitativa dei parametri definiti nel succitato Verbale per le pubblicazioni scientifiche e il parametro l1) dei titoli diversi dalle pubblicazioni.
La produzione scientifica del Candidato è stata giudicata eccellente (10 punti) e la sua capacità di guidare la ricerca eccellente (10 punti). La Commissione ha, quindi, proceduto all'analisi delle altre voci del Curriculum: anche sulla base dei criteri presentati dalla Commissione nel Verbale del 21 marzo 2012, il CV complessivo è stato giudicato eccellente. Sulla base dell'analisi completa delle pubblicazioni, del CV e dei criteri adottati, poiché il candidato ha ottenuto più dei 4 punti richiesti, la Commissione all'unanimità giudica che il Dr. Alessio Enzo sia idoneo a ricoprire il ruolo di Professore Ordinario.

03/B2 - I FASCIA

ALESSIO ENZO

Indietro

INDICATORI

SETTORE CONCORSUALE	SSD	# ARTICOLI NORMALIZZATI	# CITAZIONI NORMALIZZATE	# INDICE H-C
03/B2		58	191,7	25

Giudizio collegiale:

Il candidato Alessio Enzo ha condotto ricerche prevalentemente nell'ambito della chimica organometallica, con particolare attenzione allo studio di composti antitumorali.
Sulla base di una valutazione analitica della produzione scientifica e dei titoli prodotti, realizzata secondo i criteri e parametri adottati dalla commissione, i commissari hanno individuato qualificandoli i tratti salienti della produzione scientifica e dei titoli del candidato nelle loro valutazioni individuali (da considerarsi parte integrante della presente valutazione collegiale) e maturato come segue il loro giudizio complessivo: tre commissari hanno espresso sul candidato un giudizio positivo, due estremamente positivo. Il giudizio collegiale sulla produzione scientifica ed i titoli del candidato è pertanto positivo.
Per quanto riguarda gli indicatori bibliometrici, il candidato supera tutti i valori delle mediane di riferimento per il settore concorsuale 03/B2 per gli aspiranti professori di I fascia.
In conseguenza di quanto sopra la commissione unanime ritiene che il candidato possa essere abilitato per la I fascia di docenza del settore concorsuale 03/B2.

AWARDS

1985 *Stampacchia Award* for the first publication in the field of Chemistry.
1996 *Nasini Award* from the Italian Chemical Society for young researchers (age < 40) in Inorganic Chemistry.

INTERNATIONAL NETWORKING

1995-2001 Coordinator of the Working Group (WG) COST 'The development of ruthenium antitumor compounds' (COST Chemistry Action D1 1995–97 and COST Action D8 1997–2001).
2000-2006 Coordinator of WG 'Design of novel, innovative metal anticancer drugs' (COST Chemistry Action D20 'Metal compounds in the treatment of cancer and viral diseases').
2000-2003 **Vice-Chairman** of COST Chemistry Action D20.
2003-2006 **Chairman** of COST Chemistry Action D20.
2004-2009 Coordinator of WG 'Metal-mediated nanoscopic assemblies of chromophores for molecular electronics, light energy conversion, and molecular recognition' (COST Chemistry Action D31 'Organising Chemical Systems with Selected Functions').
2005-2010 Italian representative in the Management Committee and coordinator of WG 'Ruthenium anticancer compounds' (COST Chemistry Action D39 'Metallo-Drug Design and Action').

2012-2016 Italian representative in the Management Committee and participant to WG 'Metal bioconjugates for targeting and delivery' (COST Chemistry Action CM1105 'Functional metal complexes that bind to biomolecules').

EDITORIAL ACTIVITY

2005-2012 Member of the International Advisory Board of the *European Journal of Inorganic Chemistry*

2007-present Member of the International Advisory Board of the *South African Journal of Chemistry*

2012-2016 Member of the Editorial Board of the *Journal of Inorganic Biochemistry*

2012-present Member of the Editorial Board of the *European Journal of Inorganic Chemistry*

2014-present Member of the Editorial Board of *Inorganica Chimica Acta*

REFEREEING AND EVALUATION ACTIVITY

- I regularly act as reviewer for several Chemistry ISI Journals (an average of 60-70 manuscripts per year). In September 2015 – based on the number of reports provided in the previous 12 months – I was nominated "*Outstanding Reviewer*" (i.e. top 5% of reviewers) by ChemPubSoc Europe, the Asian Chemical Editorial Society (ACES), and the publisher, Wiley-VCH.
- I was/am in the evaluation panel of national and international research proposals for public and private Institutions.
  - Public: PRIN and FIRB Projects and VQR for the Italian Ministry of University, ANR (France), CNRS (France), ERA-Chemistry (EU), FCT (Portugal), NWO (The Netherlands), National Science Foundation (USA).
  - Private: FRC foundation (France), Genesis Oncology Trust (New Zealand), Italian-French University, ICREA (Spain).
- I was in the evaluation panel of several PhD students in chemistry in Italy and abroad:
  - University of Leiden (The Netherland, 3 times)
  - University of Strasbourg (France, 2 times)
  - University of Lausanne (Switzerland)
  - University of Dublin (Ireland)
  - Royal College of Surgeons of Dublin (Ireland, 2 times)
  - University of Florence (Italy).
- I was asked to evaluate the career achievements (for promotion) of researchers from Warwick University (UK), Dublin University and Royal College of Surgeons (Ireland), University of Strasburg (France), University of Leiden (The Netherlands).

2013 Appointed as expert by the EU-Research Executive Agency (REA) for the mid-term evaluation of two ITN Networks (acronyms: RADIOMI and TRACEnTREAT) within FP7-PEOPLE-2013-ITN.

2015 Appointed member of the Chemistry Panel by the Portuguese *Fundação para a Ciência e a Tecnologia* (FCT) for the evaluation process in the 4th "FCT Investigator" call (see http://www.fct.pt/apoios/contratacaodoutorados/investigador-fct/avaliacao).

2016 Appointed as expert by the EU-Research Executive Agency (REA) for the evaluation of the individual proposals submitted within the work programme Marie Sklodowska-Curie 2016-2017 (H2020-MSCA-IF-2016).

2017 Appointed as expert by the EU-Research Executive Agency (REA) for the mid-term evaluation of the ITN Network MULTI-APP within H2020.

2017 Appointed as expert by the EU-Research Executive Agency (REA) for the final evaluation of the ITN Network RADIOMI within FP7-PEOPLE-2013-ITN.

TEACHING ACTIVITIES

Since 1992 I have been teaching different courses of Inorganic Chemistry – including organometallic, bioinorganic, and supramolecular chemistry – to undergraduate, master and Ph D students in Chemistry. In the last 5 years my teaching activity was the following:

- *Chimica inorganica con laboratorio*. Laurea Triennale in Chimica (7 out of 11 CFU, laboratory not included)
- *Chimica inorganica e bioinorganica*. Laurea Magistrale in Chimica (6 CFU). The "inorganic chemistry" part (3 CFU) was attended also by the students of Chimica inorganica e dello stato solido.
- *Metalli in medicina*. Dottorato in Chimica (15h); from the 2016-2017 academic year, this will become an optional course for the students of Pharmacy and Chemical and Pharmaceutical Technology.

My yearly didactic evaluations from the students are of public domain (see https://valmon.disia.unifi.it/sisvaldidat/units/).

MENTORING ACTIVITIES

- B Sc students in Chemistry: > 10
- M Sc. students in Chemistry: > 35
- Ph D students in Chemistry (4):
  - Dr. Elisabetta Iengo (now Associate Professor of Inorganic Chemistry in my Department)
  - Dr. Barbara Serli (now employed in the US)
  - Dr. Massimo Casanova (now employed in The Netherlands)
  - Federica Battistin (in progress)
- Postodoctoral fellows, national and international:
  - Dr. Martin Henn (from Germany, now employed in Germany)
  - Dr. Sarah Heath (from UK, now Associate Professor at the University of Manchester)
  - Dr. Elisabetta Iengo (see above)
  - Dr. Barbara Serli (see above)
  - Dr. Ioannis Bratsos (from Greece, 4 years, now at Demokritos Research Institute in Athens)
  - Dr. Stefanie Jedner (from Germany, 2 years, now employed in Austria)
  - Dr. Ana Rilak (from Serbia, now research associate at the University of Kragujevac)
- Over the years I hosted in my group several foreign Ph D students and postdoctoral fellows (weeks to months) in the context of COST and other international collaborations. An incomplete list follows:
  - Prof. Vadim Yu. Kukushkin (from Russia)
  - Dr. Aldrik Velders (from The Netherland, now full professor at the University of Wageningen, NL)
  - Dr. Iztok Turel (from Slovenia, now full professor of General Chemistry at the University of Ljubljana)
  - Dr. Anna Hotze (from The Netherlands, now at OctoPlus pharmaceutical company in Leiden, NL)
  - Dr. Darren Griffith (from Ireland, now research associate at the Royal College of Surgeons in Dublin).
  - Dr. Ioannis Bratsos (from Greece, see above)
  - Dr. Crystine Scolaro (from Switzerland)
  - Dr. Jakob Cljun (from Slovenia, now research associate at the University of Ljubljana)

THIRD MISSION AND PUBLIC–ORIENTED ACTIVITIES

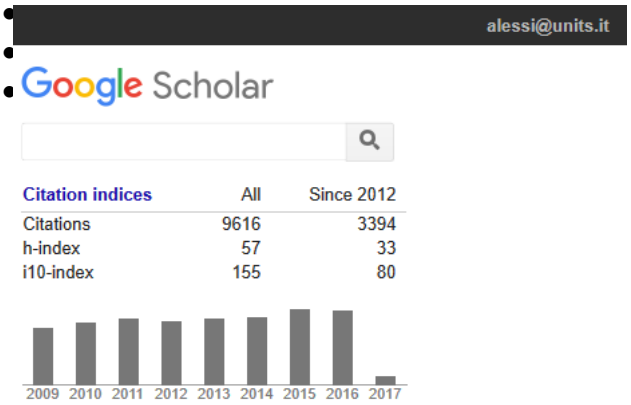
For several years (at least 10) I gave conferences (2-4 per year) in high schools in the Friuli-Venezia Giulia region and was actively involved in the "Permanent Laboratory" initiative, in which classes from high schools were hosted into the teaching laboratories of the Department for performing chemical experiments. In October 2011 I was a speaker within the festival "ELEMENTA" organized by the *Immaginario Scientifico* in Pordenone, October 12-16 (see http://www.immaginarioscientifico.it/2011/elementa).

.

PUBLICATIONS

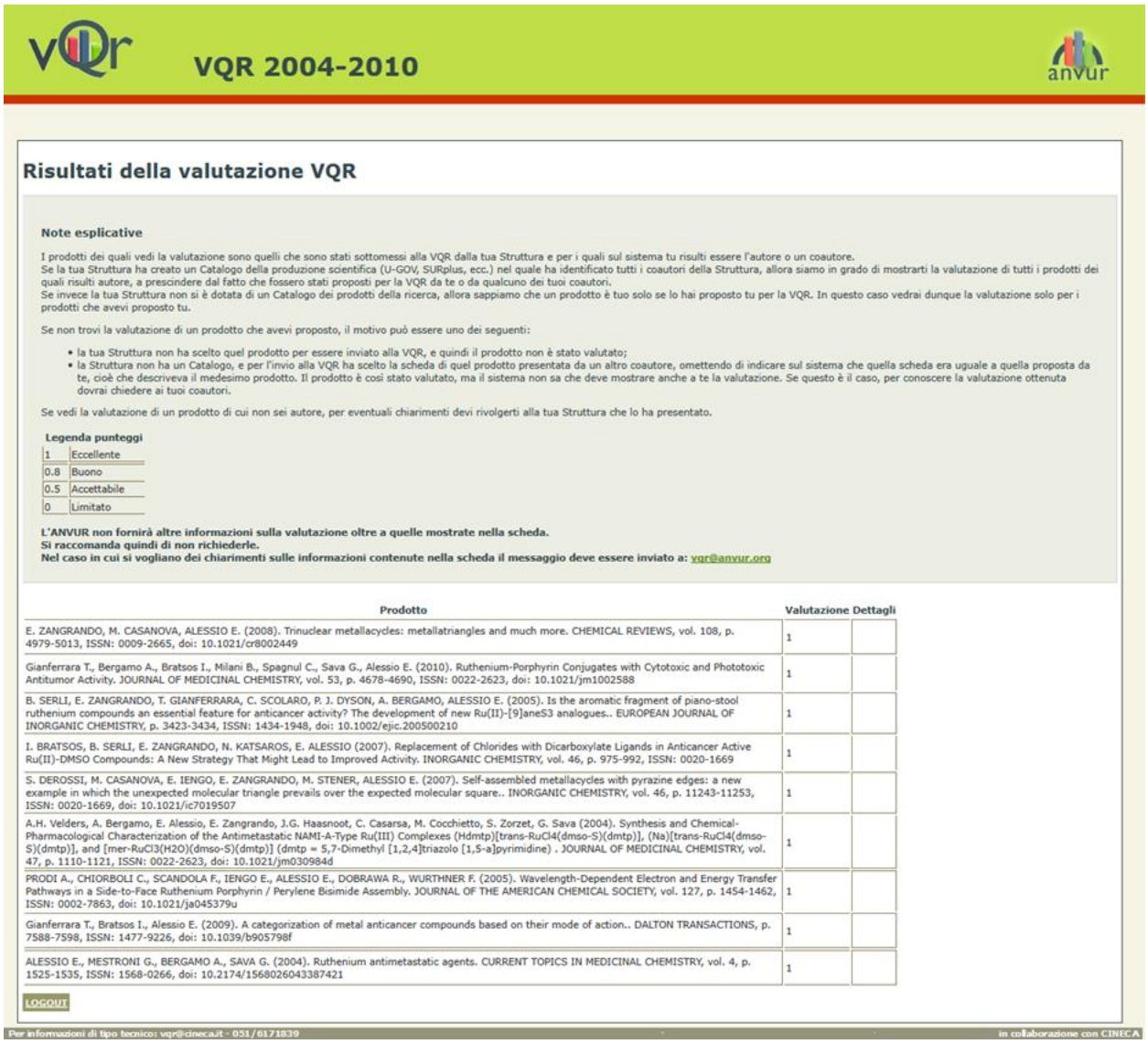
I am (co)author of 176 publications, including reviews and book chapters, in the fields of coordination and organometallic chemistry, supramolecular chemistry, and anticancer metal compounds and of 10 patents (national and international). The full list is reported in a separate file.

- ***h* index = 57** (Google Scholar, October 2016)
- total number of citations: 9616 (see below)



I rank in position 27 among the Top Italian Scientists, Chemistry (with *h*-index > 30) (http://www.topitalianscientists.org/TIS_HTML/Top_Italian_Scientists_Chemistry.htm)

My VQR 2004-2010 assessment is reported below:



VQR 2004-2010

anvur

Risultati della valutazione VQR

Note esplicative

I prodotti dei quali vedi la valutazione sono quelli che sono stati sottomessi alla VQR dalla tua Struttura e per i quali sul sistema tu risulti essere l'autore o un coautore.
Se la tua Struttura ha creato un Catalogo della produzione scientifica (U-GOV, SURplus, ecc.) nel quale ha identificato tutti i coautori della Struttura, allora siamo in grado di mostrarti la valutazione di tutti i prodotti dei quali risulti autore, a prescindere dal fatto che fossero stati proposti per la VQR da te o da qualcuno dei tuoi coautori.
Se invece la tua Struttura non si è dotata di un Catalogo dei prodotti della ricerca, allora sappiamo che un prodotto è tuo solo se lo hai proposto tu per la VQR. In questo caso vedrai dunque la valutazione solo per i prodotti che avevi proposto tu.

Se non trovi la valutazione di un prodotto che avevi proposto, il motivo può essere uno dei seguenti:

- la tua Struttura non ha scelto quel prodotto per essere inviato alla VQR, e quindi il prodotto non è stato valutato;
- la Struttura non ha un Catalogo, e per l'invio alla VQR ha scelto la scheda di quel prodotto presentata da un altro coautore, omettendo di indicare sul sistema che quella scheda era uguale a quella proposta da te, cioè che descriveva il medesimo prodotto. Il prodotto è così stato valutato, ma il sistema non sa che deve mostrare anche a te la valutazione. Se questo è il caso, per conoscere la valutazione ottenuta dovrai chiedere ai tuoi coautori.

Se vedi la valutazione di un prodotto di cui non sei autore, per eventuali chiarimenti devi rivolgerti alla tua Struttura che lo ha presentato.

Legenda punteggi

1	Eccellente
0.8	Buono
0.5	Accettabile
0	Limitato

L'ANVUR non fornirà altre informazioni sulla valutazione oltre a quelle mostrate nella scheda.
Si raccomanda quindi di non richiederle.
Nel caso in cui si vogliano dei chiarimenti sulle informazioni contenute nella scheda il messaggio deve essere inviato a: vqr@anvur.org

Prodotto	Valutazione	Dettagli
E. ZANGRANDO, M. CASANOVA, ALESSIO E. (2008). Trinuclear metallacycles: metallatriangles and much more. CHEMICAL REVIEWS, vol. 108, p. 4979-5013, ISSN: 0009-2665, doi: 10.1021/cr8002449	1	
Gianferrara T., Bergamo A., Bratsos I., Milani B., Spagnul C., Sava G., Alessio E. (2010). Ruthenium-Porphyrin Conjugates with Cytotoxic and Phototoxic Antitumor Activity. JOURNAL OF MEDICINAL CHEMISTRY, vol. 53, p. 4678-4690, ISSN: 0022-2623, doi: 10.1021/jm1002588	1	
B. SERLI, E. ZANGRANDO, T. GIANFERRARA, C. SCOLARO, P. J. DYSON, A. BERGAMO, ALESSIO E. (2005). Is the aromatic fragment of piano-stool ruthenium compounds an essential feature for anticancer activity? The development of new Ru(II)-[9]aneS3 analogues.. EUROPEAN JOURNAL OF INORGANIC CHEMISTRY, p. 3423-3434, ISSN: 1434-1948, doi: 10.1002/ejic.200500210	1	
I. BRATSOS, B. SERLI, E. ZANGRANDO, N. KATSAROS, E. ALESSIO (2007). Replacement of Chlorides with Dicarboxylate Ligands in Anticancer Active Ru(II)-DMSO Compounds: A New Strategy That Might Lead to Improved Activity. INORGANIC CHEMISTRY, vol. 46, p. 975-992, ISSN: 0020-1669	1	
S. DEROSSI, M. CASANOVA, E. IENGO, E. ZANGRANDO, M. STENER, ALESSIO E. (2007). Self-assembled metallacycles with pyrazine edges: a new example in which the unexpected molecular triangle prevails over the expected molecular square.. INORGANIC CHEMISTRY, vol. 46, p. 11243-11253, ISSN: 0020-1669, doi: 10.1021/ic7019507	1	
A.H. Velders, A. Bergamo, E. Alessio, E. Zangrando, J.G. Haasnoot, C. Casarsa, M. Cocchietto, S. Zorzet, G. Sava (2004). Synthesis and Chemical-Pharmacological Characterization of the Antimetastatic NAMI-A-Type Ru(III) Complexes (Hdmtp)[trans-RuCl4(dmso-S)(dmtp)], (Na)[trans-RuCl4(dmso-S)(dmtp)], and [mer-RuCl3(H2O)(dmso-S)(dmtp)] (dmtp = 5,7-Dimethyl [1,2,4]triazolo [1,5-a]pyrimidine) . JOURNAL OF MEDICINAL CHEMISTRY, vol. 47, p. 1110-1121, ISSN: 0022-2623, doi: 10.1021/jm030984d	1	
PRODI A., CHIORBOLI C., SCANDOLA F., IENGO E., ALESSIO E., DOBRAWA R., WURTHNER F. (2005). Wavelength-Dependent Electron and Energy Transfer Pathways in a Side-to-Face Ruthenium Porphyrin / Perylene Bisimide Assembly. JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 127, p. 1454-1462, ISSN: 0002-7863, doi: 10.1021/ja045379u	1	
Gianferrara T., Bratsos I., Alessio E. (2009). A categorization of metal anticancer compounds based on their mode of action.. DALTON TRANSACTIONS, p. 7588-7598, ISSN: 1477-9226, doi: 10.1039/b905798f	1	
ALESSIO E., MESTRONI G., BERGAMO A., SAVA G. (2004). Ruthenium antimetastatic agents. CURRENT TOPICS IN MEDICINAL CHEMISTRY, vol. 4, p. 1525-1535, ISSN: 1568-0266, doi: 10.2174/1568026043387421	1	

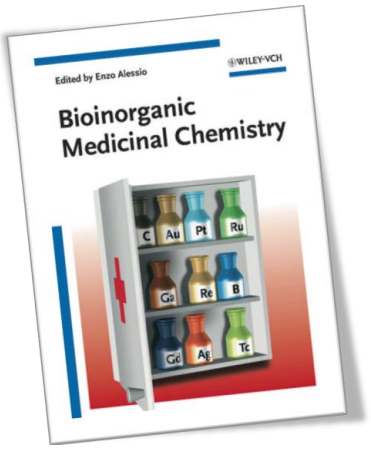
LOGOUT

Per informazioni di tipo tecnico: vqr@cineca.it - 051/6171839 — in collaborazione con CINECA

In **VQR 2011-2014** the two publications submitted have been evaluated as excellent (1.0).

BOOKS AND SPECIAL ISSUES EDITED

- 'Non-Covalent Multi-Porphyrin Assemblies', E. Alessio ed., Vol 121 in the series *Structure and Bonding*, series editor D.M.P. Mingos, Springer-Verlag, Berlin, Germany, **2006** (ISBN-10 3-540-32542-5).
- *Bioinorganic Medicinal Chemistry*, E. Alessio ed., Wiley-VCH, Weinheim, Germany, **2011** (ISBN 978-3-527-32631-0) (see figure below).
- Co-editor (with Prof. Zijian Guo, Nanjing University, China) of the thematic issue on "Metal Anticancer Complexes – Activity, Mechanism of Action, Future Perspectives" to be published by the *European Journal of Inorganic Chemistry* (EurJIC) on March 2017.



CONFERENCES, SEMINARS AND SYMPOSIA

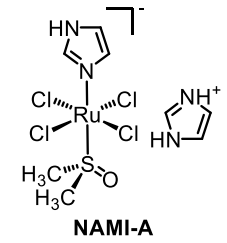
I my career I gave ca. 90 lectures/seminars (ca. 45 in the last 10 years) at Universities, national and international Symposia (session-, keynote-, invited- and plenary-lectures), including an invited lecture tour in Germany (2011) at the Universities of Dortmund, Marburg, Bochum, Göttingen and Münster and one (2015) at University in Hong Kong and Macau (China). In 2012 I was invited to organize a session on metal anticancer compounds within the Gordon Research Conference 'Metals in Medicine'. The full list is reported in a separate file, together with the publications and patents.

MAIN RESEARCH LINES

My main research interests are in the field of coordination and organometallic chemistry and concern supramolecular inorganic chemistry (in particular the preparation of multi-porphyrin assemblies for artificial photosynthesis), the development of anticancer metal compounds, and the development of "well-behaved" metal precursors (in particular of Ru and Re) for the preparation of water soluble porphyrin-metal conjugates for imaging and therapy (mainly anticancer).

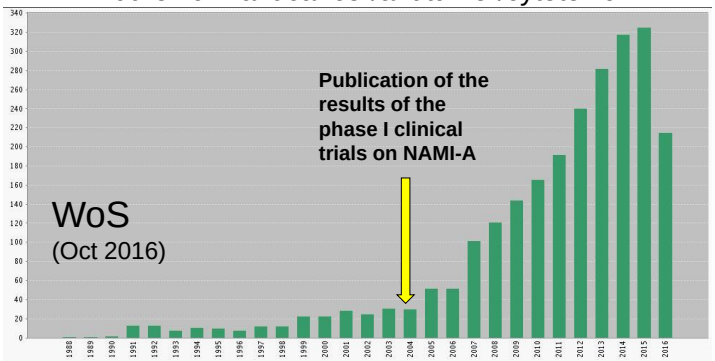
ACCOMPLISHMENTS

The most relevant result of my research within the "Metals in Medicine" context (Medicinal Inorganic Chemistry) is the development of a ruthenium coordination compound, universally known as NAMI-A (figure; it even made its way to textbooks, such as the 5th edition of the Shriver & Atkins "Inorganic Chemistry"), that was demonstrated to have excellent antimetastatic properties on preclinical animal tumor models. For this reason, after accomplishing a phase I clinical investigation in 1999 (first Ru compound ever to be tested on humans), and thanks to substantial financial support, from 2008 to 2011 I was the sponsor of a phase 1-2 clinical investigation at the Netherland Cancer Institute of Amsterdam in which NAMI-A, in combination with gemcitabine, was administered to 32 patients bearing non-small cell lung carcinoma. The results of the clinical investigation have recently been published: "Phase I/II study with ruthenium compound NAMI-A and gemcitabine in patients with non-small cell lung cancer after first line therapy." *Invest. New Drugs* **2015**, *33*, 201-214. It is worth mentioning that this paper, published in January 2015, has already received 50 citations in less than 2 years (classified as Top Cited Paper), whereas the results of the phase I investigation, published in 2004, received almost 500 citations. These numbers reflect the large worldwide interest in the field of ruthenium anticancer compounds. The

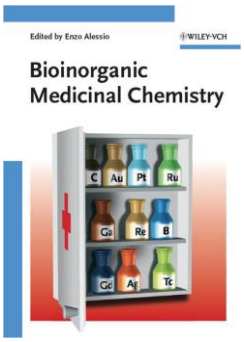


NAMI-A

Number of publications per year on the topic: ruthenium-anticancer/antitumor/cytotoxic



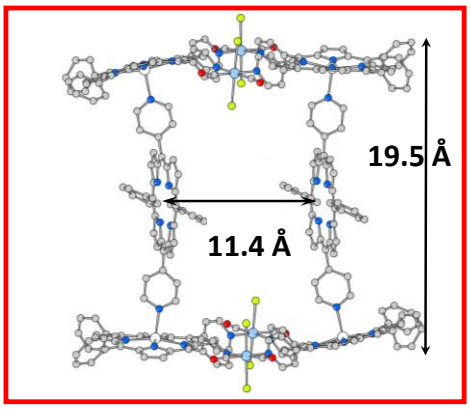
pioneering role of my group – together with very few others – in the field of ruthenium anticancer drugs is also well illustrated by the graph (see above) that reports the number of publications on this topic from 1990 to 2015. When I started back in the late '80s there were basically two or three groups in the world working on this topic. At that time the focus was almost exclusively on Pt anticancer compounds. After the phase I clinical study performed on NAMI-A in 1999, the number of publications on Ru anticancer complexes has been growing almost exponentially.



My role is well recognized in the scientific community of bioinorganic chemists working in the field of medicinal inorganic chemistry. I have actively participated to all COST Actions in this field (since 1995, in COST Chemistry Action D1) and I served as vice-Chairman (2000-2003) and then Chairman (2003-2006) of COST Chemistry Action D20 'Metal compounds in the treatment of cancer and viral diseases'. In 2010 I was asked by Wiley to be the editor of a book entitled Bioinorganic Medicinal Chemistry (see figure) published in 2011, to which contributed the most distinguished scientists in this field.

In the late 1990s I started a new relevant research line in the field of **supramolecular chemistry**, aimed at the construction of metal-mediated assemblies. The main focus of this work, that eventually led also to the publication in 2008 of a review article on metal-mediated molecular triangles on *Chem. Rev.*, was on the construction of metal-mediated assemblies of **porphyrins** that mimic the natural photosynthetic systems (**artificial photosynthesis**). This topic, that proved to be quite successful and allowed us to elucidate a large number of fascinating novel adducts (one example is shown in the figure), since a few years now is completely managed by my former PhD student, and now colleague, Dr. Elisabetta Iengo.

In more recent years, merging the expertise acquired in the fields of coordination chemistry and porphyrin chemistry, I also started exploring the new research topic of **porphyrin-metal conjugates for therapy and imaging**. We developed several novel water-soluble ruthenium- and rhenium-porphyrin conjugates that – upon irradiation with red light – showed **additive antitumor effect** *in vitro*: a combination of porphyrin phototoxicity (PDT) and cytotoxicity of the metal fragment. We also developed photolabile half-sandwich Ru(II) compounds that rapidly and selectively release a ligand upon irradiation with visible light, and are currently being investigated as photolabile protecting groups in the *photo-uncaging* approach.



In addition to these two main research lines, over the years I addressed several other "hard-core" topics in coordination/organometallic chemistry. In particular, I believe that I gave relevant contributions on the following subjects:

- Investigation through dynamic NMR techniques of ligand motions (restricted rotation about M–N bonds) in simple mono- and di-nuclear Ru and Re coordination compounds (work performed mainly at Emory University during my postdoctoral stay).
- Synthesis, characterization and investigation of the reactivity of series of novel ruthenium-dmso carbonyls and nitrosyls.
- Synthesis and characterization of series of novel Ru(II)-dmso complexes with dicarboxylate ligands. The large experience acquired in the field of Ru-dmso complexes led to the publication in 2004 of a single-name review article on *Chem. Rev.*.
- Synthesis, characterization and investigation of the reactivity of series of novel Ru(II) half-sandwich coordination compounds with face-capping ligands that are structurally similar to anticancer organometallic Ru(II)-arene compounds.
- The development of "well-behaved" and highly water soluble metal precursors – in particular of Ru(II) and Re(I) – for the preparation of porphyrin-metal conjugates to be used as photosensitizers both in artificial photosynthesis and for imaging and therapy (mainly anticancer).

RESEARCH GRANTS *(most relevant since 2000*; *Finanziamenti di Ateneo "FRA" not included)*

P.I. = Principal Investigator, L.C. = Local Coordinator

2002-2004 American Chemical Society – Petroleum Research Fund (80.000 USD).

Topic: Supramolecular assemblies of porphyrins.
Role: P.I.

2003-2005 Italian Ministry for University and Research, PRIN 2003 (2003035553_002)
Design, Synthesis, and Structural Characterization of New Nanoscopic Assemblies of Porphyrins and Metal Centers
P.I.: Prof. F. Scandola, University of Ferrara
Role: L.C. of the local unit of Trieste (51.300 €)

2006-2009 CRTrieste Foundation (250.000 €)
Clinical investigation of the anticancer ruthenium compound NAMI-A (clinical study phase 2)
Role: P.I. and sponsor of the clinical investigation.

2006-2012 Italian Government – Trieste Fund (551.500 €)
Clinical investigation of the anticancer ruthenium compound NAMI-A (clinical study phase 2)
Role: P.I. and sponsor of the clinical investigation

2007 CRTrieste Foundation (ca. 250.000 €)
Donation of a new 500 MHz NMR spectrometer.

2007 Beneficentia Stiftung Foundation (50.000 €)
Contribution for the acquisition of the new NMR spectrometer (see above)
Role: P.I. together with Prof. M. Prato

2008 Beneficentia Stiftung Foundation (50.000 €)
Support to my research in the following topics: development of ruthenium anticancer compounds and of synthetic systems for artificial photosynthesis.
Role: P.I.

2007-2009 Italian Ministry for University and Research, PRIN 2006 (2006030320_004)
Design, synthesis and structural characterization of new metal-mediated multichromophore assemblies for photo-induced processes. (Progettazione, sintesi e caratterizzazione strutturale di nuovi sistemi multicromoforici mediati da centri metallici per processi foto-indotti.
P.I.: Prof. F. Scandola, University of Ferrara
Role: L.C. of the unit of the University of Trieste (45.800 €)

2010 Beneficentia Stiftung Foundation (50.000 €)
Support to my research in the following topics: development of ruthenium anticancer compounds and of synthetic systems for artificial photosynthesis.
Role: P.I.

2010-2012 Italian Ministry for University and Research, PRIN 2008 (20085ZXFEE_003)
Design and modular synthesis of multi-chromophore assemblies for sunlight-energy conversion and photocatalysis
P.I.: Prof. F. Scandola, University of Ferrara
Role: L.C. of the unit of the University of Trieste (43.500 €)

2011 Italian Ministry for University and Research, PRIN 2010-2011 (2010N3T9M4_001)
Hierarchical Photosynthetic Nano-Structures for Carbon-Neutral Renewable Energy
Nanostrutture gerarchiche foto sintetiche per la produzione di energia
P.I.: Prof. M. Prato
Role: participant in the unit of the University of Trieste (73.000 €).

2012 Beneficentia Stiftung Foundation (20.000 €)
Support to my research in the following topics: development of multichromophoric synthetic systems for artificial photosynthesis.
Role: P.I.

2013 Beneficentia Stiftung Foundation (30.000 €)
Contribution for the acquisition of a ^{19}F NMR probe

Role: P.I.

2014 Beneficentia Stiftung Foundation (25.000 €)
Contribution for the acquisition of a new UV-vis spectrophotometer and of a microwave synthesizer.
Role: P.I.