

IFAC BIOMED

Past, Present and Future

Ewart Carson

The Beginnings of IFAC

- 1st IFAC Congress – 1960 (Moscow)
- 1st IFAC BIOMED Conference – 1973
(Rochester, NY)

Promoting the scientific and technological activities of modelling and control in biomedicine (including biology)

Before the Beginning

- “On Growth and Form” (1915) – D'Arcy Thompson

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- Simple examples of modelling of glucose metabolism, respiratory dynamics and population dynamics

My Beginnings

CD Barr, **ER Carson**, L Finkelstein, EA Jones.

A study of the dynamics of plasma protein metabolism,

in: Proc 4th IFAC Congress, Warsaw. IFAC 1969; section 70: 87-100

ER Carson, DG Cramp, L Finkelstein, AS Tavill.

Problems in dynamic systems analysis of metabolic systems,

in: Regulation and Control in Physiological Systems, AS Iberall, AC Guyton (eds). Pittsburgh: Instrument Society of America 1973; 491-493

IFAC BIOMED Old and New

Old series

- Rochester NY 1973
- Leipzig 1977

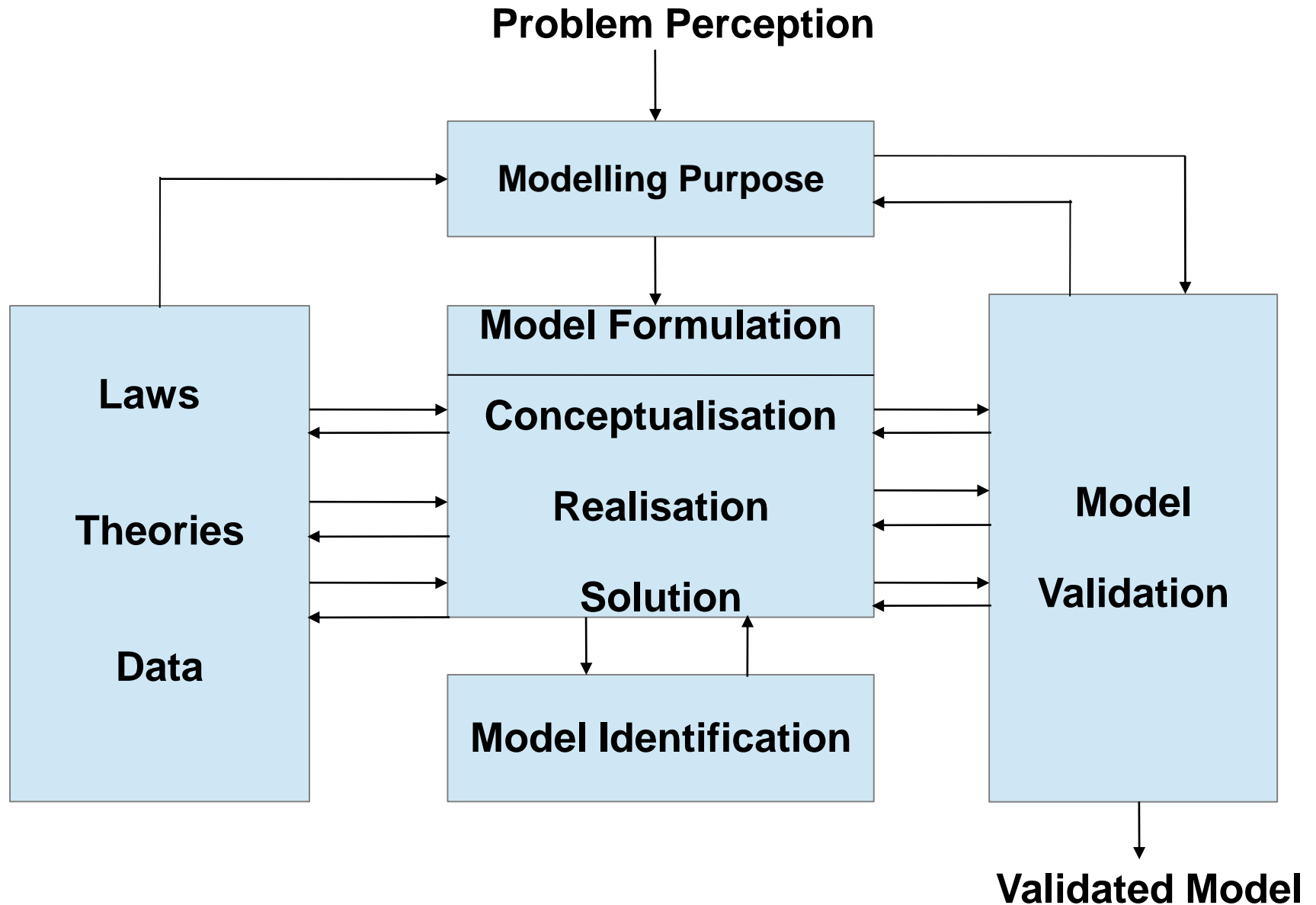
IFAC World Congresses in Helsinki, Kyoto, Budapest and Munich

New series

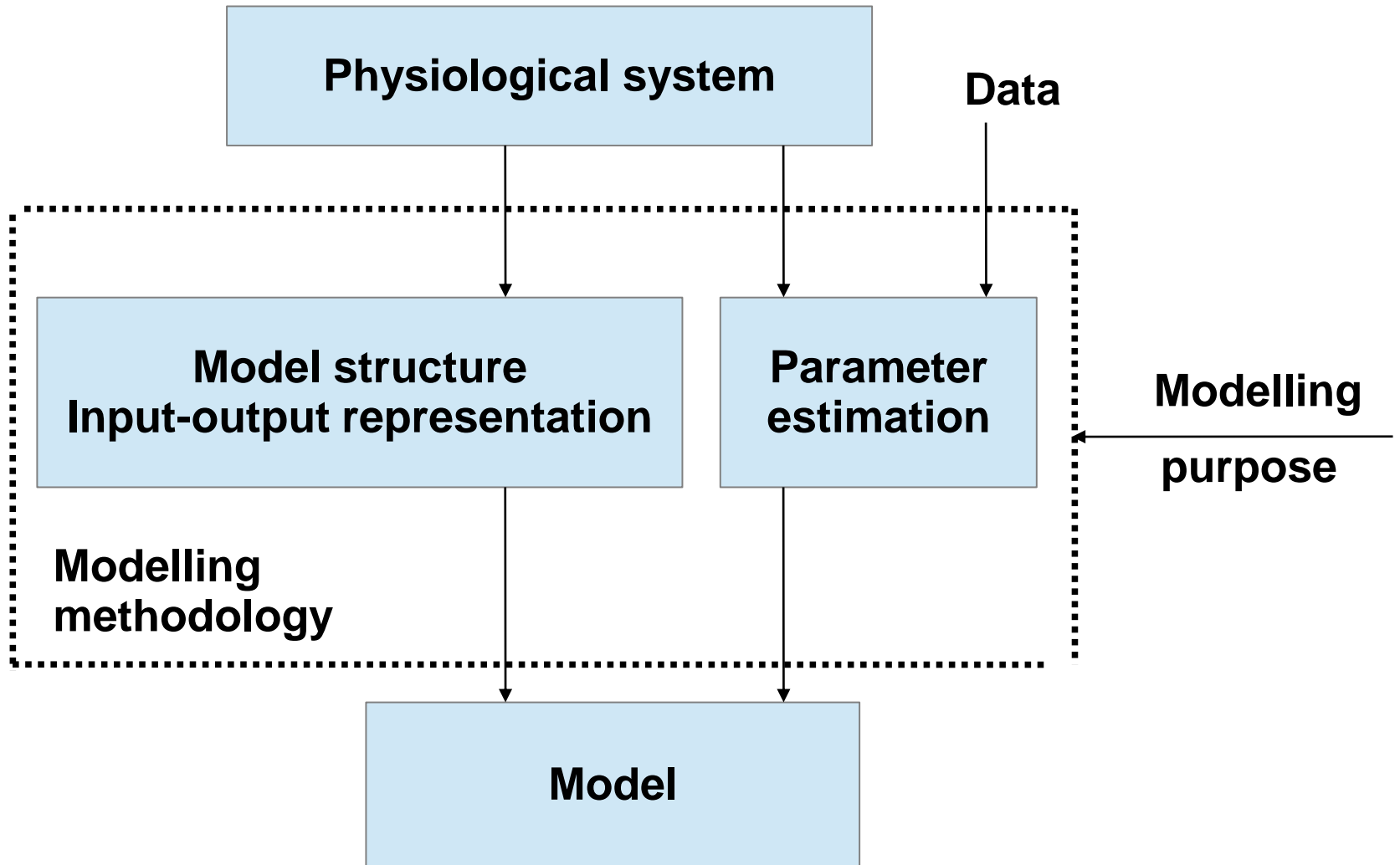
- Venice 1988

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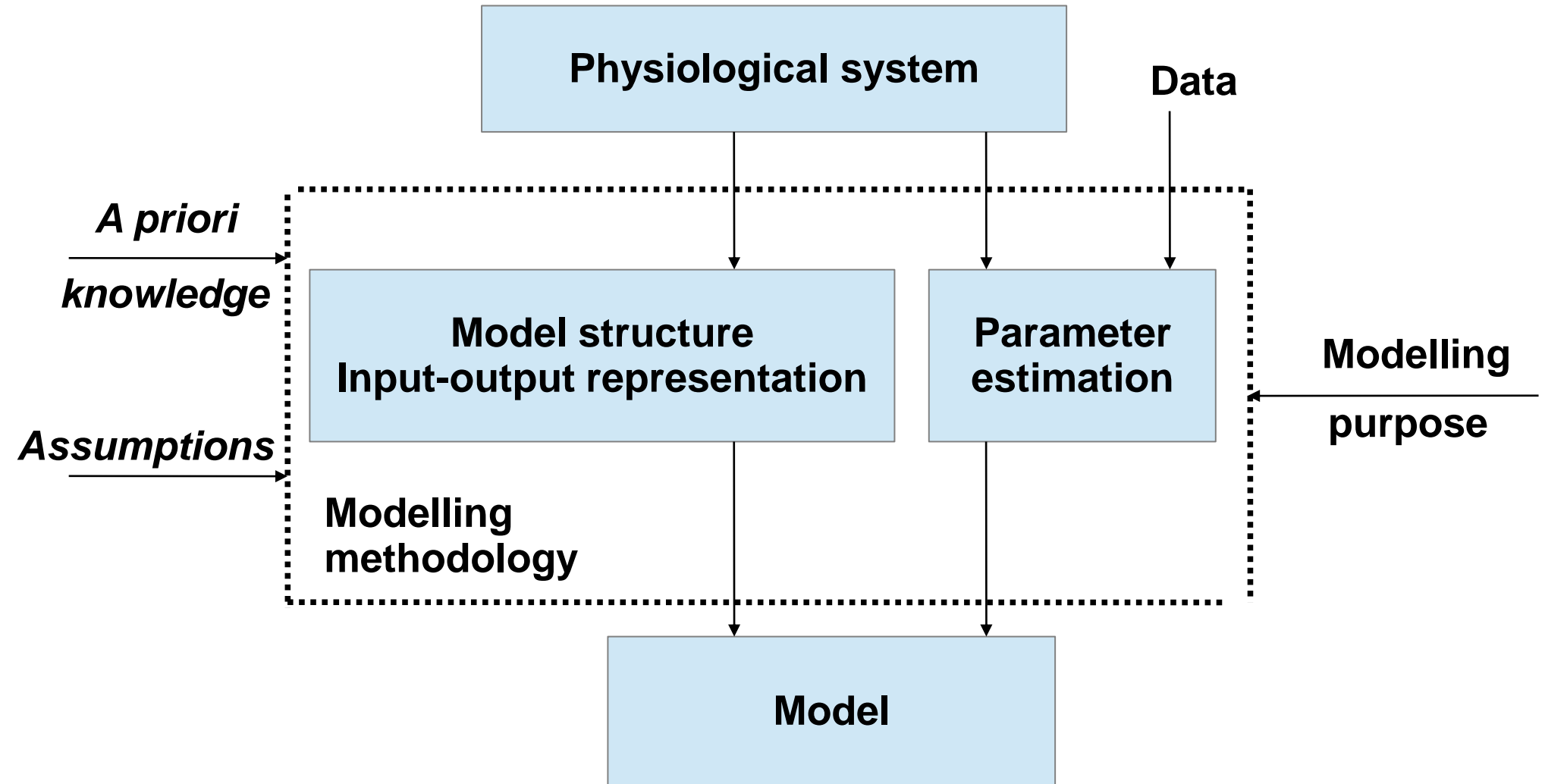
The Modelling Process



Modelling the Data

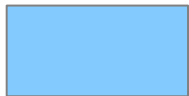


Modelling the System



Qualitative and Quantitative Models

Purpose	Diagrammatic		Mathematical		Statistical		Logical	
	Qual	Quant	Qual	Quant	Qual	Quant	Qual	Quant
Description	Almost always successful	Rarely if ever successful	Almost always successful	Almost always successful	Rarely if ever successful	Sometimes successful	Almost always successful	Rarely if ever successful
Prediction	Sometimes successful	Rarely if ever successful	Sometimes successful	Almost always successful	Rarely if ever successful	Almost always successful	Almost always successful	Rarely if ever successful
Explanation	Sometimes successful	Rarely if ever successful	Sometimes successful	Sometimes successful	Rarely if ever successful	Sometimes successful	Almost always successful	Rarely if ever successful



Rarely if ever successful



Sometimes successful



Almost always successful

Model Validation

- Validation during model formulation

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- Validation of the completed model
(Empirical, Theoretical, Pragmatic, Heuristic)

Validation Strategies

- Validation of a single model

overall patterns of response

features of response

parameter precision

residuals of the mismatch between model and data

parameter plausibility

Validation Strategies

- Validation of a single model
 - overall patterns of response
 - features of response
 - parameter precision
 - residuals of the mismatch between model and data
 - parameter plausibility
- Validation of competing models
 - goodness of fit
 - features of response
 - model plausibility

Modelling Applications

- Large scale models
- Minimal models

IFAC BIOMED – The New Series

- Venice 1988
- Galveston 1994
- Warwick 1997
- Greifswald 2000
- Melbourne 2003
- Reims 2006
- Aalborg 2009
- Budapest 2012

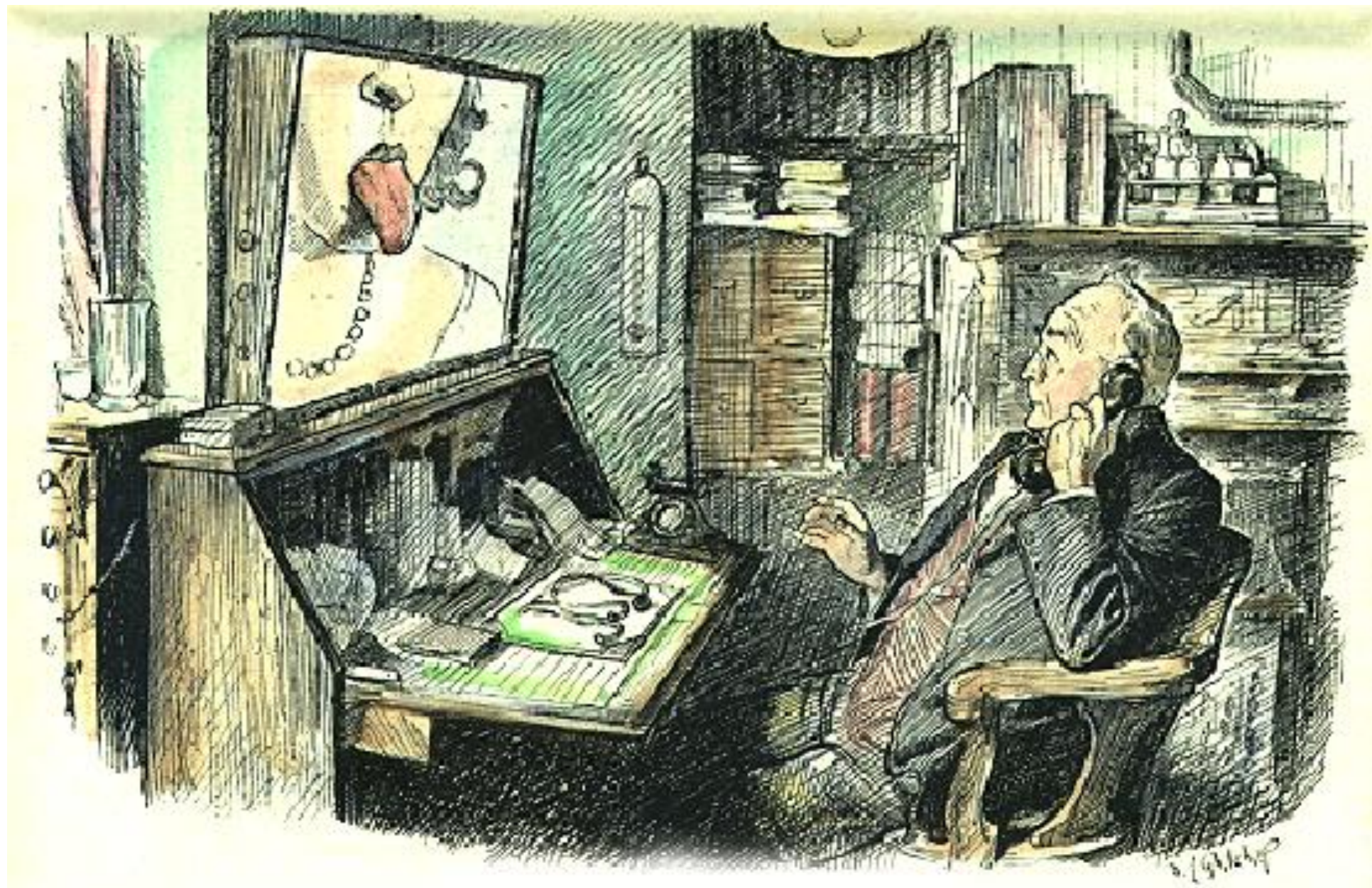
The Last Two Decades

- Clinical decision support (mathematics and artificial intelligence)
- Model-based image analysis
- Systems biology (“omics” modelling)
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- e-Health
- Telemedicine
- m-Health



Partnerships

Organisations

- IEEE EMBS
- IMEKO

Journals

- Computer Methods and Programs in Biomedicine
- Biomedical Signal Processing and Control
- Journal of Clinical Monitoring and Computing

Developments for the Future

- Models for personalised medicine

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 - multi-level (cell, organ, organism, community)

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Decision Support/Making

- Telemedicine
- Advisory systems
- Closed loop systems

Technology

- Mobile
- Wearable
- Embedded

The Hospital of the Future

- Medical workforce modelling
- Data and information modelling
- Patient modelling (e.g. controlling the flow of patients in a surgical progressive care system)

Future IFAC BIOMED

- BIOMED 2015 ?
- BIOMED 2018 ?