Automated Digital Cell Morphology
Improving the Efficiency, Proficiency and Connectivity of the Manual Differential

Scott Dunbar, CellaVision

CellaVision
Headquartered in Lund, Sweden.
Develops software products and hardware platforms to assist in cell analysis and diagnosis.
CellaVision systems are in use in over 1000 labs around the world.
Over 2,000 users have registered.
Competency Software

Why automate the manual differential?
- Declining availability of medical technologists, less graduates and accelerating retirements.
- The need for a greater level of standardization and consistency for the manual differential.
- Increasing demand for connectivity between healthcare providers.
Problems with Manual Microscopy

Labor intensive
Not standardized
Difficult to train
No historical images
Limited consultation
No traceability

May 2008 Clinical Laboratory News: The Worsening Shortage of Lab Staff

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"Not only will the sheer number of people retiring be enormous," she added, "but the collective years of knowledge that will be lost will be staggering. I try to use that as a selling point for students and tell them that the opportunities for advancement will be correspondingly huge."

Data from Gross's lab backs up Doig's predictions. "In our lab, as of July 2006, 20 of the 79 clinical laboratory scientists were older than 55 and had more than 30 years of service," Gross said. "Another 9 were older than 55 and had more than 21 years of service."

CellaVision Product Portfolio

Automated Digital Cell Morphology Systems

- CellaVision® DM96 (High Volume)
- CellaVision® DM1200 (Mid Size)
- CellaVision Image Capture System (Rural/Remote Lab’s)

Software and Applications

- CellaVision® Peripheral Blood Application
- CellaVision® Body Fluids Application
- CellaVision® Remote Review Software
- CellaVision® Competency Software
CellaVision® DM96

- 35 slides/hr
- Small footprint: ~2 x 2'
- Continuous feed
- 96 slide loading capacity
- Able to run Peripheral Blood, Body Fluids and create Digital Pathology Slides
- Uses same software as CellaVision DM1200 and can share network

CellaVision® DM1200

- 20 slides/hr
- Smaller footprint: ~1.5 x 1.5'
- Fully automated
- 12 slide loading capacity
- Able to run Peripheral Blood, Body Fluids and create Digital Pathology Slides
- Uses same software as CellaVision DM96 and can share network
Leading-edge Technologies

High Speed Auto focus for pristine image capture
Image tiling to create virtual slides for RBC, cytospin buttons and tissue images
Artificial Neural Networks trained on hundreds of thousands of cells to analyze over 350 different cell characteristics to pre-classify WBC, accurate with all “flavors” of Romanowsky stains

Features, Benefits & Value

EFFICIENCY, PROFICIENCY & CONNECTIVITY
Efficiency Impact
>50% time savings

Cells are automatically located
Pre-classification of cells reduces # of cells for the MT
Display of all WBC on one screen allows fast confirmation of cell counter Diff
Multiple slide merge on low counts eliminates buffy coat preps
Streamlines collaborations & consultations
Eliminates searching for slides
Automated competency assessment
More efficient training of new MT’s

Display cell counter results & flags

......plus one click, high resolution detail
Find more abnormal cells faster...

Proficiency

Viewing patients cell classes side-by-side
Improved Proficiency

1. View cell classes side by side
   - Aid cell identification by seeing the "company they keep"
2. Compare patient cells to custom ref cell library
   - Using their stain and patients
3. Access to historical images
   - Track patient changes over time
4. Real-time collaboration
   - Listen and learn from the experts
5. Competency test cases offer self improvement
   - 24/7 education

Powerful database search tools

Archiving

Want to see cells from last month?
Start searching....?

....or start searching!
High resolution/autofocus ensures nothing is missed.

**CellaVision Competency Software**
- Save time preparing, conducting and documenting competency assessment
- Serves as education tool
- Allows testing of remote locations over network
- Uses slides from DM system
- Available as a standalone product
- Free to certified CLS/MT programs via CASE Initiative

WEB/CLOUD Based Coming Soon!!!

*Trends by Tech and cell class can be spotted*
Cells not in agreement are displayed

Connectivity

Connectivity Benefits
- Clinicians access to images reduces TAT
- Easy saving/sharing of images
- Real-time collaboration
- Email images anywhere
- Access from home
- Unlimited image storage
- Maintain competency across multiple sites
- Centralize expertise
- Share staff
Related labs can provide labor to each other as needed. Routine or Path reviews can be centralized.

Expanding Test Menu
Amortize costs with Body Fluids and Anatomic Pathology Applications

Body Fluid Differential
Body Fluid full button scan, tag "regions of interest"
CellaNet
Streamlined patient care, regardless of location

CellaVision
Lab
Doctor
Patient
Medium
Large
Small

CellaNet™ is CellaVision plus You

- CellaNet is a simple network solution for the sharing, review and storage of blood and body fluid differentials, between facilities.
- All CellaVision systems, in any locations, can be connected.
- The new CellaVision Image Capture System now allows even your smallest labs to join CellaNet.

CellaNet improves service to the pathologists and clinicians, streamlining patient care

Doctors

- Immediate access to patient images
- Eliminates slide transportation
- Consult from home or clinic

Patient

- Reduced turnaround time
- Improved quality of results
- Faster treatment decisions
CellaVision Image Capture System (ICS)

an indispensable addition to your CellaVision DM96 or DM1200

- Designed for small labs performing 1 – 20 differentials per day
- ICS is installed onto an existing microscope and assists the tech to find, focus and capture cells
- Cell images are seamlessly sent to a CellaVision DM system at a main lab anywhere on the same network.
- The main lab performs the review and releases the results.
- Images of any tissue (e.g. bone marrow, fluids) can also be captured and transmitted.

The Software
auto cell capture and focus-assist

Review WBC Images
Capture & Review RBC/PLT Images

Images transmitted to a DM96 or DM1200 database for smear review
- Slide sent from ICS lab appears in DM database in main lab
- Cell classification performed by ICS user or DM user.
- Review is performed and signed
- Results sent back to ICS lab and/or released to LIS

Product Specifications & Requirements
- Image Capture System includes:
  - PC with CellVision Image Capture Software
  - Camera
  - Adaptor
  - Monitor/keyboard/mouse
  - Microscope supplied by lab must have:
    - Triocular head
    - 50X oil objective
  - Requires network connection to a DM96 or DM1200 system.
- Optional Accessories
  - CellVision Remote Review Software
  - CellVision Competency Software
CellaNet and the CellaVision Image Capture System benefits....

to the ICS lab:
• Eliminates the need for local morphology expertise 24/7
• Improves turnaround time for consultations
• Eliminate transportation costs to send slides

to the main lab:
• Ability to grow competency in all labs
• Improved confidence in quality across entire organization

No capital investment required
innovative, flexible software license

• Image Capture Camera
  • CellaVision Image Capture Software
  • Intermediate Optics
  • PC/Monitor/Keyboard/Mouse
  • Lifetime instrument and software support
  • Lifetime replacement warranty
• Simple, 1-page agreement
• Laboratory may cancel anytime with return of system

Now all your labs can afford to be best practice
in cell morphology with CellaNet and the.....

CellaVision Image Capture System
Automated Digital Cell Morphology

Case Studies

Case #1

7 DAY OLD FEMALE
Fever, ELEVATED WBC
LETHARGY
FAILURE TO THRIVE

SHARP MEMORIAL HOSPITAL
SAN DIEGO, CA

WBC 21,000
ONE BLAST

DX: Sepsis from Placental Infection

Case #2

16 YEAR OLD FEMALE
CHILLS, MALAISE
FEVER
HEADACHE

SAMARITAN HEALTH
ALBANY, OREGON

Cell Morphology
DIAGNOSIS: MONONUCLEOSIS

Case #3

13 YEAR OLD MALE
SENT TO A CHILDREN’S HOSPITAL
FOR CONSULT
HIGH WBC
LOW PLT
Fever

CHILDREN’S HOSPITAL
OAKLAND, CA

Cells Found
40% Blasts Found on Smear

Very Important Finding Here

ACUTE MYELOID LEUKEMIA

CASE #4

14 YEAR OLD FEMALE
PAIN
WBC 7,000
PLT 4
H&H 11.2/31.4

CHILDREN’S HOSPITAL
OAKLAND, CA
Cell Morphology

More Cells

Important Cell Finding

DIAGNOSIS: APL

AUER ROD
CASE #5
70 YEAR OLD MALE
KNOWN ONCOLOGY PATIENT
PRESENTS WITH SHORTNESS OF
BREATH
FEVER
LETHARGY
LEBANON SAMARITAN HOSPITAL
LEBANON, OREGON

Pleural Fluid Aspiration
Cyto-Spin Prep

MALIGNANT CELLS IN PLEURAL
FLUID
CASE #6

44 YEAR OLD FEMALE
KNOWN ONCOLOGY PATIENT

CITY OF HOPE
LOS ANGELES, CA
Other Cells Found

CML WITH CIRCULATING MICROMEGAKARYOCYTES

CASE #7

32 DAY OLD FEMALE FAILURE TO THRIVE

CHILDREN’S HOSPITAL
PHOENIX, AZ
DIAGNOSIS: SEPSIS

CASE #8

60 YEAR OLD MALE KNOWN ONCOLOGY PATIENT

UNIVERSITY MEDICAL CENTER
TUCSON, ARIZONA
Cells Found

More Cells Located

Predominant Cells Found
Case #9

1 YEAR OLD FEMALE
WHITE HAIR
NEUROPATHY
FREQUENTLY ILL
NYSTAGMUS
UNIVERSITY OF CALIFORNIA
SAN FRANCISCO, CA

Cells Found

RBC’s were Normal. Platelet Count Normal
Neutrophils in the “Company They Keep”

CHEDIK-HIGASHI ANOMALY

Chediak-Higashi syndrome is rare disease of the immune and nervous systems that involves by pale-colored hair, eyes, and skin.

Best Outcome: Bone Marrow Transplant
Case #10
NEWBORN FEMALE
HEEL STICK MICROTAINTER
PLT COUNT DECREASED

UNIVERSITY MEDICAL CENTER
TUCSON, ARIZONA

Cells Found

Platelet Clumps

DIFFICULT VENIPUNCTURE
VS. SPECIMEN MIXING
Case #11
5 YEAR OLD CHILD
BRAIN TUMOR
HIGH DOSE CHEMOTHERAPY
G-CSF PROTOCOL

CHILDREN’S HOSPITAL
OAKLAND, CALIFORNIA

Cells Found
1 LYMPH, 1 META, 1 PRO

More Cells
IG’S AND TOXIC
DOHLE BODIES PRESENT
Concerning Cells Found

TRANSIENT BLASTS DUE TO G-CSF STIMULATION IMMATURE CELLS

Case #12

TEEN WITH RECENT TRAVEL TO THE CONTINENT OF AFRICA. FEVER/ANEMIA

BELLVIEW HOSPITAL
NYC, NEW YORK

Morphology/Cells
Interesting Cells

RBC’S WITH GAMETOGENESIS

Diagnosis: Malaria

Case # 13

60 YEAR OLD MALE
WBC 10.9
PLT 90
HGB 12.2
HCT 32
CONSULT

VANCOUVER GENERAL HOSPITAL
BRITISH COLUMBIA, CANADA
Cells Found

Lymphocytes in the "Company they Keep"

More Leukocytes
HAIRY CELL LEUKEMIA

Case #14
79 YEAR OLD MALE
REFRACTORY CLL
PERSISTENT CYTOPENIA

WBC 6.27
RBC 2.85
HGB 8.7
HCT 27.1
MCV 95.0
MCH 30.6
MCHC 32.2
PLT 21

UNIVERSITY MEDICAL CENTER
TUCSON, ARIZONA

Cells Captured
More Cells

Predominant Cells

67% EOSINOPHILS BY CELL COUNTER
SYSTEMIC FUNGAL INFECTION
IV AMPHOTERICIN B AND FLUCONAZOLE
Random Cells and Findings

Bacterial Meningitis
Immature Neutrophils with Toxic Granulation

Toxic granulation is found in severe inflammatory states.

- Burns
- Infections
- Physical trauma
- Neoplastic
- Wissler’s disease
- May-Hegglin anomaly
- Chédiak-Higashi’s syndrome

Döhle Bodies

39 Year Old Female
Breast Cancer
CSF Cytospin Preparation

METASTATIC BREAST CANCER CELLS FOUND IN SPINAL FLUID
WG STAIN/CLEAR COLORLESS
PRESBYTERIAN ST. LUKE’S
DENVER, COLORADO
16 Year Old Male
Ewing's Sarcoma
WBC 3.3/HGB 11.6/PLT 330

CHEMOTHERAPY
RADIATION THERAPY
G-CSF SUPPORT
ROCKY MOUNTAIN CHILDREN'S HOSPITAL
DENVER, COLORADO

EVIDENCE OF GRANULOCYTE STIMULATION

NRBC's and Platelet's of Various Sizes
STIMULATED BONE MARROW TURNOVER
EWING'S SARCOMA IS A MALIGNANT SMALL, ROUND, BLUE CELL TUMOUR. IT'S A RARE DISEASE IN WHICH CANCER CELLS ARE FOUND IN THE BONE OR IN SOFT TISSUE. THE MOST COMMON AREAS IN WHICH IT OCCURS ARE THE PELVIS, THE FEMUR, THE HUMERUS, THE RIBS AND CLAVICLE.

EWING'S SARCOMA OCCURS MOST FREQUENTLY IN TEENAGERS AND YOUNG ADULTS, WITH A MALE/FEMALE RATIO OF 1.6:1.

BURKITT'S LYMPHOMA, BODY FLUID: C-MYC GENE MUTATION
HYPER-SEGMENTED NEUTROPHILS > 6 LOBES CONCERN ANEMIA B12/FOLATE DEFICIENCY

MALIGNANT CELLS IN PLEURAL FLUID

MACROPHAGE WITH PHAGOCYTOSIS OF TWO RBC’S.
HIV PATIENT
INTRACELLULAR YEAST INFECTION
EXPIRED 3 HOURS AFTER HOSPITAL
ADMISSION

SHARP MEDICAL CENTER
SAN DIEGO, CALIFORNIA

PLATELET SATELLITOSIS
CAUSES SPURIOUS
THROMBOCYTOPENIA

IgG anti-neutrophil antibodies and the alpha granule protein
USVA MEDICAL CENTER, San Francisco, California
An acquired or pseudo-Pelger-Huet anomaly is seen in myelodysplastic disorders and following drug therapy, and may accompany leukemia and certain infections.
Justify?
Remember the “Key Three”
1. Save labor you do not have
2. Improve turnaround time
3. Guarantee accuracy and consistency of results

Questions and Answers?

THANK YOU!